Home Energy Coach Program:
lessons learned from a pilot study in Waterloo Region, Ontario

by

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Environmental Studies
in
Environment and Resource Studies

Waterloo, Ontario, Canada, 2016

Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Andrea Bale

Abstract

The uptake of energy-efficiency investments in the residential sector is relatively low, despite evidence of short payback periods and numerous co-benefits, including increased home comfort and reduced negative environmental impacts. Common barriers facing homeowners include financial and time constraints, competing priorities, and a lack of adequate information. Home energy audits are an established approach to encourage energy-efficiency investments, with the intention of overcoming the informational barrier by providing personalized energy-efficiency recommendations to homeowners. However, literature suggests that the impacts of these audits are mixed, due to a lack of guidance, procedural information and support from social networks. To fill this gap, the Home Energy Coach program was piloted in Waterloo Region, Ontario, involving government, non-profit, industry and academic stakeholders. Upon receiving an EnerGuide home energy evaluation, homeowners were eligible to participate in free consultation sessions with an Energy Coach to help develop and execute a renovation plan. This thesis documented the coach interactions and renovation progress of 21 program participants through a series of online surveys, with added insight from follow-up interviews with five of these participants. The results indicated that the Energy Coach was helpful in the development of renovation plans of many participants by clarifying the audit recommendations, helping to evaluate options based on each household's circumstances and guiding participants to additional resources. At the end of the program, 17 out of 18 exit survey respondents had made progress on or completed at least one-energy efficiency measure, with an overall conversion rate of 29 percent from audit recommendation to completed action. The most frequently completed measures were basement/crawl space insulation, draftproofing and window/door replacement, which were also the most frequently recommended measures. This thesis adds to the literature on motivations and barriers to energy-efficiency investments in the residential sector and on the potential role of a coaching service to guide and support homeowners in overcoming these barriers. Future research is needed to determine the impacts of this program on a larger scale and over a longer timeframe, with the potential for added insight from utility consumption data or the presence of a control group.

Acknowledgements

First and foremost, I would like to thank my advisor Ian Rowlands, who has been a constant source of encouragement, entertainment and invaluable insight over the last two years. I always left our meetings with a greater sense of purpose and confidence and for that I am very grateful. I would also like to thank my committee member Paul Parker, without whom I would not have had the opportunity to work on this project. Paul's knowledge of, and passion for, local community energy programs has strengthened my own desire to pursue work in that field, and has served me well during my thesis research. Thank you as well to Carrie Mitchell for sitting on my thesis committee and taking the time to provide me with valuable feedback.

I would like to extend heartfelt thanks to the team at REEP Green Solutions, especially Mary Jane Patterson and Dave Blake, for openly welcoming me to the 'Catalyst' team, for providing me with access to participants and other data, and for acting as sounding board for my surveys and other research materials. As well, thank you to Torrie Santucci for reaching out to potential participants and for administrative support whenever needed. Thank you also to Philip Drader and James Howe for their help along the way. I will miss our Tuesday morning meetings and am thankful for the opportunity to work with you all. I would also like to thank the other partners on this project, particularly Mindscape Innovations Inc. and Scaled Purpose, for providing insight into the design of the surveys. I would also like to thank my fellow energy researchers for inspiration and support whenever needed, and especially to those that helped me pre-test my surveys.

This thesis could not have been completed without the generous support of various funders, including Natural Resources Canada, the Ontario Graduate Scholarship, the President's Graduate Scholarship, the Social Sciences and Humanities Research Council of Canada (SSHRC), and with support from the NSERC Smart Net-Zero Energy Buildings Strategic Research Network (SNEBRN) under the Strategic Research Networks programme of the Natural Sciences and Engineering Research Council of Canada (NSERC).

Finally, I wish to thank my family and friends, who have been a constant source of encouragement and support over the last two years. Thank you to my parents, Barb and Steve, for always encouraging me to set my sights high and for supporting my seemingly ever-changing life goals. To my siblings, Kevin and Erin, thank you for putting up with me all these years and thanks for all the visits to Waterloo! Nathan, thank you for your constant love, encouragement and patience,

especially over the past few months as I've worked to get this across the finish line. I couldn't have done it without you! And to Tonks, for always letting me know when it was time to take a break.

Dedication

I would like to dedicate this thesis to my parents, for instilling in me a love of learning.

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List of Abbreviations

CAWR – Climate Action Waterloo Region

CMHC – Canada Mortgage and Housing Corporation

ECCC – Energy and Climate Change Canada

EGH – EnerGuide for Houses

GHG – greenhouse gas

HEC – Home Energy Coach

IEA – International Energy Agency

IPCC – Intergovernmental Panel on Climate Change

MECC – Ministry of the Environment and Climate Change

MMAH – Ministry of Municipal Affairs and Housing

NRCan – Natural Resources Canada

StatsCan – Statistics Canada

Chapter 1: Introduction

1.1. Problem Context

1.1.1. Energy and Climate Change

Climate change is arguably the greatest challenge facing society. The scholarship on climate change sources and mitigation strategies has grown immensely over the last several decades. There is extensive evidence that anthropogenic influences have had a substantial impact on global climate systems, and global action will be required to face these challenges in the future. It is widely accepted that drastic reductions in fossil-fuel consumption and associated greenhouse gas (GHG) emissions are necessary actions for the future sustainability of all living systems.

Energy consumption is an interesting and contentious area of research within this context, as it is intrinsically and complexly linked with positive and negative consequences, such as human well-being and environmental degradation, respectively. On one hand, energy provides essential services that maintain and enrich our daily lives. On the other hand, the life cycle of energy has severe negative impacts on environmental systems, such as resource extraction, land degradation and atmospheric pollution. Further complicating this delicate balance is a rising global population and higher standards of living on a planet that has already surpassed its carrying-capacity.

1.1.2. Climate Change Mitigation Targets in Canada

In response to the robust evidence on the contributors to and consequences of climate change, many countries have signed on to reduce their GHG emissions through international agreements, and Canada is no exception. On a national scale, Canada has targeted reductions in GHG emissions by 30 percent below 2005 levels by 2030 (IEA, 2016). Ontario's ambitions – in relation to 1990 emission levels – include 15 percent reductions by 2020, 37 percent reductions by 2030 and 80 percent reductions by 2050 (MECC, 2016). Municipalities are also setting their own targets, such as Waterloo Region, with a target of six percent below 2010 levels by 2020 (CAWR, 2013). Energy consumption is an area deserving of particular attention with respect to climate change mitigation targets and strategies, as it accounts for approximately 80 percent of GHG emissions in Canada (ECCC, 2016). This thesis narrows its focus to one segment of energy consumption, discussed in the next subsection.

1.1.3. Energy and Buildings

From an international to local scale, buildings are an important area of research in climate change mitigation. Buildings account for a substantial proportion of total global energy consumption and associated GHG emissions. Lucon et al. (2014) estimated that in 2010, buildings accounted for 32 percent of global final energy use, corresponding to 19 percent of GHG emissions. In Ontario, buildings constitute approximately 19 percent of total GHG pollution, and emissions from this sector are projected to rise by 2020 (MECC, 2016). Focusing on a subset of this sector, residential buildings constitute a large share of energy consumption and GHG emissions. Globally, residential buildings account for approximately 25 percent of energy consumption (Lucon et al., 2014; Ürge-Vorsatz et al., 2012). In Canada, residential buildings constitute approximately 17 percent of energy consumption (NRCan, 2011).

Energy is used in residential buildings for a variety of end-uses. Ontarian homes use approximately 65 percent of energy for space heating purposes, while 21 percent is used for water heating, 9 percent for appliances, 3 percent for lighting and 2 percent for space cooling (NRCan, 2016b). Evidently, a substantial amount of energy is used for space heating, and this is primarily sourced from fossil-fuel based sources, though the supply mix varies provincially. In Ontario, approximately 68 percent of households are heated with natural gas, followed by 14 percent of households heated by electricity, and the remaining by oil, wood and wood pellets and propane (NRCan, 2016b). Further, approximately 73 percent of water heating is by natural gas, followed by 23 percent by electricity, and the remaining by oil, wood and propane (NRCan, 2016b). In turn, space heating accounts for nearly 75 percent of GHG emissions (excluding electricity-related GHG emissions) in Ontario's residential sector, while water heating accounts for 25 percent of GHG emissions (NRCan, 2016b). Taken together, residential buildings consume a considerable amount of energy for space heating and water heating, and a substantial share of this is supplied by fossil-fuel based sources which contribute to GHG emissions. As such, residential buildings have an important role to play in achieving GHG emissions reduction targets.

The transition pathway to a sustainable energy future in buildings can be paved by three distinct, but complementary, roads. Three main approaches to energy sustainability, broadly, include replacing fossil-fuel based energy sources with renewable or non-GHG emitting sources,

decreasing the total amount of energy required through conservation and increasing the efficiency of energy currently used (St. Denis & Parker, 2009). With respect to demand-side efficiency, increased energy-efficiency means that the same services are provided for less energy input (IEA, 2016). This thesis will narrow its focus to energy-efficiency, as the opportunities for energy-efficiency in the residential sector are plentiful.

1.1.4. Energy-Efficiency in the Residential Sector

The residential building stock in Ontario represents a serious challenge for emission reductions, as a substantial proportion of existing buildings were built prior to high energy-efficiency standards and climate change considerations (MECC, 2016). Further, the long lifespan of buildings means that the inefficiencies of these buildings are 'locked-in' for a long period of time, while serious reductions in GHG emissions must be achieved now. Although old and inefficient buildings could be demolished and rebuilt to better efficiency standards, there are substantial environmental, social and economic costs associated with these activities. These include large inputs of embodied carbon, high levels of material waste in landfills, noise/disruption and high capital costs (Power, 2008). Weighing these costs against the benefits of refurbishment, such as less waste to landfills, reuse of materials and infrastructure, neighbourhood rejuvenation and local economic development, Power (2008) argues that energy-efficiency upgrades (or retrofits) to existing buildings hold the most potential to achieve the large-scale energy reductions required. The Intergovernmental Panel on Climate Change also emphasizes the importance of retrofits to existing buildings as a critical part of reducing emissions in the building sector (Lucon et al., 2014).

Numerous studies have identified the economic and technical feasibility of retrofits to existing houses, which have the potential to produce substantial energy and cost savings (eg. Lucon et al., 2014; McKinsey and Company, 2010). However, despite low and even negative net cost energy-efficiency investment opportunities, the uptake of these measures remains persistently lower than economists or engineers would expect, a term cited in the literature as the energy-efficiency gap (Jaffe & Stavins, 1994). A large body of research has been dedicated to explaining the energy-efficiency gap, which argues that homeowners face a number of challenges or barriers in their decision to undertake renovations, such as a lack of information, access to capital and uncertainty in the renovation process. Thus, in order for these attractive opportunities to be

realized, these barriers will need to be removed (eg. Hirst & Brown, 1990). The literature on energy-efficiency potential and barriers is discussed further in Chapter 2.

It should also be acknowledged that the case for energy-efficiency investments in the residential sector is not limited to energy and cost savings. There are numerous co-benefits to energy-efficiency improvements, such as improved home comfort, energy security, local economic development through employment opportunities and improved health through better indoor and outdoor air quality (Lucon et al., 2014).

In summary, there are economically and technically feasible energy-efficiency opportunities in the residential sector that will contribute to GHG emission reductions and numerous co-benefits, though the uptake rate for these opportunities is not as high as expected (Schleich, 2007; Brown et al., 1998; Hirst & Brown, 1990). In order to overcome the barriers facing homeowners, a number of energy-efficiency interventions have been attempted in the residential sector. These are discussed briefly in the next section.

1.1.5. Energy-Efficiency Interventions in the Residential Sector

Many energy-efficiency interventions have been implemented in the residential sector, with mixed success (eg. Abrahamse, Steg, Vlek, & Rothengatter, 2005). These interventions have the objective of helping homeowners to overcome barriers to energy-efficiency upgrades through information provision, financial incentives or other regulatory measures (Karvonen, 2013). One such intervention is the home energy audit, whereby an audit professional conducts a comprehensive evaluation of the energy systems in a house to identify personalized recommendations that homeowners can implement to improve their home's energy-efficiency (Palmer, Walls, Gordon, & Gerarden, 2013). It is thought that, through the provision of personalized information, audits can overcome the information barrier facing homeowners and encourage widespread efficiency investments (Murphy, 2014). However, the impacts of these audits have demonstrated mixed success, questioning the potential that audits hold (eg. Murphy, 2014).

1.2. Research Gap and Needs

The literature suggests that conventional energy-efficiency interventions are not sufficient to address and overcome the barriers to the adoption of energy-efficiency investments in the

residential sector on a widespread scale (eg. Karvonen, 2013; Wilson & Dowlatabadi, 2007). Crosbie (2006) argues that many household energy interventions focus on the technical aspects and impacts of the intervention (ie. energy use before and after), but fail to address the social elements of energy use, specifically, and the social elements influencing the intervention, more broadly. Extending to energy audits, conventional intervention studies focus on what actions were and were not implemented, but fail to address why particular actions were and were not observed (Crosbie & Baker, 2010). On this point, some researchers argue that a lack of appropriate guidance and support are to blame for the relative lack of action following audits (Shapiro, 2011; Parnell & Popovic Larsen, 2005a, 2005b). Moreover, other researchers call for collaboration with local actors in energy intervention programs (eg. Karvonen, 2013), as these stakeholders possess specialized knowledge about the localized context in which the energy issues exist (Sol, Beer, and Wals, 2013). Some programs of this nature have been delivered in the United States (eg. Small Town Energy Program, which is discussed further throughout this thesis), though not in an Ontario context to the best of the researcher's knowledge.

To answer these calls, an innovative pilot project was developed in Waterloo Region with collaboration from various stakeholders, including a local non-profit, a department of the Canadian federal government, an academic institution, and several industry organizations. The product of this collaboration, the Home Energy Coach (HEC) program, was designed to facilitate the uptake of audit recommendations by households that received an EnerGuide home energy audit and evaluation report by providing support and guidance through a free Energy Coach consultation service. This thesis takes a predominantly exploratory approach to investigate the experiences of participants in the HEC program and contribute to a better understanding of how and why homeowners responded to the HEC program in the ways they did.

1.3. Research Purpose and Objectives

The purpose of this thesis is to document the experiences of homeowners taking part in the Home Energy Coach program and explore the impacts of the Energy Coach on the renovation activity of these participants. This thesis set out using an exploratory approach, thus did not set out with testable hypotheses in mind. Rather, this thesis was guided by several objectives that continued to take shape as the research unfolded. The four main objectives are:

1. To describe the kinds of households that were attracted to the Home Energy Coach (HEC) program and the householders' motivations for participating.
2. To document the renovation plans of participants as they moved through the renovation process.
3. To explore the influence of the Energy Coach on the renovation plans of participants.
4. To identify lessons that can be learned from participants to reshape similar interventions moving forward.

Through this investigation, this thesis aims to contribute knowledge to the literature on the potential role of an Energy Coach, or a similar kind of supplementary support, for homeowners that are in pursuit of renovations.

1.4. Structure of Thesis

Chapter 1 outlines background information deemed relevant to the development of this thesis, outlines the research gap and need, and presents the purpose and objectives that this thesis aims to address. Chapter 2 presents a review of the literature on previous interventions aimed at encouraging residential energy efficiency, and discusses the underlying barriers that prevent the widespread uptake of feasible energy-efficiency investments among homeowners. The literature review then focuses on energy audits as one intervention strategy to overcome the information barrier among homeowners, addressing its strengths and limitations. Finally, the literature review draws from research on 'coaching' in other domains, how those applications may be transferable to home energy coaching, and thereby makes the case for the Home Energy Coach Program. Chapter 3 discusses the case study studied in this thesis, the Home Energy Coach Program, including the partners involved in the project and the design of the program. Chapter 4 discusses the qualitative and quantitative research methods used for primary data and secondary data collected and how these data were analyzed. This chapter also overviews the recruitment strategies for this research study. Chapter 5 presents the results from the primary and secondary data collection methods. The results are broken down into two main sections. The first section provides a rich description of the research sample, and the second section presents the results from the survey and interview responses. Chapter 6 discusses the results with respect to the research purpose and objectives and in relation to findings from the literature. This section also addresses limitations in the research

design and areas for improvement. Chapter 7 discusses the implications of the findings for academia, industry and government and highlights areas where future work may be carried out.

Chapter 2: Literature Review

2.1. Introduction

The goal of this chapter is to provide a review of the relevant literature that informs the design of the intervention employed in this thesis, the Home Energy Coach Program, and the foundations used in the development of the research methodology. The literature review chapter of this thesis is broken down into five sections. Section 2.2. outlines the unsustainability of energy consumption in the residential sector and the requirement for improved energy-efficiency in households, supporting the purpose of the intervention in this thesis. This section also discusses the energy-efficiency gap in the residential sector, as well as common barriers preventing the uptake of energy-efficiency solutions, highlighting the particular barriers that this thesis will focus on. Next, Section 2.3. presents literature on home energy audits as an energy-efficiency intervention strategy, noting the impacts of this approach on the uptake of energy-efficiency investments and identifying gaps in research approaches. This section also discusses the use of energy audits in a Canadian context. Section 2.4. then discusses a new approach to the design of energy audit programs that includes guidance and support, the role of local actors in the development of this type of program, and how to evaluate such a program. Finally, Section 2.5. integrates these findings to summarize the foundations for the development of the program used in this thesis.

2.2. Energy Unsustainability in the Residential Sector

2.2.1. Energy-Efficiency and the Housing Stock

It is argued that energy-efficiency improvements to existing buildings hold the greatest potential for energy savings in most developed countries (Gram-Hanssen, 2014; Power, 2008). There are several reasons for this argument. First, Power (2008) argues that when considering the embedded energy and life-cycle analysis of new buildings, including the demolition of existing buildings and the construction of new, more efficient buildings, it is more valuable to invest in retrofits of existing houses. In particular, Gram-Hanssen (2014) argues that older single-detached homes hold the greatest potential for energy savings through retrofits. Second, existing buildings typically have a lifespan of 50 to 100 years (Power, 2008) and the performance of these buildings is

determined during the planning and construction phase (Karvonen, 2013). Therefore, buildings that are/were constructed during eras of low energy-efficiency building standards 'lock in' their energy use for decades (Gram-Hanssen, 2014). The IPCC's most recent report on buildings argues that 80 percent of energy use in buildings in 2005 will be locked in until 2050 (Lucon et al., 2014).

In Canada, the federal government has released national energy-efficiency standards by way of the National Energy Code for Buildings, with the first iteration released in 1997 (NRCan, 2016a). The uptake of these energy-efficiency standards varies provincially, as each province or territory has ultimate jurisdiction over the energy requirements in their respective building code (NRCan, 2016a). Over time, the energy requirements in buildings codes have become more stringent across the provinces and territories (NRCan, 2012), though the Canadian building stock constitutes many houses constructed without deep consideration for energy-efficiency during design and construction (MECC, 2016). The proportion of the housing stock by vintage for Ontario and Canada is displayed in Figure 2-1. Approximately 70 percent of the housing stock was constructed before 1995 in Ontario and Canada.

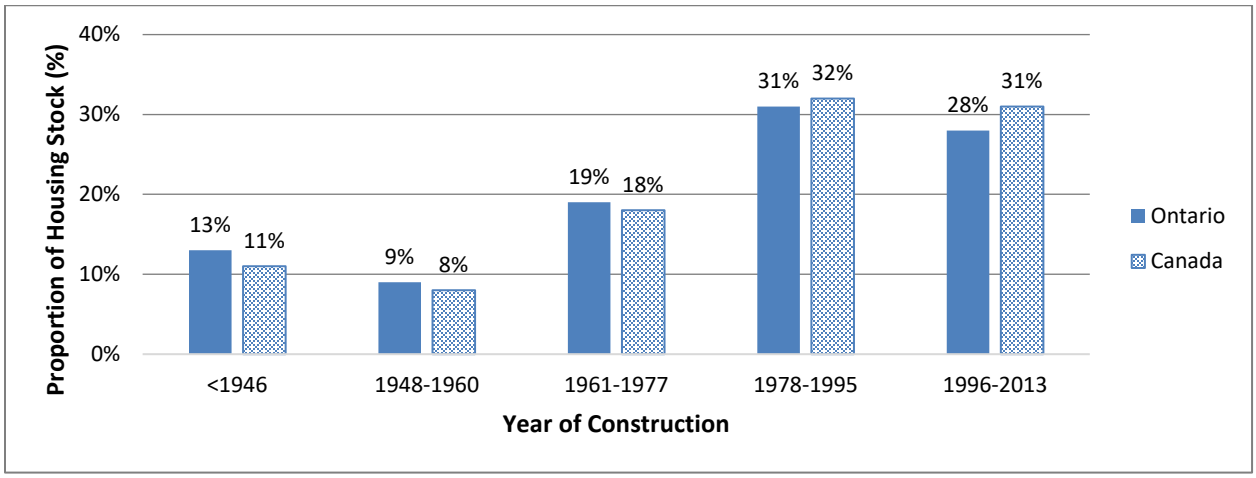

Figure 2-1: Building Stock by Year of Construction in Ontario and Canada in 2013 (NRCan, 2016b)

Since older homes were constructed before higher energy-efficiency standards, they require substantially more energy than newer houses. It is estimated that older homes, such as those built between 1950 and 1980, use at least 25 percent more energy for heating than houses constructed after 2010 on average (CMHC, 2012). The Comprehensive Energy Use Database from Natural Resources Canada (2016b) provides a detailed breakdown on space heating energy consumption in

Ontario's and Canada's residential sector, displayed in Figure 2-2. As this figure demonstrates, houses built before 1995 account for approximately 80 percent of space heating energy consumption in Ontario and Canada (and 70 percent of the housing stock), which is important since space heating accounts for 65 percent of total energy consumption in the residential sector (NRCan, 2016b). This provides support for the need to improve the energy-efficiency of the housing stock, broadly, and the objective of the Home Energy Coach program, specifically.

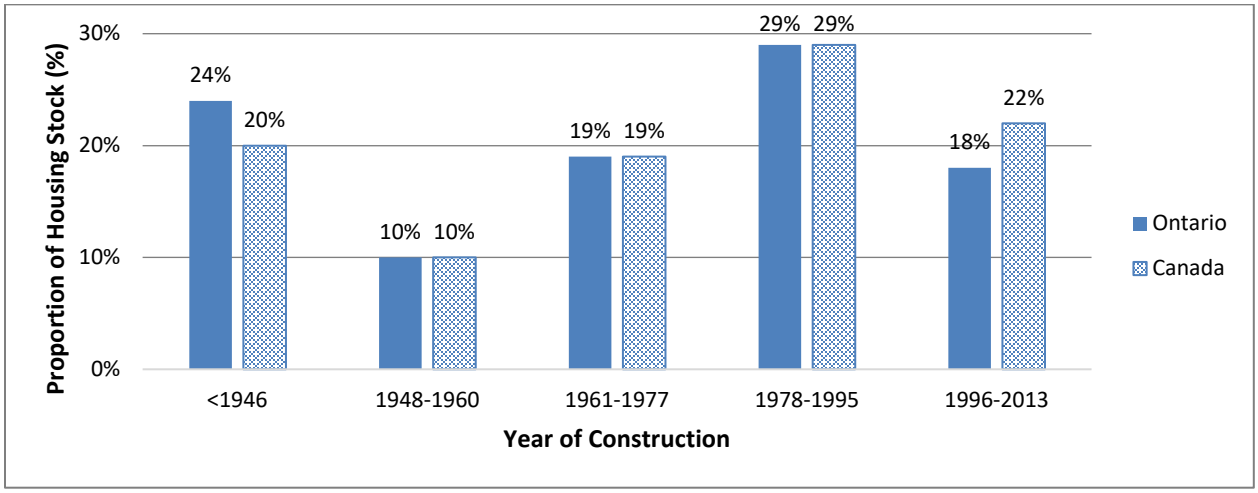

Figure 2-2: Space Heating Secondary Energy Use by Year of Construction in Ontario and Canada in 2013 (NRCan, 2016b)

While the last several decades have seen notable improvements to household energy-efficiency in Canada, these achievements have been counterbalanced by increases in the total number of households. Between 1990 and 2009, the number of households in the residential sector grew by 36 percent, which corresponded to an 11 percent increase in the total energy consumption. Thus, while space heating realized large energy-efficiency gains due to the replacement of old, inefficient heating systems, space heating requirements still rose 13 percent between 1990 and 2009, which accounted for 65 percent of total energy consumption (NRCan, 2016b). On the other hand, water heating energy use in the residential sector only rose 0.5 percent, though water heating only accounted for 21 percent of total energy consumption (NRCan, 2016b).

2.2.2. Energy-Efficiency Gap

There is a large body of literature that demonstrates the economic feasibility of innovative technological solutions that will improve the energy-efficiency of buildings, including the residential

sector. In an extensive sectoral review in the United States, Brown et al. (1998) documented cost-effective carbon-reduction potential in buildings, industry, transportation and utilities. In the residential sector, carbon-reduction opportunities were identified through improvements to the building envelope and other technological solutions. More recently, McKinsey and Company (2010) demonstrated, on their GHG abatement cost curve, that energy-efficiency investments in the residential sector, including upgrades or retrofits to lighting, appliances, HVAC, and insulation, are cost-effective solutions to achieve widespread reductions in emissions. Finally, Harvey (2013) reviewed studies on comprehensive energy-efficiency retrofit projects from around the world and concluded that single-family houses have reduction potential of 50 to 75 percent in their heating energy requirements. Therefore, feasible energy-efficiency improvement options do exist that address the concerns around space heating and water heating in the residential sector.

However, there exists a disparity between these economically feasible technological innovations and the actual market uptake in the residential sector (among other sectors), commonly referred to as the 'energy-efficiency gap' (Jaffe & Stavins, 1994). This gap represents an interesting phenomenon that has been the focus of a large body of research (McKinsey & Company, 2010; Schleich, 2007; Brown et al., 1998; Jaffe & Stavins, 1994; Hirst & Brown, 1990). Overall, while the financial justification for energy-efficiency investments has been made, the uptake of such measures among homeowners is low. The next section draws on different bodies of research to characterize the barriers that may be preventing the widespread adoption of energy-efficient measures.

2.2.3. Barriers to Residential Energy-Efficiency

2.2.3.1. General Barriers to Energy-Efficiency

Researchers argue that the energy-efficiency gap can be explained by various market failures and barriers faced by homeowners (eg. Backlund, Thollander, Ottosson, & Palm, 2012). Researchers from various disciplines, including economics, psychology, engineering, and sociology have focused on identifying and understanding the barriers facing homeowners in energy-efficiency decision-making processes. An overview of some of the oft-cited barriers is presented here in broad categories.

The first category includes financial barriers, such as limited access to capital, unattractive payback periods and uncertainty in the return-on-investment (Karvonen, 2013; Hamilton & Killip, 2009; Schleich, 2007; Wilson & Dowlatabadi, 2007, Brown et al., 1998; Hirst & Brown, 1990). The second category involves a lack of engagement from homeowners, which may be the result of a lack of interest (Karvonen, 2013) or a lack of experience (Hamilton & Killip, 2009). A third category often cited is a lack of information (Hamilton & Killip, 2009; Schleich, 2007; Wilson & Dowlatabadi, 2007, Brown et al., 1998; Hirst & Brown, 1990). Finally, trust is also a barrier often noted by homeowners (Hamilton & Killip, 2009), which is also evidenced by uncertainty in contractor reliability and quality (Wilson, Crane, & Chryssochoidis, 2015). Two of these barriers – information and trust – will be described in more detail below.

2.2.3.2. The Information Barrier

The information barrier is based on the premise that homeowners lack the relevant and necessary information to make appropriate decisions (which, in the context of this thesis, are taken to mean investments in energy-efficiency measures). Information may be provided, generally, about the nature of energy-related problems, or it may be provided to specifically address solutions that may be adopted (Abrahamse et al., 2005). There are a number of channels through which to provide information, including mass media campaigns, workshops, and tailored information programs (eg. home energy audits) (Abrahamse et al., 2005). Much research has been dedicated to understanding the most effective means of communicating information that will be converted into action. Some of the important variables in effective communication are discussed below.

One of the key factors that increases the effectiveness of information transfer is personalizing or tailoring the information to the audience. Tailored information has been recognized as holding more potential than general information, as it eliminates the 'overload' of information that may not be relevant to a particular homeowner's circumstances (Murphy, 2014; Ingle, Moezzi, Lutzenhiser & Diamond, 2012; Abrahamse et al., 2005). Indeed, literature from social psychology emphasizes that in order for information provision to be most effective, information must be highly personalized (Scott et al., 2016; Coltrane, Archer & Aronson, 1986; Costanzo et al.,

1986). Further, Kaplan (2000) argues that "people prefer acquiring information … in answer to their own questions" (p.498).

Another important factor is the availability of choices for the audience. Fischer (2008) asserts that information that is interactive and presents choices for homeowners is more engaging than information that is more standardized. Similarly, other researchers have found that individuals want to participate and play an active role in developing solutions to problems, which may contribute to greater effectiveness of the information transfer (Kaplan & Kaplan, 1989; Costanzo et al., 1986). Individuals are likely to avoid situations in which they perceive they are 'helpless' or cannot do anything to change the outcome (Kaplan, 2000), therefore flexibility and the availability of choices to craft a personalized solution to a problem is likely to increase the effectiveness of information transfer.

Fischer (2008) also argues that the way information is presented will influence the effectiveness of communication. She argues that information should be provided in a clear, understandable and appealing way. Similarly, Coltrane et al. (1986) argue that information should be presented in simple and concise language that is suitable to the audience. Additionally, information transfer is considered more effective when it is vivid, such as through face-to-face interaction and through stories, rather than static, dull presentations of numbers or figures (Costanzo et al., 1986).

Further, information is more likely to be believed when it can be validated by one's own knowledge and within their social networks (Scott et al., 2016; Bartiaux, 2008; Gram-Hanssen, 2007; Parnell & Popovic Larsen, 2005a). When individuals are faced with new information, they must weigh that information in relation to existing knowledge and decide how the information will be processed (Gram-Hanssen et al., 2007).

2.2.3.3. The Trust Barrier

Evidently, homeowners need access to personalized, clear information about their own circumstances and have choices available in order to make appropriate decisions for energy-efficiency investments in their household. It is also important that this information comes from a

credible, trustworthy source (Coltrane et al., 1986). Darby (1999) argues that effective information transfer requires trust between the advisor and client (ie. homeowner). For example, homeowners may hold uncertainty that material suppliers and contractors are unbiased when providing product recommendations, as these industries rely on sales to make a profit. The argument stands that homeowners are more likely to believe information that comes from a trusted source because the advisor has the best interests of the homeowner in mind, and provides unbiased advice.

2.2.4. Energy-Efficiency Interventions in the Residential Sector

Energy interventions in the residential sector are designed with the objective of helping homeowners overcome the aforementioned barriers and facilitate the uptake of economically viable energy-efficiency investments. Broadly, these approaches fall into three categories: policy regulation, financial incentives, and information provision (Karvonen, 2013). On a conceptual level, each of these interventions are based on the premise that homeowners want to save energy and money, but are prevented from doing so by any number of barriers (Wilson et al., 2015). Policy regulation may include changes to efficiency standards or the requirement of energy rating certificates. Financial incentives may take the form of government grants, tax credits, subsidies or low-interest loans. Finally, information interventions may include marketing, education campaigns and workshops, or home energy audits (Wilson et al., 2015). It is home energy audits that will be the focus of the next section of this literature review.

2.3. Home Energy Audits

2.3.1. Theoretical Background of Energy Audits

Home energy audits are touted as a valuable and effective tool to overcome the information barrier. The underlying assumption is that energy audits can overcome the information barrier by providing customized recommendations to homeowners on energy-efficiency opportunities in their home, thereby eliminating any unnecessary or irrelevant information. It is argued that homeowners will then initiate energy-efficiency improvements with this information in hand (Murphy, 2014).

There are three general types of home energy audits: Class A, Class B, and Class C. The distinction between each class is the level of sophistication of information provided by the audit.

Class C audits are completed by the homeowners themselves and are the most basic type of audit (McDougall, Claxton & Ritchie, 1983). Class B audits require particular information to be input by homeowners, upon which an analysis is carried out by a computer program. These types of audits are often criticized for relying on inaccurate or inadequate information and for their inability to appreciate the particularities of each house (McDougall et al., 1983). Further, while this class of audit has the potential to reach a large portion of the population in a given time for a given cost, it is unsuitable for houses with particular or complex issues (Darby, 2003). Class A audits, on the other hand, involve an on-site inspection from an energy auditor (McDougall et al., 1983). It is this class of audits that is seen as holding the most potential to facilitate energy-efficiency investments in the residential sector (Murphy, 2014), and will be the focus in this literature review and thesis. In these types of home energy audits, the auditor assesses the house for air leaks and areas of heat loss, as well as inefficient appliances and lighting. Based on the walk-through inspection and analysis of past utility bills, the auditor develops a personalized report with recommendations for efficiency improvements based on the payback periods of each investment (Palmer et al., 2013). However, a lack of standardization in the audit industry means that the type and quality of services offered may differ greatly between one audit firm and the next (Palmer et al., 2013), and even between auditors in the same organization (Hoicka, 2012).

2.3.2. Impacts of Energy Audits

The literature on the impacts of energy audits provides evidence from a variety of sources, including self-reported impacts from homeowners, quantitative analyses based on analyses of energy consumption data and surveys with energy audit professionals. Taken together, the evidence suggests that the impacts of energy audits are quite mixed. The following will present these impacts, with an emphasis on identifying limitations or gaps in research approaches where applicable.

Some research has identified positive relationships between receiving an energy audit and implementing energy-efficiency measures. Hirst, Berry and Soderstrom (1981), in their investigation of six energy audit programs in the United States, found that on average, 40 to 50 percent of audit recipients implemented energy-efficiency measures. The authors compared these findings with a

larger sample of homeowners that had not received an energy audit and found that only one-third of those homeowners implemented energy-efficiency measures. Therefore, the authors concluded that the audit had a positive impact on the uptake of energy-efficiency renovations.

In a related study, Winett, Love and Kidd (1982-83) compared electricity consumption between apartment dwellers who had received an audit from a trained professional in energy conservation, an auditor with no training in energy conservation and a control group. The audit focused on hot water heating and air conditioning. The authors found that the audit groups reduced electricity consumption by 21 percent compared to baseline and the control group, and that the difference between the two audit groups was minimal, though the group who received the audit by the auditor trained in energy conservation demonstrated more consistent and long-lasting reductions.

In another study, Gonzales, Aronson and Costanzo (1988) compared the likelihood of implementing audit recommendations and utility consumption data between two groups of audit recipients: one group received an audit from an auditor 'trained' in socio-psychological communication techniques (persuasive communication, personalized information, encouraging commitment and framing recommendations in terms of loss rather than gain) and one group received an audit from an 'untrained' auditor. The researchers found that those in the 'trained' auditor group were more likely to implement audit recommendations. However, a longitudinal analysis of the utility consumption data showed no differences between the experimental and control groups. The authors attributed the inconsistent results to the complex relationship between energy-related behaviours and fuel consumption, while underscoring the success of their intervention from a behavioural change standpoint.

Finally, Ingle et al. (2012) investigated the differences between groups that had received an audit report with personalized recommendations versus standardized suggestions. The authors found that those who received personalized recommendations were more likely to invest in efficiency upgrades to equipment, appliances and the building envelope.

Evidence from the audit industry also sheds light on the impact of energy audits, though the potential bias of this source must be acknowledged. Palmer et al. (2013) surveyed professional

auditors to determine how often households complete recommendations following an audit. The responses indicated that 71 percent of auditors reported that homeowners make at least one improvement fairly often or always. However, 29 percent of auditors reported that at least half of their customers do not follow through with any improvements. Moreover, homeowners rarely complete all of the recommended improvements (Palmer et al., 2013).

There is also a body of literature that suggests energy audits do not positively impact the uptake of energy-efficiency measures. Recently, Murphy (2014) administered a survey to a large sample of Dutch households (n=3,411) to compare the role of audits in the decision-making processes of energy-efficiency investments between households that had and had not received an energy audit. Overall, the author found no significant relationship between implementing an energy-efficiency measure and receiving an energy audit. Further, only 19 percent of audit recipients indicated that the audit had influenced their decision to implement energy-efficiency measures.

In another study, Hirst and Goeltz (1985) examined the impact of the Bonneville Residential Weatherization Pilot Program in the United States, which offered a free energy audit program and zero-interest loans for weatherization. The researchers compared electricity consumption before and after the audit intervention to characterize the net energy-saving impact of the program, and found 'surprisingly small' reductions (p.27).

Finally, Bartiaux (2008) demonstrated that, while customized energy-efficiency recommendations were more appreciated by homeowners than general advice, these were not necessarily translated into implemented measures. The author found that one year after the energy audit, households had implemented only 10 percent of the recommendations, and that these were more likely to be the 'smallest' or easiest to implement, such as pipe insulation or water-conserving showerheads.

Some researchers have even identified a negative relationship between energy audits and the uptake of energy-efficiency measures. Frondel and Vance (2013) investigated the impacts of audits on four different types of retrofits among a sample of German households. The authors

found that the impacts of the audit varied greatly, and that in some cases the information provided by the audit had the opposite effect than was intended.

The differences in evaluation and reporting in the above studies, including a mix of self-reported data from homeowners and some analysis of utility consumption data, make it difficult to compare the effectiveness of audits on a broader scale. Surveys from audit professionals also illustrate the variability in follow-up once an audit is completed. In their sample, Palmer et al. (2013) found that roughly 40 percent of auditors rarely or never compare actual savings to the projected savings, while 40 percent often or always do, and these calculations vary depending on the source of the data. This thesis does not attempt to criticize one evaluation method or another, but to highlight the variability in evaluation techniques which makes direct comparison between studies difficult.

2.3.3. Limitations of Energy Audit Programs

Despite the rational theoretical underpinnings of audits, the literature presented here demonstrates that the impacts of audits are mixed. The authors of these studies, among others, provide explanations for the lack of uptake, many of which mirror the barriers discussed in Section 2.2.3. For example, Murphy (2014) indicated that over one-third of respondents (from n=776) consider their house to be efficient enough already, while others indicated financial constraints, long payback periods, and inconvenient measures as reasons for not adopting energy-efficiency measures. Frondel and Vance (2012) identified insurmountable financial barriers in their study, while Palmer et al. (2013) argued that the high costs of retrofits and low energy prices contribute to a lack of action more than a lack of information. Palmer et al. (2015) found that characteristics of the auditor were related to the uptake of investments, which relates to themes of trust and uncertainty in the literature on barriers. Palmer et al. (2013) asserted that homeowners must understand the information provided from the audit in order for the audit to facilitate changes in energy-efficiency investments, and that a lack of knowledge, understanding, and trust in audits are pervasive obstacles in the industry. Evidently, there is a range of barriers that energy audits alone do not seem capable of overcoming, and information is not the only barrier that audits need to address.

Some researchers have taken a different perspective on energy audits, arguing that the limitations of energy audits stem from an unsupportive environment after the audit is conducted. Shapiro (2011) contends that a major limitation of energy audits is a lack of appropriate guidance for implementing audit recommendations. Further, Parnell and Popovic Larsen (2005a) argue that the traditional audit process promotes the homeowner as the problem, while audit programs should promote the homeowner as part of the solution by encouraging the exploration and active participation of homeowners in finding unique solutions to their problems. Further, Parnell and Popovic Larsen (2005a) argue that homeowners lack sufficient resources on procedural information. Similarly, Scott et al. (2016) argue that energy audits do not provide supportive social networks, which was identified in Section 2.2.3. as an important component of information transfer.

On a conceptual level, energy audits rely on a 'rational-actor model', which characterizes homeowners as motivated to act in ways that maximize economic benefits, given appropriate incentives (Archer et al., 1987). These are typically based on a top-down governance approach (Catney et al., 2013; Karvonen, 2013). The decision to undertake energy-efficient renovations is framed as a technical or economic problem, but critics argue that the depiction of homeowners as individualistic, rational consumers solely facing technical or economic problems ignores the social context in which decisions are made (Gram-Hanssen, 2014; Catney et al., 2013). These authors argue that, to have greater impact, energy audit programs need to recognize and integrate the broader social networks in which energy-efficiency decisions are made.

2.3.4. Energy Audits in a Canadian Context

The Canadian government has deployed various programs aimed at increasing household energy-efficiency in the residential sector since the late 1990s (Hoicka & Parker, 2011). In 1998, the EnerGuide for Houses (EGH) program was introduced by the Canadian government to stimulate energy-efficiency improvements in the residential sector, and is managed by Natural Resources Canada (NRCan). Under this program, homeowners are encouraged to complete a home energy audit and to complete appropriate energy-efficiency upgrades (Gamtessa, 2013). Most provinces in Canada, including Ontario, utilize an EnerGuide rating scale which ranges from 0-100, with 0 being

the least and 100 being the most energy-efficient (NRCan, 2016c). The typical rating based on various house characteristics is displayed in Table 2-1.

Table 2-1: Typical EnerGuide Rating Based on House Characteristics (taken from NRCan, 2016b)

House Characteristics	Typical Rating
Older house not upgraded	0 to 50
Upgraded older house	51 to 65
Energy-efficient upgraded older house	66 to 74
New house built to building code standards without energy requirements	70 to 76
New house built to building code standards containing energy requirements	77 to 80
Energy-efficient new house	81 to 85
High-performance, energy-efficient new house	86 to 99
Net zero house	100

According to the Climate Change Action Plan for 2016—2020, released by the Ontario government, energy audits will be required for newly-built or existing single-family homes before they can be listed for sale. The government plans to launch a program that will offer these audits for free by 2019, with the intention to improve consumer awareness when purchasing a home, and to encourage the uptake of energy-efficiency incentive programs (MECC, 2016). This highlights the need to increase the effectiveness of audit programs to maximize the participation rates in energy-efficiency programs.

2.4. Toward a New Approach in Energy Audit Programs

Section 2.3.1. described the conceptual basis of energy audits, which is that audits can overcome the information barrier by providing personalized recommendations in a vivid, clear manner by credible energy audit professionals. However, as Section 2.3.2. highlighted, the mixed success of energy audit programs demonstrates a gap in the design of energy audit programs. Thus, Section 2.3.3. identified some of the potential gaps by highlighting some components of effective information transfer that energy audits alone may fail to operationalize. Individuals want access to choices and to participate in developing solutions to their problems (Fischer, 2008; Kaplan & Kaplan, 1989). Individuals also need access to information regarding the next steps to overcome feelings of helplessness (Kaplan, 2000). Finally, individuals process information more effectively when it is supported by their own knowledge and within their social networks (eg. Bartiaux, 2008; Gram-Hanssen, 2007). Therefore, there may be room to reshape energy audit programs to

incorporate these aspects for more effective program design. This section of the literature review will present research from various disciplines that contributes to understanding how these aspects of information transfer can be better addressed in a new energy audit program.

2.4.1. Role of Supportive Environment

In response to low uptake of energy-efficiency recommendations in their audit report program, Parnell and Popovic Larsen (2005a, 2005b) proposed an alternative design. The authors argue that the energy audit and associated report should be components of a larger program to increase the effectiveness of energy audit programs. Within their 'everyday householder-centred' framework, the authors emphasize the necessity of a supportive environment that engages the homeowner and encourages action from the recommendations. The four components of the supportive environment are discussed below and illustrated in Table 2-2.

Parnell and Popovic Larsen (2005a) argue that the first component of the supportive environment is exploration on the part of the homeowner, meaning that the program should be accessible and open to homeowners as they develop questions and seek out information based on their audit report. This relates back to themes of personalized information transfer (Kaplan, 2000; Coltrane et al., 1986; Costanzo et al., 1986), as homeowners seek out specific information that is relevant to their own situation.

The second component of the supportive environment is participation on the part of the homeowner, meaning that the program should promote the participation of homeowners in developing appropriate solutions for their household based on their own goals and those options which are technically and economically feasible (Parnell & Popovic Larsen, 2005a). These two components address individuals' desire for choices and interactivity in information transfer (Fischer, 2008) and allows people to help construct their own solutions to overcome feelings of helplessness and incompetence (Kaplan, 2000; Kaplan & Kaplan, 1989).

Parnell and Popovic Larsen (2005a) go on to discuss procedural information as the third component of the supportive environment. By providing procedural information, the program would address the need for guidance to execute the renovations as Shapiro (2011) calls for. Further, equipping individuals with relevant, actionable information helps to provide motivation to actively

contribute to solutions (Kaplan, 2000). Procedural information should include a description of the actual work involved, information on how to choose a contractor, and information on selecting high-quality products for those that are doing work themselves (Parnell & Popovic Larsen, 2005a). This would also address barriers of uncertainty in material supply and contracting work as discussed by Wilson et al. (2015).

Finally, Parnell and Popovic Larsen (2005a) assert that the supportive environment would provide an opportunity for social interaction. This would address the aspect of information transfer that favours information that is supported by social networks (Scott et al., 2016; Bartiaux, 2008; Gram-Hanssen et al., 2007; Coltrane et al., 1986) and by providing a trustworthy and credible environment for discussion (Coltrane et al., 1986). Social interaction could entail group events so that individuals could provide encouragement and support for one another. This notion is supported by a recent study by Scott et al. (2016), who investigated the effectiveness of energy audits compared to community energy events and found that a combination of the two events may be the most effective at encouraging energy-efficiency investments among homeowners.

Table 2-2: Components of a Supportive Environment and Information Transfer Attributes (adapted from Parnell & Popovic Larsen, 2005a, 2005b)

Component	Description	Information Transfer Attribute
Exploration	– Homeowner guides further information provision	– Personalized information (eg. Abrahamse et al., 2005)
Participation	– Homeowner plays active role in developing solutions	– Interactivity, availability of choices (Fischer, 2008)
Procedural Information	– Homeowner has guidance through renovation 'milestones'	– Competence to overcome helplessness (Kaplan, 2000) – Trustworthiness in contractors and materials (Wilson et al., 2015)
Social Interaction	– Homeowner has interaction with other homeowners through group events	– Information supported by social networks (Scott et al., 2016; Bartiaux, 2008; Gram-Hanssen et al., 2007) – Information exchange through trusted networks of peers (Costanzo et al., 1986)

Parnell and Popovic Larsen (2005a) argue that a follow-up advice service is an appropriate solution to operationalize the four components of a supportive environment. The authors argue

that all of these components necessitate a dialogue between homeowner and expert, or between homeowners and other homeowners, which is suitable for face-to-face interaction. Parnell et al. (2002) investigated the interest level of a free advice program provided to homeowners who had received an energy audit report upon moving in to their new home and found that 80 percent of their sample (n=256) indicated that they would use a free advice service if offered.

The assertion for greater guidance and support following an energy audit was put into action through the Small Town Energy Program (STEP) in University Park, Maryland, USA. This energy-efficiency program incorporated an Energy Coach to encourage energy-efficiency upgrades to the aging housing stock in the community by providing individual support to homeowners as they worked their way through the renovation process (Wilson, 2014). This program is discussed further in Chapter 3, as the methods for the intervention design and data collection drew from this program.

The next section, Section 2.4.2., discusses the effectiveness of these types of services in other domains, which this thesis will broadly term 'coaching services'. Then, Section 2.4.3. discusses the appropriate stakeholders to take the lead on deploying such services in an energy audit program. Finally, Section 2.4.4. briefly presents literature pertaining to how this energy audit program should be studied.

2.4.2. Personal 'Coaching' in Other Domains

The role of coaching has found applications in many domains, such as health care, fitness, and education. While the label in each application may differ (eg. personal trainer, tutor), the definition of the role of the 'coach' is taken to be the same in this thesis. For the purpose of this thesis, the role of the coach is to engage in one-on-one dialogue with an expert to address a specific problem through the provision of resources and support. This section discusses empirical evidence on the role of the 'coach' in these three applications.

Within the health care field, patient decision aids (PDAs) represent a comparable role with which to compare an energy coach. As O'Connor et al. (2004) identify, three main objectives of patient decision aids are (1) to provide information on relevant options and the associated benefits and risks of each option, (2) to understand the patient's values so that the chosen option

incorporates the best interests of the patient and (3) to provide guidance in the deliberation process and enhance communication skills with practitioners. These objectives are analogous to the objectives of an energy coach, whose purposes would be to provide information on the relevant energy-efficiency upgrade options, to incorporate the homeowner's interest and concerns into the decision, and to guide the decision-making process while building the capacity to communicate with relevant actors, such as contractors. O'Connor et al. (2004) investigated the impact of patient decision aids and found that they were more effective at increasing knowledge, promoting active participation from the patient, and supporting consistency in the patient's values and the option chosen. This provides support for the role of an energy coach in promoting active participation and supporting homeowner interests in decision-making, both attributes that promote the conversion of information transfer into action.

Similarly, Appel et al. (2011) investigated the effectiveness of two weight loss intervention programs involving coaching support against a control group in a population of obese patients. In one intervention, participants were provided with support through telephone, internet and email, while the second intervention offered these sources of support as well as an in-person health coach in both individual and group settings. The control group was given general advice but did not have access to these additional sources of support. The two intervention conditions are comparable to the services provided by an energy coach, while the general advice may be comparable to the audit report with no follow-up resources. The authors found that those participants in the intervention conditions achieved greater weight loss than those in the control group. Further, the authors found no statistically significant differences between the intervention conditions, providing support for multiple avenues of support (both remote and in-person). The authors noted that the effectiveness of remote support in their study is advantageous for its flexibility and scalability. This also provides support for the role of an energy coach in facilitating action, specifically through a range of follow-up resources.

In a related study by Jeffrey et al. (1998), the authors investigated the use of personal trainers and incentives to encourage weight loss in participants. The authors found that both interventions were more effective than the control at encouraging weight loss, and that the combination of both was most effective. This provides further support for the use of personal coaches in achieving

specific results, and also indicates the importance of incentives which is established in the literature on energy studies.

In the fitness industry, the prevalence of personal trainers suggests that one-on-one interaction with a professional is beneficial to the recipients of this service. In one study, Ratamess et al. (2008) found that women working with a personal trainer were more likely to self-select higher workout intensities and perceived higher exertion in resistance-training programs than those working without a personal trainer, which is important because the level of intensity is crucial in resistance training as it dictates the level of muscle growth through training. Therefore, working with a personal trainer in this study was positively correlated with more effective workouts through the provision of support and expertise in effective resistance-training workouts.

Support for personal coaching also comes from the field of education. For students struggling to understand course material, a tutor provides one-on-one interaction to understand the specific problem and developing a targeted approach to facilitate learning. Again, a tutor plays an analogous role to an energy coach as the problem area is identified, customized solutions are developed, and resources and support are provided to improve or 'correct' the problem. Topping (2005) indicates that peer tutoring is effective at improving academic achievement within subject areas, and that it can also support development in social and communication skills.

Taken together, evidence from the domains of health care, fitness, and education provide support for the effectiveness of personal coaching to encourage positive results in particular situations. Based on these foundations, it is believed that similar applications of coaching may be of value in an energy context. The next section explores the stakeholders that may hold the most potential for an energy coach intervention study.

2.4.3. Role of Local, Community-Based Initiatives and Stakeholder Collaboration

Karvonen (2013) argues that while current top-down, macro-level approaches to encourage energy-efficiency investments are important and necessary, they are proving insufficient to prompt the widespread, significant changes to the housing stock that are required. As discussed, top-down approaches typically favour economic and technical interventions, without giving consideration to

other motivations or concerns. Karvonen (2013) argues that a change in the governance structure that includes initiatives on a more local scale will be required to complement existing approaches. Local initiatives hold great potential to stimulate energy-efficiency investments and contribute to GHG emission reductions (Bale et al., 2013), which is supported by others in the literature (Berry, 2010; Parker & Rowlands, 2007).

There is a growing body of literature that suggests that the regional or local scale is the most important scale to concentrate and implement interventions (Sol et al., 2013). This is because regional actors have particular localized knowledge that actors outside of the region may not have access to (Sol et al., 2013). There are many factors that may be specific to a particular region, such as features of the housing stock, incentive programs, skills capacity and public engagement. Further, the regional or local scale is one that "allows for directly linking with those who should act, be it the key stakeholders or the citizens themselves" (Bohunovksy, Jäger, & Omann, 2011, p.272).

Within local contexts, community-based organizations have been deemed as holding great potential for more effectively designing and implementing energy-efficiency programs (Berry, 2010; Fuller et al., 2010). Community-based organizations (in an energy context) are broadly defined as nongovernmental entities with the purpose of facilitating energy savings in a particular region, and are usually non-profit organizations (Berry, 2010). Indeed, the important role of non-profit organizations in sustainable development was internationally recognized in Agenda 21, the proceedings from the 1992 United Nations Conference on Environment and Development (UNCED) (UN, 1992). Community-based organizations possess unique advantages over other entities in terms of recruitment and participation through civic engagement and social marketing (Berry, 2010). Through civic engagement, community members are motivated to participate in efficiency programs for reasons such as helping a cause, caring for the place in which they live, learning and improving their skills and social interaction (Measham & Barnett, 2007). As discussed in Section 2.2.3., information transfer and program design are most effective when coming from trustworthy, credible sources, and community-based organizations have been demonstrated as trusted information sources for community members (Berry, Sharp, Hamilton & Killip, 2014; Berry, 2010; Middlemiss & Parrish, 2010; De Vita & Fleming 2001; Kennedy et al., 2001; Stern et al., 1985). Through social marketing (or community-based social marketing), community-based organizations

are more effective in program design by focusing on a particular issue, identifying the desired outcome and the barriers to that outcome, and running pilot programs to refine programs based on evaluation from participants and other stakeholders (McKenzie-Mohr, 2000).

One of the challenges with community-based initiatives is that they often have only limited resources (Berry et al., 2014; Berry, 2010; De Vita & Fleming, 2001). To overcome these limitations, collaboration with other stakeholders is a feasible solution, as the resources, expertise and funding from a variety of sources can be leveraged (Berry, 2010). Collaboration with research institutions, citizens, support organizations and ministries have the capacity to generate new, specialized knowledge (Sol et al., 2013; Pekkarinen & Harmaakorpi, 2006), as it allows for greater consideration of the local context in which research studies take place and contributes to deeper understandings of local, situated knowledge and circumstances (Cada & Ptácková, 2013). Collaboration also overcomes barriers of trustworthiness by combining the resources of lower credibility sources like utility companies with the higher credibility sources like non-profit community groups (Berry, 2010; Stern & Aronson, 1984). Therefore, collaboration between various stakeholders holds the potential to encourage energy-efficiency recommendations by recognizing the interests and concerns of the local community and using localized knowledge to develop solutions, while pooling together resources and overcoming issues of trust that any one organization may face on their own.

2.4.4. Evaluation of Energy Audit Programs

Crosbie (2006) argues that energy studies are often investigated using quantitative research approaches, calculating the 'success' of interventions based on energy savings before and after the intervention. However, these types of analyses fail to address the human dimensions of the intervention, and cannot answer questions such as why homeowners failed to implement simple, low cost measures. She argues that the effective design of energy interventions necessitates a qualitative research approach to understand the perspectives of program participants. Similarly, Crosbie and Baker (2010) argue that investigations limited to technical analyses of an intervention are flawed for their lack of understanding about why participants responded to the intervention in the ways that they did. Without an understanding of how and why energy programs do or do not

suit the audience, interventions will continue to be ineffective at facilitating widespread changes in energy use, broadly, and energy-efficiency investments, specifically.

In response to this, Crosbie and Baker (2010) investigated four energy-efficiency interventions to understand the demographics, motivations, perceptions of the intervention and reflections for how the intervention could be improved in the future. In a related domain of energy studies, Hargreaves, Nye and Burgess (2010) piloted the use of several different smart energy monitors among homeowners. As their investigation focussed on a new technological intervention, the authors collected information on motivations for participating in the program, how the technology was used, what perceived impact the technology had, and suggestions for improving the technology using a qualitative research approach.

This thesis arguably embarks with an analogous objective, which is to pilot an innovative energy audit program with the addition of an Energy Coach. Therefore, the arguments put forward by these researchers are applicable to the evaluation methodologies developed for this thesis, which are discussed in greater detail in Chapter 4.

2.5. Integration and Summary

As the literature has demonstrated, there is a need to improve the efficiency of the residential building stock which requires the cooperation and actions of homeowners. While energy-efficiency opportunities are available at low cost, the uptake of these measures is surprisingly low, which is attributed to various barriers (eg. lack of information, lack of trust). Energy audits have been discussed as a valuable tool to provide customized information to homeowners to overcome the information barrier so that appropriate energy-efficiency measures can be implemented in the home, though evidence suggests that the actual impacts of audits are mixed. Several potential reasons include inconsistencies in the information provided with established social networks, a lack of understanding or trust with the audit industry, and a lack of appropriate guidance following the audit. Literature from other domains suggests that a 'coach' may help to overcome these barriers. A new framework for energy audit programs calls for a supportive environment to engage homeowners once the audit report is received, which would facilitate action by promoting exploration and active participation by the homeowner, guiding homeowners to relevant

procedural information to take the next steps, and offering opportunities for social interaction with family, friends and peers. The literature suggests that non-profit organizations have a role to play in facilitating this type of program on a local level, and that collaboration from other stakeholders can strengthen the effectiveness of the program with resources and expertise. The literature also calls for an assessment of the energy audit program through the perspective of how and why participants responded in particular ways so that these findings can be used to improve the effectiveness of future interventions.

Chapter 3: Case Study

3.1. Introduction

The chapter describes the case study that was the focus of this thesis' investigation: the Home Energy Coach Program. Section 3.2. discusses the partners involved in the development of the program. Next, Section 3.3. outlines the objectives the program set out with. Section 3.4. outlines the design of the program, followed by the available rebates in Section 3.5. Finally, Section 3.6. describes how the program was marketed to homeowners in Waterloo Region.

3.2. Program Partners

The Home Energy Coach Program[1] was a collaborative project developed and funded by a number of different partners who bring with them expertise, innovative ideas and community leadership. Leading the project is REEP Green Solutions (REEP), a non-profit charitable organization in Kitchener, Ontario with 17 years of experience in the community. REEP's mission is to promote energy and water sustainability initiatives, through technical and behavioural change (REEP Green Solutions, n.d.). Further, REEP has been a delivery agent of EnerGuide home energy audits to thousands of houses in Waterloo Region since its inception in 1999 (Hoicka & Parker, 2011). Mindscape Innovations Group Inc. is an organization bringing experience in energy-efficiency in buildings, as well as renewable energy technology and sustainability training (Mindscape Innovations, n.d.). Scaled Purpose Inc. is a consulting company focused on sustainability initiatives and social innovation (Scaled Purpose, n.d.). Other project members include Kitchener Utilities, a local electricity distribution company, and Green Communities Canada, an association of environmental community organizations across Canada. The core funder of the program was Natural Resources Canada, a department of the federal government.

3.3. Program Objectives

The overarching objective of the HEC program was to encourage and enable builders and homeowners in Waterloo Region to invest in residential energy improvements that will contribute to the Region's community-wide goal of greenhouse gas emission reductions. As such, the project

[1] Previously called *Home Energy Catalyst: Changing the Housing Stock in Waterloo Region*.

was divided into two parts; one that was dedicated to working with residential builders, and one that was dedicated to working with homeowners. This thesis focuses on the Home Energy Coach and his interactions with homeowners involved in the program.

3.4. Program Design

The Home Energy Coach (hereafter referred to as the Energy Coach) was selected on the basis of having building science technical expertise and experience, as well as an ability to conduct personable consultations with homeowners. REEP Green Solutions held an introductory session at the REEP House to 'meet the coach' on Saturday, October 3, 2015 to introduce the Energy Coach to the community. An introduction hosted by a local organization was used in a study by Ornetzeder & Rohracher (2003) to overcome uncertainty and improve participation rates.

The Energy Coach was offered as a free service to homeowners in Waterloo Region between October 2015 and March 2016, on the condition that homeowners purchased and completed an EnerGuide home energy evaluation (EGH evaluation) by a certified Energy Advisor[2]. However, a free orientation session with the Energy Coach was offered for homeowners who were unsure of whether or not to complete a home energy evaluation, with no obligation. Following the orientation session, homeowners could decide – with no 'time limit' – whether they wanted to pursue a home energy evaluation. Once homeowners had completed an initial EGH evaluation, at a cost of $375[3] through REEP Green Solutions (REEP Green Solutions, 2015), they received an evaluation report from the Energy Advisor with information about their house's EnerGuide rating, and customized recommendations to increase the energy-efficiency of their home (Natural Resources Canada, 2016). A sample evaluation report is included in Appendix B.

Upon completing the EGH evaluation, homeowners were offered three free consultations with the Home Energy Coach, up to 45 minutes per consultation. These consultation sessions were

[2] Distinct from the Energy Coach, the role of the Energy Advisor was to conduct the EnerGuide home energy evaluations and prepare subsequent evaluation reports. All energy audits were conducted by the same Energy Advisor.

[3] Residents of Kitchener are charged $315, as Kitchener Utilities provides a $60 contribution.

offered in-person, over the phone, or by email[4]. The in-person consultations were held at the REEP House for Sustainable Living, a green demonstration home located in Kitchener, Ontario. At the REEP House, consultations were held in an office with a large insulation display, exhibiting numerous types of insulation with relevant technical information, installation costs and estimated payback periods.

The services offered included a review of the recommendations from the evaluation report, determining priorities for the renovations, developing a 'game-plan' on how the renovations would be completed, creating a budget (including help accessing available incentives) and executing the renovations. In order to qualify for any rebates, a follow-up home energy evaluation was required to assess the changes that have been made. Follow-up evaluations were offered through REEP Green Solutions for a price of $150[5]. Homeowners were also encouraged to bring in quotes from contractors for review with the Energy Coach.

3.5. Rebates Available

While the role of incentives was not a central focus of this thesis research, the incentive program that was promoted by REEP Green Solutions is briefly described.

3.5.1. Union Gas Home Reno Rebate

Union Gas is a natural gas utility company that services over 1.4 million customers in residential, commercial and industrial sectors across northern, eastern and southwestern Ontario. Union Gas provides service to residents in Waterloo Region (Union Gas Limited, 2016), except residents in Kitchener which are serviced by Kitchener Utilities (REEP Green Solutions, 2016).

The Home Reno Rebate was offered to active Union Gas account holders who owned a detached, semi-detached, row townhouse or mobile home and had a natural gas furnace/boiler. Further, homeowners must have completed a pre-renovation and post-renovation energy evaluation of their home, in addition to completing at least two eligible renovations. The eligible

[4] On January 29, 2016, interim feedback was provided by the researcher to REEP Green Solutions that indicated some homeowners wanted to hold consultation sessions with the coach in their own home. As a result, the coach was available for consultations at the homeowner's residence beginning early February 2016.
[5] Residents of Kitchener are charged $110, as Kitchener Utilities offers a $40 contribution.

renovation items included air sealing, insulation (attic, basement or exterior wall), and upgrades to the furnace/boiler, water heater and window/door/skylight (Union Gas Limited, 2016). Therefore, these were the seven items that were included as renovation priorities on the surveys, though an 'Other' option was included. The maximum rebate amount for eligible homeowners was $2,500, which included up to $500 for the required energy evaluations (Union Gas Limited, 2016).

3.6. Marketing for the Home Energy Coach Program

REEP Green Solutions (REEP) headed the marketing and communications strategy for homeowner recruitment for the Home Energy Coach Program. REEP has been recognized for its success in participant recruitment for EnerGuide home evaluations through community-based social marketing techniques (Kennedy et al., 2001). The marketing strategy focused on targeting older homes, defined as homes built before 1975. The rationale behind this selection was that retrofits to these homes (those built before building regulations became stricter in terms of energy efficiency) would generate greater energy savings for the homeowner. In turn, this was thought to maximize greenhouse gas emission reductions as compared to homes built after 1975. It is important to note that, despite the 'target audience', no household was excluded from the program.

A promotional email was sent out to all subscribers on REEP's mailing list by REEP Customer Service on several occasions, beginning in late summer 2015. As well, emails sent out from REEP Customer Service advertising other events included a brief message and link to the Home Energy Coach at the bottom of the email. Promotional materials for the Home Energy Coach Program were shared on REEP's social media platforms, including their website, Facebook page and Twitter account (samples found in Appendix A). Poster materials were also distributed to local hardware stores in Waterloo Region (including Waterloo, Kitchener, Cambridge, Elora, St. Jacobs), including Home Hardware, Home Depot and Lowes. Poster materials were also distributed to local shops in Uptown Waterloo, and the public libraries in Waterloo and Kitchener. Finally, word-of-mouth was used to advertise the energy coach throughout the community.

In combination with these promotional materials, the Energy Coach delivered monthly workshop sessions at the REEP House for Sustainable Living, in which he spoke about relevant

topics for renovating households between December 2015 and March 2016. As well, the Energy Coach developed a series of blog posts and short video clips, which were delivered between January 2016 and March 2016. The workshop sessions and blog series were advertised on REEP's social media platforms as well, which may have helped to attract homeowners to the program, or strengthen existing engagement with the Energy Coach for current coach participants.

Homeowners who were interested in working with the Energy Coach were asked to contact REEP Customer Service to set up an orientation or consultation session. Once a homeowner signed up for the program, REEP Customer Service had the homeowner fill out an application form, including their contact information, some questions about household characteristics and how they heard about the program.

The next chapter discusses the methods employed in the data collection and analysis of this program.

Chapter 4: Methods

4.1. Introduction

The purpose of this thesis was to explore the impact of the Home Energy Coach (HEC) program, offered to homeowners in Waterloo Region. This chapter presents the research design and methods that were selected to achieve the four objectives of this thesis. Section 4.2. outlines the research characterization of this thesis. Next, Section 4.3. describes the program partnerships and the study location. Section 4.4. discusses the rationale behind the selection of the data collection methods. Following this, Section 4.5. discusses the important considerations and techniques used in the design of the survey and interview questions. Next, Section 4.6. describes the recruitment strategies for the HEC program and for this thesis research. Section 4.7. discusses validity, reliability and trustworthiness and how this thesis sought to ensure these. Next, Section 4.8. discusses the approaches utilized for data analysis. Finally, Section 4.9. addresses the strengths and limitations of the chosen methods.

4.2. Research Characterization

The goal of this research was to investigate the Home Energy Coach program, a pilot program employed for the first time in Waterloo Region. To the best of the researcher's knowledge, little research has been conducted on coaching programs in an energy context in Waterloo Region, specifically, and in the academic literature more broadly. Bryman et al. (2009) argue that "if a researcher is interested in a topic on which no or little research has been done, … a more qualitative exploratory approach may be preferable" (p.17). Therefore, the research design began with this starting point in mind.

The HEC program represented a suitable case for which to employ a case study design. Bryman et al. (2009) argue that cases can be selected for a number of reasons, such as extreme circumstances in a particular group or revelatory opportunities to study a phenomenon that had not been available to scientific study, but that case studies can also be selected on the basis of proximity and willingness and are still suitable candidates for examining important social processes. Yin (2009) argues that case study research is appropriate for research interested in answering 'how' or 'why' questions, when the researcher has little control over the study and when the research

focuses on current, real-life social phenomena. As this thesis set out to investigate the HEC program guided by 'how' questions, the researcher had little control over the design of the program, and the research focused on a current, real-life program, this supported the decision that case study research was an appropriate method. Bryman et al. (2009) argue that the case in case study research is "an object of interest in its own right" (p.38), and the research objective is to provide a rich, detailed portrayal of it. Bryman et al. (2009) indicate that, while case studies are often studied using a qualitative research lens, case study research can be both qualitative and quantitative. For the former, in-depth interviews are often used as the primary data collection method, while for the latter, survey research is often employed.

The decision to employ qualitative or quantitative methods was guided by the research objectives, which sought to understand the kinds of people and houses that participated in the intervention, on the one hand, and to document and develop an understanding of their experiences, on the other hand. These goals are supported by Crosbie and Baker (2010). In general, one goal of this thesis was to describe the sociodemographic trends in the research sample using numbers and statistics, which is characteristic of quantitative research (Bryman et al., 2009). Another goal of this thesis was to understand the experiences of the research sample, which is suited to qualitative research methods. Qualitative research methods are considered appropriate for studying social phenomena for their focus on the perspectives of individuals within that system (Bryman et al., 2009) and for their emphasis on understanding and developing meaning to human phenomena (Edmonds & Kennedy, 2013). Therefore, it was evident that elements of both quantitative and qualitative research would be suitable for this thesis.

Bryman et al. (2009) argue that multi-strategy research – that is, a combination of quantitative and qualitative methods – can be integrated to strengthen research investigations. Yin (2009) asserts that using a mix of methods allows the researcher to collect "a richer and stronger array of evidence than can be accomplished by any single method alone" (p.63). Hammersley (1996) proposed that multi-strategy research can be used to triangulate, facilitate and complement the findings from either method on their own (cited in Bryman et al., 2009). In this thesis, triangulation was an important consideration to strengthen the credibility (Lincoln & Guba, 1985) of this research. Additionally, complementarity was considered important to "fill in the gaps" (Bryman

et al., 2009, p.289) about house characteristics (such as age of house, square footage of house) that homeowners may not have known accurately. Therefore, this thesis employed mainly qualitative research methods to obtain a rich description of participants going through the Home Energy Coach Program, though elements of quantitative research were employed to strengthen the investigation.

Social research can be grouped into three main purposes: exploration, description, and explanation (Babbie, 2004; Sue & Ritter, 2012). Often, research studies have more than one purpose. Exploratory research is often employed to "test the feasibility of undertaking a more extensive study" and "to develop the methods to be employed in any subsequent study" (Babbie, 2004, p.88). Further, Berry (2010) argues that energy-efficiency programs implemented by community-based organizations should take on a 'learning by doing' research approach to learn from the unique experiences and circumstances of a particular community or region. Based on these sources, exploratory research was deemed appropriate since the Home Energy Coach Program was a pilot project and the potential impacts of this program in Waterloo Region were unknown at the outset. Descriptive research seeks to describe observations in social settings, and answer questions like 'what', 'when' and 'how' (Babbie, 2004, p.89). As this research was investigating a pilot program, it was considered relevant to document and describe the experiences of participating homeowners, which has been done in the literature (Hargreaves et al., 2010). Further, to increase the transferability (or external validity in quantitative studies) of this research (Lincoln & Guba, 1985), Bryman et al. (2009) recommend providing thick descriptions of the study so that other researchers may determine if the results from this study are transferable to their own. Finally, explanatory research looks to explain 'why' social phenomena are observed (Babbie, 2004). This thesis did not set out with an explanatory purpose in mind. Case study research, similarly, can be exploratory, descriptive, or explanatory in nature, or some combination of the above (Yin, 2009).

The research design of this thesis is mainly inductive in nature. However, as Bryman et al. (2009) note, "in actual research situations it is impossible to conduct a study that is purely deductive or purely inductive" (p.6). Qualitative research uses a mainly inductive approach which involves gathering data relevant to the research focus and then offering explanations or theories, rather than beginning with a testable theory and testing it with empirical data that is characteristic of a deductive, quantitative research approach (Bryman et al., 2009).

4.3. Study Design

4.3.1. Program Partners

As discussed in Chapter 3, the Home Energy Coach Program was the product of collaboration between a number of diverse stakeholders. The inclusion of various partner organizations was also seen in the Small Town Energy Program with a similar program design as the present study. In their study, the program connected municipal leaders, utility companies, a department of the federal government and a financial institution. The authors argued that collaboration between many organizations was an asset, as the skills and resources from each organization could be leveraged (Wilson, 2014). This provides support for the collaborative approach taken in this thesis.

The importance of partnerships between various stakeholders is also supported in the literature (discussed in Section 2.4.3). Parker and Rowlands (2007) argue that community-scale climate action programs (specifically, in the case of this thesis, an energy-efficiency program) require partnerships among municipalities, utilities and other interested stakeholders to provide financial support and promote local awareness to facilitate high rates of community involvement, and ultimately, GHG emission reductions. Further, partnerships between utility companies and non-profit organizations are a suggested strategy to overcome trust barriers among homeowners (Stern & Aronson, 1984, as cited in Costanzo et al., 1986).

The collaborative nature of this program presented many opportunities, though it was not without its challenges. The opportunities afforded from this collaborative work were believed to be mutually beneficial between the partner organizations and the University of Waterloo. From the researcher perspective, involvement in this program granted access to participants and their data, access to a funded program, and the ability to work with established organizations in the community. From the perspective of the project partners, the research team brought a strong reputation from a respected university and third-party evaluation to establish degrees of separation from the participants and the Energy Coach to obtain feedback that may be more impartial.

However, there were challenges that arose during the intervention and evaluation design that must be acknowledged. First, one of the challenges of multi-partner projects was different

overarching objectives. From an academic perspective, completing robust thesis research requires proper research design and execution. However, for non-profit organizations that rely on external funding, concerns about accountability and outcome assessment have become increasingly important (Ebrahim, 2003) and may play more of a governing role in program design. For these reasons, some compromises had to be made by all parties. Another challenge that presented itself in the early stages of the research design was a differing frame of view. From a research perspective, the presence of a control group would have been more conducive to drawing comparisons between the intervention group and the control group. However, it was important to the partners that all participants be provided with the opportunity to receive the intervention. Crump and Logan (2008) summarize these challenges well, by arguing that "balancing stakeholder expectations and requirements is frequently a challenge for the ethical research contracted to evaluate government-funded community projects" (p.21).

Overall, the Home Energy Coach Program was developed largely by REEP Green Solutions, with assistance from the industry stakeholders and other program partners. As such, the researcher had little control over the design of the intervention. This section will document, in as much detail as possible, the design of the intervention and the rationale behind these decisions where applicable.

4.3.2. Study Location and Population

The study area for this research project was the Regional Municipality of Waterloo, located in Southern Ontario, Canada. It comprises the cities of Cambridge, Kitchener and Waterloo, and the townships of North Dumfries, Wellesley, Wilmot and Woolwich (Region of Waterloo, 2010).

The geographic location of Waterloo Region in relation to other large cities in Southwestern Ontario is displayed in Figure 4-1. Waterloo Region is recognized for its technological and entrepreneurial innovation and its engagement from the community (Parker & Rowlands, 2007).

Figure 4-1: Map of Southwestern Ontario (St. Jerome's University, 2016)

As of 2011, Waterloo Region had a population of 507,096 and a total number of households of 191,599 (Statistics Canada, 2012). The population is concentrated in the cities of Cambridge, Kitchener and Waterloo, with smaller populations in the townships. The breakdown of population and number of households by city and township is displayed in Table 4-1.

Table 4-1: Population of Waterloo Region by City or Township (Statistics Canada, 2012)

City or Township	Population (as of 2011)	Total Number of Households (as of 2011)
Cambridge	126,748	46,460
Kitchener	219,153	86,374
Waterloo	98,780	37,517
North Dumfries	9,334	3,229
Wellesley	10,713	3,143
Wilmot	19,223	6,963
Woolwich	23,145	7,913
Total	**507,096**	**191,599**

The research population for this study was all participants that had received an EnerGuide home energy evaluation on their household, signed up for the Home Energy Coach program, and

had at least one consultation session with the Energy Coach. Only those individuals that had interacted with the Energy Coach were selected for this research study, as the purpose of this thesis was to explore the impacts of the Energy Coach on the extent and kind of renovation activity of participating homeowners.

4.4. Selecting a Data Collection Method

Crosbie and Baker (2010) underscore the need to understand energy-efficiency interventions from the perspective of homeowners in order to increase their effectiveness, rather than just focusing studies on technical impacts. Survey research is a widely used approach for researchers interested in acquiring knowledge about the perspectives, actions and experiences of individuals (Cohen, Manion, & Morrison, 2007). The information obtained from survey research is relevant to any fields that aim to incorporate human experience and knowledge into their understanding and applications. In the literature, the term survey is often used to describe a type of research (that is, gathering information from individuals on their experiences), as well as a data collection method (also known as a 'questionnaire'). Within survey research, surveys/ questionnaires[6] and interviews are used to collect data.

Prior to selecting the appropriate data collection methods, several considerations were important to address. Yin (2009) emphasizes the importance of acquiring data from multiple data sources and triangulating the data in case study research. For this reason, it was determined that primary data and secondary data would be collected from the coach program participants to attempt to triangulate the data collected. Further, Wilson, Crane, & Chryssochoidis (2015) discuss the ongoing nature of renovations, in that they often occur over periods of time rather than as 'one-off' instances, so the point at which participants are surveyed during their renovation process may influence the responses obtained. As well, it was possible that program participants may have had more than one consultation session with the coach, which may influence responses to questions about the coach services provided. Therefore, it was deemed appropriate that the chosen sampling strategy be easy, cost-effective and efficient to sample participants at more than one point in time. In addition, the anticipated number of program participants was over 60, so

[6] This thesis will use the term 'survey' when referring to the data collection method to maintain consistency with the term used with participants.

consideration was giving to a sampling method that would be efficient in terms of cost and time for this number of potential participants. Finally, this thesis drew on the work of the Small Town Energy Program (STEP) in University Park, Maryland, USA, which also employed an Energy Coach to assist with energy-efficiency investments. In this program, a series of surveys was administered through various stages of the renovation process to measure the impact of the program (Wilson, 2014). Since this thesis had a similar research objective, it was deemed suitable to employ similar methods to the STEP program.

4.4.1. Selecting Qualitative Data Collection Methods

As an exploratory technique, surveys can sample a large population at once to generate a broad knowledge base on a particular topic (Cohen et al., 2007). Surveys fall into three general categories: structured, semi-structured and unstructured, based on the extent that the questions are fixed-choice or open-ended (Bernard, 2013). Semi-structured surveys may be desirable over structured surveys if the research question is intended to be at least partially exploratory, or if not all possible responses are known (Cohen et al., 2007). They are often used for course or program evaluations, whereby some data are collected in an identical manner from all respondents, with space provided for free-form elaboration (Cohen et al., 2007). Further, surveys are often used as a preliminary measure of study on a new subject, from which other methods can draw upon to develop deeper understanding, such as interviews (Cohen et al., 2007). These applications are consistent with this thesis research, as the investigation is partly exploratory and seeks to develop an understanding on a new research area for which not all answers are known. Therefore, including elements of both structured and unstructured surveys was deemed most useful, thus semi-structured surveys were chosen as an appropriate starting point for the investigation.

Once semi-structured surveys were deemed appropriate as the main sampling method to be used, it was necessary to determine how the surveys would be administered. There are several options for administering surveys, including over the phone, in person, self-administered via mail, and various methods online (Sue & Ritter, 2012). As discussed above, one of the criteria for the sampling strategy was the ability to sample participants at multiple points in time easily and in a cost-effective manner. For this reason, telephone and in-person surveys were deemed too time-

consuming for the researcher and the participants, thus were excluded as potential sampling strategies. The remaining two survey strategies – mail and online – were compared. Sue and Ritter (2012) discuss several advantages of mail surveys, including low cost, anonymity, the ability to reach a wide geographic range and the absence of interviewer biases. However, online surveys also possess these same positive qualities. In fact, it is argued that online surveys are cheaper to administer than mail surveys that require postage, paper, envelopes and time to separately package each survey (Sue & Ritter, 2012). Further, online surveys lend themselves to faster return times than mail surveys, as well as faster processing of data since the responses are already entered on a computer (Sue & Ritter, 2012). Research also shows that online surveys return fewer unanswered questions compared to mail (Bryman, Teevan, & Bell, 2009). Moreover, it has been shown that open-ended questions are more likely to be answered online, and for these answers to be more detailed, than those open-ended questions on mail surveys (Bryman et al., 2009). However, it is important to acknowledge that online surveys possess disadvantages too, since only those individuals with access to the internet can participate, and online surveys are quite widespread, which may reduce response rates as individuals are overloaded with survey invitations (Sue & Ritter, 2012). Nevertheless, online surveys best satisfied the sampling criteria of this thesis and were chosen as the appropriate sampling strategy.

As discussed above, Cohen et al. (2007) argue that semi-structured surveys are often used for introductory investigation, from which other methods can draw deeper understandings. This thesis followed this research design by employing semi-structured surveys to develop a preliminary understanding of the renovation plans of each household and the ways in which the Energy Coach helped their renovation progress, and then using interviews to develop a deeper understanding of emergent themes from the surveys.

4.5. Primary and Secondary Data Collection Methods

4.5.1. Surveys

The first method used in primary data collection for this thesis was a series of online semi-structured surveys. All surveys were hosted on a survey platform called Lime Survey. Lime Survey was chosen because of its ease of use for survey design and administration, the ability to host

unlimited surveys, and the low cost of hosting the surveys. As well, Lime Survey has servers located in Canada rather than the United States, which eliminates the need for a disclaimer about the U.S. Patriot Act on the information and consent form (University of Waterloo, 2014).

Several techniques were incorporated in the design of the surveys to optimize their effectiveness at satisfying the research objectives. Bernard (2013) suggests that questions should be worded using the clearest, most unambiguous word to avoid different interpretations by respondents that may skew the results, which is supported by Cohen et al. (2007). For example, 'Did you complete different and/or greater or fewer renovations than you had initially intended?' was improved by asking 'Did you complete different and/or greater or fewer renovations than you had intended when you signed up for the program?' to avoid ambiguity in the word 'initial'. Word choice should also be appropriate to the respondent's skill level and may need to be tailored to the population of study (Bernard, 2013; Cohen et al., 2007). Therefore, the vocabulary on the surveys was chosen to be unambiguous and was tailored to the general population, rather than the scientific community. For example, 'renovation' was largely used instead of 'retrofit'[7], as renovation is a more commonly known term. Further, questions should be free of leading statements, which impose researcher characteristics onto the response and do not accurately reflect the respondent (Bernard, 2013). Therefore, the questions were designed to avoid leading the respondent. For example, instead of asking 'What are your household's concerns [with a particular renovation activity]?', respondents were first asked if they had any concerns, and then asked to elaborate.

The order of the questions was considered in the design of the surveys. In general, the surveys were designed to capture respondents' renovation plans and priorities first, followed by questions about their interactions with the Energy Coach, concluded with their evaluation of the program and any suggestions for improvement. Bernard (2013) argues that questions should serve a clear purpose throughout the survey and be generally placed within thematic groups, thus the initial and exit surveys were both broken down into five to six question groups. Within most groups, questions included both structured and open-ended questions as the research question was partially exploratory and not all responses were known (Cohen et al., 2007). Further, closed-ended

[7] 'Retrofit' was used in Question 2 on the initial survey, though 'renovation' was used on all subsequent questions.

questions also included an ‘Other’ option in case a relevant option was not included, as suggested by Cohen et al. (2007).

In terms of question responses, Bernard (2013) argues that answers should be rated on a scale that is easily understood. The most common scale employed is the Likert scale, which is an odd-numbered scale usually comprising five options from which respondents rate their level of agreement or disagreement (Bernard, 2013). Categorical scales are also frequently used, such as yes or no questions or ranking options (Creswell, 2003). Both of these types of scales were employed in the design of the surveys, though Likert scale questions were employed more frequently. Further, responses may be put in a range so people feel more comfortable answering (Bryman et al., 2009). This strategy was employed for the demographic information collected on the initial survey, including age and annual household income before taxes.

Once the survey has been designed, it is suggested that the forms be administered as a pre-test or pilot study (Bernard, 2013; Cohen et al., 2007; Creswell, 2003). This is used as a refinement exercise, after which researcher administer the surveys to their selected sample. All surveys were administered to colleagues and peers as a pre-test before being delivered to HEC participants. The initial survey was administered to a group of six colleagues who filled out the survey independently and provided comments in the margin when questions were unclear. The responses led to several changes in word choice, though no new questions were added. As well, one question had been separated into two because it appeared to be asking two questions at the same time. The initial survey was also shared with REEP Green Solutions, who had positive feedback about the professionalism and comprehensiveness of the survey. The feedback also included several helpful suggestions that led to changes in the survey. First, the terms that were used to refer to the coach were consistently made Energy Coach. Second, some words were changed to be less ambiguous. Third, there were two questions for which an ‘Other’ option was included. The initial survey was also pre-tested with an actual program participant to help refine the question wording and order. The survey tested well with this respondent, though ‘contributor’ was changed to ‘collaborator’.

The monthly survey was pre-tested on one colleague, which did not yield any suggestions, thus no changes were made based on this pre-test. The monthly survey was also shared with REEP

Green Solutions, who suggested adding in an 'Other' question to include any comments that had not been captured by any of the other questions.

The exit survey was pre-tested on one colleague, and several changes were made to make the questions read more clearly. The exit survey was also shared with REEP Green Solutions, who again commented on the comprehensiveness of the survey.

The following subsections elaborate on the design of the initial, monthly and exit surveys. Then, Section 3.6.2. describes how the surveys were administered.

4.5.1.1. Initial Survey

The initial survey was semi-structured and contained 24 questions, broken down into five thematic categories. The initial survey drew on the work of the Small Town Energy Program (STEP) in University Park, Maryland, which employed an Energy Coach and administered a series of surveys to participants in the program (Wilson, 2014). The first section of the survey probed general motivations for undertaking home renovations and perceived ease or difficulty of various activities in the renovation process. The second section of the survey included questions about the household's renovation plans and priorities based on the report received from the home energy evaluation and the likelihood of completing renovations. The third section of the survey asked about specific motivations for signing up for the HEC Program and components of the program that would be influential in their decision to proceed with renovations. The fourth section of the survey included questions about participant satisfaction with the program. Finally, the last section of the survey contained basic demographic questions. A full copy of the initial survey is in Appendix F.

4.5.1.2. Monthly Survey

The monthly survey was intended to capture renovation progress and interactions with the Energy Coach throughout the renovation process. Wilson et al. (2015) argue that renovations are often a process rather than a one-time event, so the timing of a survey may provide inaccurate results. Therefore, it was determined that administering several surveys over the course of the renovations would help to mitigate this challenge.

The monthly survey was semi-structured and contained six questions. The first question on the survey asked the number of interactions with the Energy Coach within the last 30 days. Next, a list of ten renovation activities was provided, and participants were asked which activities had been completed within the last 30 days, which activities the coach service had assisted with, and for which activities the coach service was helpful or not helpful. Participants were also provided with space to elaborate on how the service had been helpful or not helpful for applicable renovation activities, and if there were any instances in the last 30 days that more assistance was needed. A full copy of the monthly survey is available in Appendix G.

4.5.1.3. Exit Survey

The exit survey was semi-structured and contained 25 questions, divided into six sections. The exit survey also drew on the work of the Small Town Energy Program (Wilson, 2014). Several questions on the exit survey were inductively generated after the initial survey had been completed by a number of people. The first section of the exit survey contained questions about the household's renovation progress to date, including challenges faced, how the homeowner was able to overcome them, and the influence of the coach throughout the process. The second section of the exit survey asked questions about where the consultations took place, if another method would have been preferred, and questions to reflect on the interactions with the coach. The third section of the exit survey contained questions about behavioural changes that may have occurred as a result of the coach. The fourth section of the exit survey contained questions about program evaluation, suggestions for improvement, and the feasibility of offering the program as a fee-for-service. The last question on the exit survey asked whether participants would be willing to participate in a short follow-up telephone interview with the researcher. A full copy of the exit survey is available in Appendix H.

4.5.2. Interviews

The final question on the exit survey asked respondents whether they would be willing to participate in a short follow-up interview with the graduate student researcher. The interviews were intended to serve three research purposes – exploration, description and explanation, as Babbie (2004) discusses.

Interviews can be performed in person, on the telephone, or over the internet (Bernard, 2013). Due to the researcher's time constraints, it was determined that telephone interviews would be the easiest and most convenient method to organize. As with surveys, interviews can be generally categorized as structured, semi-structured, and unstructured, depending on the level of structure or control in the question and answer format (Bernard, 2013; Cohen et al., 2007). The level of flexibility in the question wording and order varies depending on the type of information sought and the context in which the interview takes place (Bernard, 2013). Since the interviews were utilized as a supplementary research tool to the surveys, there were specific themes in mind that the researcher wanted to study in greater depth. However, since the interviews were intended to probe exploratory themes, and some questions may have led to the natural progression of other questions, it was determined that semi-structured interviews would be an appropriate method to use.

Semi-structured interviews follow an interview guide, which is a list of topics and questions to be covered throughout the interview (Bernard, 2013). During these interviews, the interviewer is responsive to questions from the interviewee. This means that if the interviewee does not understand a question, the interviewer can clarify or provide more information (Bernard, 2013). In addition, interviewers can probe interviewees for more information if a question has not been fully answered. Interviewers are also adaptable to answers. This means that if an interviewee veers off topic, the sequence of questions can be changed to accommodate this new information (Bernard, 2013). All interviews were conducted in this spirit.

The interview guide contained the same questions for each participant, but the specific themes probed differed slightly depending on the renovations pursued by each participant, and the manner in which the renovations were being completed. A copy of the interview guide is available in Appendix I. As an exploratory tool, the interviews contained questions without known answers, such as the definition of a successful energy coach and what value would be placed on this type of program in the renovation process. As a descriptive tool, the interviews contained questions about their motivations to work with the Energy Coach, the household's renovation progress to date and the interactions with the Energy Coach. As an explanatory tool, some questions were included to investigate 'how' and 'why' the Energy Coach had or had not been helpful with respect to the

particular renovation activity of interviewees. Some questions were also included as confirmatory questions to triangulate findings from the online surveys. Generally, the interviews were employed to add 'texture' to the survey findings.

Many of the same considerations about question wording and order from the design of the surveys applied to the design of the interviews, such as using clear, unambiguous language, arranging questions in a logical sequence and grouping questions thematically, and avoiding leading questions.

4.5.3. Secondary Data Collection

Other data were collected to supplement the primary data from the three online surveys and interviews. Some of this information was collected as secondary data to avoid duplicating questions that had been asked by other partners on the project, to shorten the surveys. Overall, these data were used to provide richer descriptions of the program participants. More specifically, there were three sets of secondary data that were collected.

4.5.3.1. Application Forms and Evaluation Reports

An application form was filled out by participants when signing up for the HEC program, which included the participant's address, city or township, contact information and how they heard about the program. An evaluation report – drafted by the certified Energy Advisor who performed the EnerGuide Home Energy Evaluation – was provided to the homeowner following their home energy evaluation. The evaluation report was broken down into five sections, including an EnerGuide rating, a list of personalized recommendations to increase the energy-efficiency of the home, information on the EnerGuide rating system, an estimated of energy consumption in the household, an analysis of the household's space heating, and information about implementing the energy-efficiency recommendations. A sample report is available in Appendix B.

Hard-copies of the application forms were provided on-site at the REEP House for transcription by the researcher. The forms were transcribed by the researcher to an Excel spreadsheet onto a password-protected file location. Soft-copies of the evaluation reports were

transferred – at the REEP House – from REEP Customer Service to an Excel spreadsheet, also kept on the password-protected hard-drive of the researcher.

4.5.3.2. Detailed Residential Reports from Municipal Property Assessment Corporation

Residential Detail Level 2 reports were purchased from the Municipal Property Assessment Corporation (MPAC, 2016) for each of the households, using the address provided from each respondent. An ethics review committee (ORE #21040) approved the collection of these data on the condition that the information be presented at a macro-level rather than at the individual household level. The information collected from the reports included a description of the household's characteristics such as municipal services, square footage, number of storeys, bedrooms and bathrooms, building permits issued to the property and assessed value. A sample of this report is included in Appendix N. The information was transcribed into an Excel spreadsheet for ease of data analysis.

4.6. Participant Recruitment

4.6.1. Participant Recruitment for Research Study

Homeowners that were interested in working with the Energy Coach were asked to contact REEP Customer Service to set up an orientation or consultation session. All homeowners that signed up to work with the Energy Coach were prenotified that there was a research study assessing the program and that they may be contacted with more information about the study[8]. Prenotifying potential participants has been shown to increase the response rate of online surveys (Sue & Ritter, 2012).

Once participants had completed at least one consultation with the Home Energy Coach, they were invited to participate in the research study by email. From November 19, 2015 to March 28, 2016, invitations to participate in the research study were sent to potential participants via email[9]. The email provided a brief overview of the research study, and contained a link to the online

[8] Nine participants indicated that they were not interested in learning more about the research study and did not wish to be contacted about it. They nevertheless continued to participate in the HEC program.
[9] From November 19 to December 23, 2015, REEP Customer Service delivered 18 invitation emails. The email was drafted by the researcher and provided to REEP (see Appendix C). Beginning January 4, 2016, a new protocol allowed the researcher to deliver the survey invitation email containing the same content (see Appendix C). This

survey (attached as Appendix F). The first page of the online survey contained the combined information and consent form (attached as Appendix D), to be filled in by participants online. The information and consent form provided the participant with more information about the study procedures and the contact information of the research team and collaborators on the project if the participant had any questions or concerns. A reminder email was sent to participants approximately one week later if the online survey had not been completed, and a follow-up phone call was placed approximately three weeks after the initial email invitation. These follow-up strategies were used to mitigate the low response rates characteristic of online surveys (Bernard, 2013; Sue & Ritter, 2012).

Invitations to complete the monthly surveys were sent out approximately one month after the initial survey had been completed[10]. Only those that had completed the initial survey were sent an invitation to complete the monthly survey. A reminder email was sent one week after the first survey invitation, and a follow-up phone call was placed after two weeks.

Invitations to complete the exit survey were sent out to all participants that had completed the initial survey on April 6, 2016. The surveys were administered immediately following the end of the program, which was March 31, 2016. Two reminder emails were sent to participants; one was sent one week after the first survey invitation, and one was sent two weeks after.

4.6.2. Participant Sampling

This research utilized a non-probability sampling strategy. As the research purpose was partially exploratory in nature, it was not deemed necessary to obtain a random sample of the population. Indeed, exploratory research, such as in a case study context, looks to sample individuals that possess knowledge about a particular subject or process (Sue & Ritter, 2012). Therefore, this thesis utilized a purposive sampling approach. As the name suggests, purposive sampling selects participants for a purpose, because they are knowledgeable in a particular subject area (Bernard, 2000). Purposive sampling is a common sampling approach in pilot studies, prior to studies seeking a representative sample to test a hypothesis (Bernard, 2000). Therefore, all

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new strategy was adopted with the intention of more clearly distinguishing the homeowner's involvement in the Home Energy Coach Program and their participation in the research study.

[10] Not all participants that completed an initial survey were sent a monthly survey request. This is because one month had not elapsed between the two surveys. Further, all 21 participants were to be sent an exit survey, so the monthly survey was bypassed to avoid potential respondent fatigue.

homeowners participating in the Home Energy Coach Program were provided information about the research study and, if interested, sent an invitation email to complete the online surveys.

In total, the sample size of the respondents was 21 homeowners. With such a small sample size, it is not possible to generalize the findings of this research to larger groups or populations. Despite this limitation, there are a number of studies in the literature that make use of small samples to provide rich, deep findings. For example, Snow, Vyas and Brereton, (2015) documented the experiences of 12 households through self-authored videos regarding their interactions with an eco-feedback device in the home to understand the various household dynamics that impacted its use. As well, Risholt and Berker (2013) interviewed 11 homeowners on their personal renovation progress and barriers encountered. Similarly, Hargreaves, Nye and Burgess (2013) conducted interviews with 11 homeowners on their interactions with an energy feedback device and wove the results into a narrative. Two other examples from an energy context include Grønhøj & Thøgersen (2011) and Wallenborn, Orsini and Vanhaverbeke (2011) who had samples of 20 and 11, respectively.

Some literature also suggests that there is call for qualitative studies to investigate the nuances and unique factors that shape energy-related decision making. For example, Schelly (2015) argues that the rich understanding of energy practices in her study would not have been uncovered without the use of qualitative research – in particular, interviews – as some of the responses were unexpected.

4.7. Validity, Reliability and Trustworthiness in Research Design

As this thesis used quantitative and qualitative methods, different metrics were used to ensure validity and reliability in the research design.

With respect to the quantitative components of this research, validity and reliability were two criteria used in the evaluation of the research design. Validity has three main associated criteria, which are measurement (that is, whether the indicator measures what it is supposed to), internal (that is, the degree to which a causal relationship can be concluded based on the study) and external (that is, the extent to which findings can be generalized to larger populations) (Bryman et al., 2009). With respect to measurement validity, the survey instruments were administered to

colleagues in the field to establish face validity (Bernard, 2013; Bryman et al., 2009). With respect to the other two types of validity, this thesis did not set out to determine a causal relationship between any of the variables studied, thus the internal validity of the survey instruments was not investigated. Further, due to the small sample size and non-random sampling strategy utilized in this thesis, external validity was not deemed appropriate to test for. Comparable criteria for these two types of validity are discussed further under 'trustworthiness' in qualitative research.

To test for reliability in the primary data collected from surveys, a series of surveys were administered over time with some of the same (or very similar) questions posed across the surveys. The findings were then compared across the surveys to discern whether internal consistencies or differences existed (Bernard, 2013). To test for interobserver reliability, a copy of the surveys was also included as Appendices F, G and H so other researchers could administer the surveys as well (Bernard, 2013). To test for reliability in the secondary data collected from the EnerGuide evaluation reports and MPAC reports, the two sources were compared to ensure consistency in the findings (Bernard, 2013). If discrepancies were identified, they were flagged and included as a footnote in this document.

With respect to the qualitative components of this research, Lincoln and Guba (1985) argue that qualitative research requires different evaluation standards than those used in quantitative research. Rather than validity and reliability, Lincoln and Guba (1985) discuss 'trustworthiness' as an evaluation criterion. Trustworthiness is comprised of four components, each of which draws parallels to the metrics used in quantitative research. First, the researchers discuss credibility, a comparable metric to measurement and internal validity. Credibility refers to the plausibility of the findings, or that the study instruments test what they are intended to test. To ensure credibility, the survey instruments were administered to peers and colleagues for constructive criticism and multiple data collection methods were used to triangulate the findings (Shenton, 2004).

Second, the authors discuss transferability, a comparable metric to external validity. Transferability refers to whether or not the findings are applicable to other situations or contexts (Lincoln & Guba, 1985). To ensure transferability, Bryman et al. (2009) suggests presenting 'thick descriptions' of study variables to be used by future researchers. For this thesis, rich descriptions

were collected on survey respondents – including demographic information on the people and their households – and on the procedures used in the design of the Home Energy Coach Program and the consultation interactions. Therefore, other researchers looking to draw on this work can compare the contextual variables of their work to the variables presented in this thesis to determine whether the findings would be analogous.

Third, the authors discuss dependability, an analogous measure of reliability. Dependability refers to whether or not the findings would be consistent if measured at different times (Lincoln & Guba, 1985). In a household energy context, this concern was highlighted by Wilson, Crane and Chryssochoidis (2015), who noted that renovation activity in households is typically an ongoing process, so the time at which respondents are surveyed may impact the responses given. Therefore, surveys were administered at several times during the course of the HEC program, with similar questions on each of the surveys. Further, the interviews were used to investigate any discrepancies between responses from surveys at different times (eg. between the initial and exit survey). As well, semi-structured interviews were conducted with a subset of participants, and some questions were used to triangulate the findings from the interviews to ensure consistency in the responses.

Fourth, the authors discuss confirmability, a comparable measure of replicability. Confirmability refers to whether or not another researcher would draw the same conclusions given the same set of results and relates to the researcher's objectivity (Lincoln & Guba, 1985). As Shenton (2004) argues, the reasons for favouring particular methods were discussed, as well as the limitations in the chosen methodologies and weaknesses found after the method was employed. Further, the researcher used a number of different data sources to triangulate the findings when possible (Shenton, 2004).

4.8. Data Analysis

To contextualize the sociodemographic data collected about the households in the research sample, data are compared to statistics from Waterloo Region where possible. If data were not available on Waterloo Region, data are compared to statistics on Ontario as a whole.

Descriptive statistics are used to provide a basic description of data from a study. Sue and Ritter (2012) argue that, to begin data analysis on survey responses, each individual question should be examined individually by creating frequency distributions or summary statistics for each. Since semi-structured surveys were used, the open-ended and structured questions were analysed separately. Due to the small sample size and semi-structured nature of the survey, it was not deemed necessary to use a statistical software package to analyze the data. The structured survey data are presented using a combination of figures and tables to display the data, with summary statistics included for each question or statement where applicable. Some questions (particularly related to planned and/or completed renovation activity) were analyzed for internal consistencies or differences based on house age, which has been studied by other researchers (Murphy, 2014; Ryan, 2009; Song, 2008). Due to the small sample size in this study, the cohort was separated into two groups. More specifically, house age was classified as 'older' for houses constructed before 1970 and 'newer' for houses constructed after 1970. This was deemed an appropriate place to separate the data, as there was a natural break in the data (no values between 1970 and 1980). After all of the questions from the surveys were individually examined, links were made between related items on the initial and exit surveys. For example, renovation items included on the initial survey were compared to those items included on the exit survey.

The qualitative (open-ended) survey data and the text from the semi-structured interviews were analyzed using qualitative content analysis. While grounded theory is the most commonly used framework for qualitative data analysis, the primary research outcome of that approach is theory building (Bryman et al., 2009), which was not a goal of this thesis. Rather, this thesis sought to develop meaning from the data in response to the research objectives put forward, including answers to 'what', 'how' and 'why' questions, which qualitative content analysis is suited for (Schreier, 2012; Morgan, 1993).

Qualitative content analysis uses a process of coding to analyze the qualitative survey data and interview transcripts. To begin, it involves a process of data reduction, whereby analysis is limited "to those aspects that are relevant with a view to your research question" (Schreier, 2012, p. 7). In general, this meant organizing the survey responses and interview transcripts according to each question. The interview transcripts, transcribed from audio recordings by the researcher, were

highlighted according to relevance to the research objectives as well. An open coding strategy was then employed for each passage or response. First, the responses were given a label. Some responses were given more than one label if more than one idea was presented, a process called simultaneous coding (Saldaña, 2013). Then, similar labels were grouped together to investigate the similarities between them and define a common label. These labels represented the *concepts* that were generated for a particular question. In the results section, these are referred to as 'sub-themes'. Next, the concepts that were related were arranged into groups, or *categories* (Saldaña, 2013). In the results section, these are referred to as 'themes'. As a note, similar concepts and categories across different questions were compared to develop consistent category names, when possible (eg. between similar questions on the initial and exit survey). The main difference for the analysis of the surveys versus the interviews was that more questions were related to similar topics than the surveys, thus more 'cross-question' comparison was conducted for the interview data. As a result, the interview findings are not presented by question as the survey results were. For the most part, the qualitative data are summarized in the text of the Results chapter, with a table illustrating the key themes and sub-themes that emerged from the analysis, as well as presenting an 'exemplar' or quotation to illustrate the theme (Bernard, 2000). The full quotations will be available for review in appendices, indicated where applicable.

Coding software was not used in the analysis of the qualitative data. Basit (2003) argues that "the choice will be dependent on the size of the project, the funds and time available, and the inclination and expertise of the researcher" (p.143). Therefore, the small scale of the project, the funding available, and the preference of the researcher did not necessitate the use of coding software.

4.9. Strengths and Limitations of Methodology

There are some limitations to the chosen methods that must be acknowledged. The first limitation is the research design, sampling strategy and sample size in this thesis that limits the ability to generalize the findings of this research to larger populations. Since the data collected here emerged from a case study context, which focuses on a particular set of individuals in a specific real-life context, findings from this type of research are not generalizable to larger populations (Yin, 2003). This issue is also created from the small sample size and non-random sampling procedure

used in this thesis. In this case, conclusions can only be drawn based on the sample (Creswell, 2003).

With respect to the data collection methods, there are some limitations of survey research that must be addressed. Since surveys are completed independently of the researcher, this limits the respondent's ability to ask for clarification on any ambiguity (Bernard, 2013). Therefore, any misinterpretation of the question limits the conclusions that can be drawn from the responses. Another limitation is that respondents will only choose from the choices that are provided on the structured questions, even if they do not entirely agree (Bernard, 2013). Semi-structured surveys were employed to offer open-ended questions to respondents so that they were not limited to the fixed responses provided by the researcher, but open-ended questions are subject to low response rates (Sue & Ritter, 2012). More generally, surveys themselves are often subject to low response rates of 20 to 30 percent (Bernard, 2000), which calls into the question the generalizability of the results based on self-selection biases (Sue & Ritter, 2012).

Chapter 5: Results

5.1. Introduction

This chapter presents data collected from 21 HEC program participants from a series of surveys administered between November 2015 and April 2016, from semi-structured follow-up interviews with five HEC program participants, and from secondary data collected from HEC application forms, EnerGuide evaluation reports and from the Municipal Property Assessment Corporation (MPAC) for 21 HEC program participants (full details in Appendix K). To guide the reader, these findings are presented in separate sections with connections drawn at the end of the chapter. Section 5.2. presents results related to profiles of the research sample (the survey respondents). This section is broken down into 'The People' and 'The Houses' to distinguish between the types of homeowners that signed up for the Home Energy Coach program and the types of houses that these homeowners occupy. This section also describes the ratings and recommendations from the EnerGuide energy evaluations. The next four sections present findings from the surveys and interviews, with the response rate for each data collection method at the beginning of the respective section. To guide the reader, results are grouped within each section based on key themes that each instrument sough to explore. Therefore, Section 5.3. presents findings from the initial survey, Section 5.4. presents findings from two monthly surveys, Section 5.5. presents findings from the exit survey, and Section 4.6. presents findings from five follow-up interviews.

5.2. Profiles of Respondents and their Houses

5.2.1. The People

Sociodemographic information on the research sample was collected on the initial survey. Twenty-one respondents returned the initial survey, on which all gave their permission to release their HEC program application form and EnerGuide evaluation report to the research team. From these sources, data were collected on the building characteristics of each house. These data are presented to characterize the types of people that took part in the intervention and the types of houses in which these people reside. These data are compared to statistics for Waterloo Region,

where possible, to contextualize these findings. The research sample consists of approximately 40% of all participants in the program.

5.2.1.1. Geographic Location

Most respondents reside in the cities of Kitchener and Waterloo. The breakdown of the research sample is compared to the number of households in Waterloo Region in Figure 5-1. The results indicate that Cambridge is underrepresented and Waterloo is overrepresented in the research sample based on their relative proportions in Waterloo Region's total population.

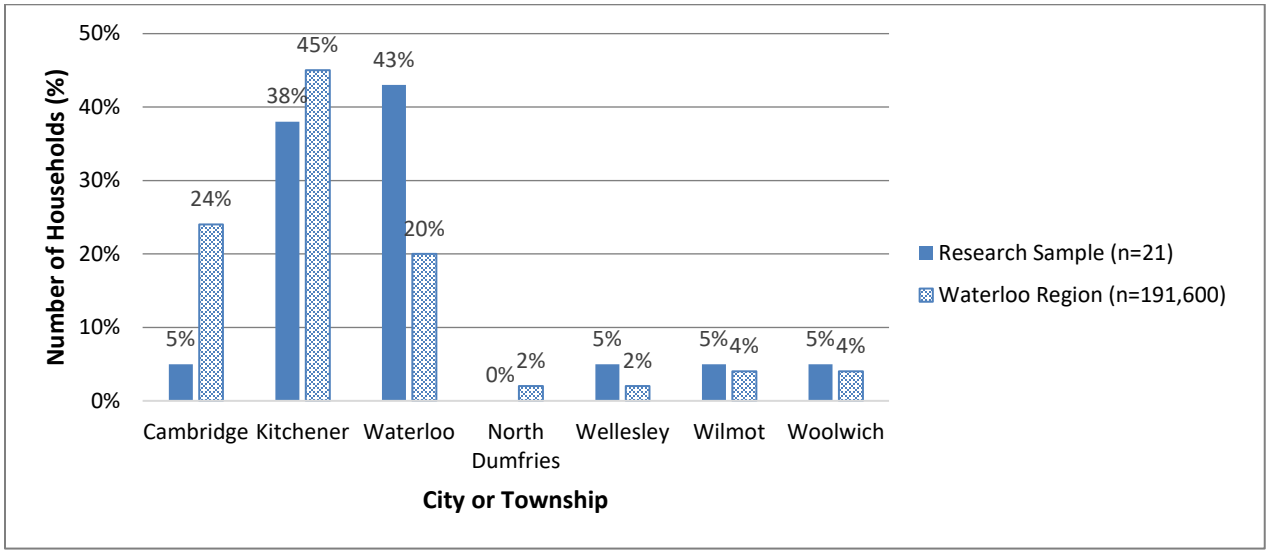

Figure 5-1: Research Sample Compared to Waterloo Region (StatsCan, 2012)

5.2.1.2. Household Size

Over one-third of participants indicated two members living in the home regularly. The full set of responses is displayed in Figure 5-2. On average, households had three household members, with a median of three members and a standard deviation of 1.4. This is slightly higher than the Waterloo Region average of 2.6 members per household (StatsCan, 2012) and is consistent with the Ontario average of 2.9 members per household for single-detached houses (StatsCan, 2013a).

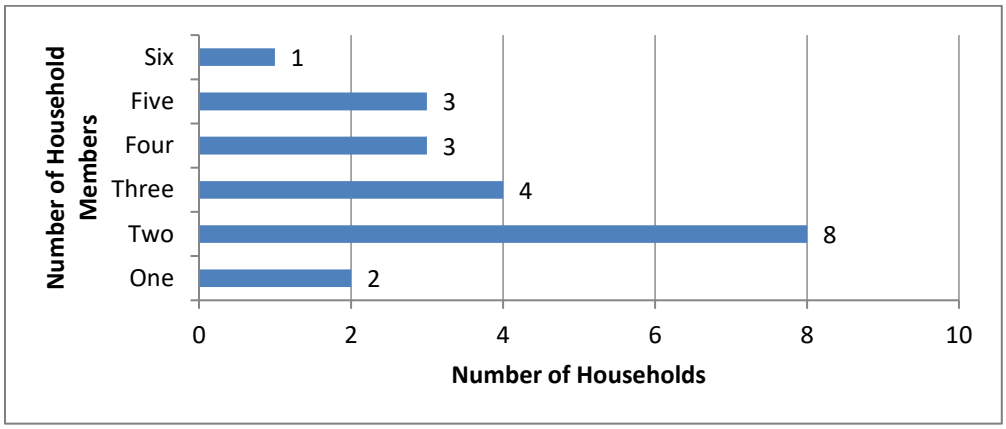

Figure 5-2: Household Size of Research Sample (n=21)

5.2.1.3. Household Structure

Ten out of 21 respondents (48%) indicated at least one household member between the ages of 0 and 18, while 11 out of 21 respondents (52%) did not. All of the households with children were two-parent households. As well, three out of 21 respondents indicated that at least one household member was above the age of 65. The full dataset is available in Appendix L as Table 6.

The age range of the respondents was documented separately. This information represents the age ranges of those homeowners that interacted with the Energy Coach, though it is possible that another household member was present during the consultation. The age range of respondents spanned almost all of the categories, though no respondents were between the ages of 25 and 30. The responses are presented in Figure 5-3. The median age range was between the ages of 41-45.

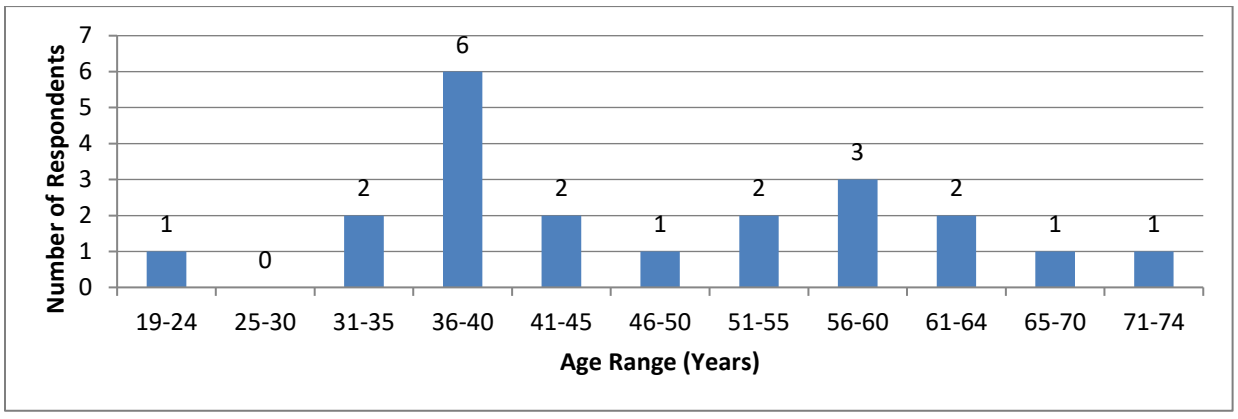

Figure 5-3: Age Range of Respondents Who Interacted with the Energy Coach (n=21)

5.2.1.4. Educational Attainment

Respondents were asked to indicate the highest level of educational attainment by someone in their household. The responses are displayed in Figure 5-4. The majority of respondents (95%) indicated that the highest level of educational attainment in their household included some form of post-secondary education. This is compared to 52 percent of Waterloo Region residents and 55 percent of Ontario residents over 15 years of age with some form of post-secondary education (StatsCan, 2013b). Further, over one-half of the sample had a graduate degree.

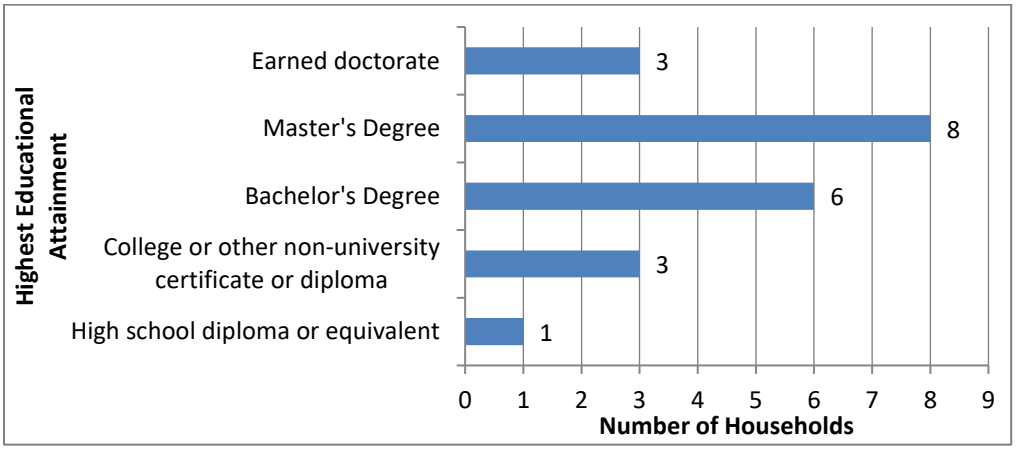

Figure 5-4: Highest Level of Educational Attainment in Household (n=21)

5.2.1.5. Annual Household Income

Respondents were also asked to indicate their annual household income before tax. The responses are displayed in Figure 5-5. The reported income levels spanned all income category options, though over 40 percent of the research sample indicated an annual household income above $100,000. The median household income was $100,000-149,999, though four respondents (19%) did not answer this question. This is compared to the median pre-tax household income of $69,706 and the average household total income of $85,546 for Waterloo Region in 2010 (StatsCan, 2013b). This suggests that the median annual household income of the research sample is higher than the median and average in Waterloo Region.

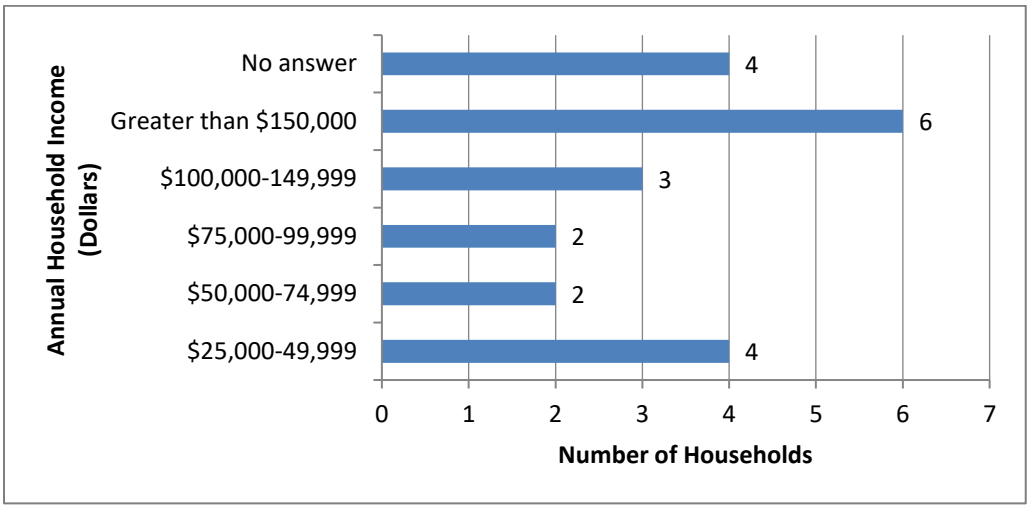

Figure 5-5: Reported Annual Household Income (n=21)

5.2.1.6. Length of Time Living in House

The reports collected from the MPAC database indicate the last sale date for each house, which were interpreted as the year that each homeowner moved into the house. The results are displayed in Figure 5-6. This field was left blank on one report, thus the following represents 20 out of 21 respondents. On average, respondents had been living in the house for seven years, with a median of 3.5 years, a minimum of zero years, and a maximum of 22 years, with a standard deviation of 6.6. Further, 40 percent of respondents moved into their house within the last two years.

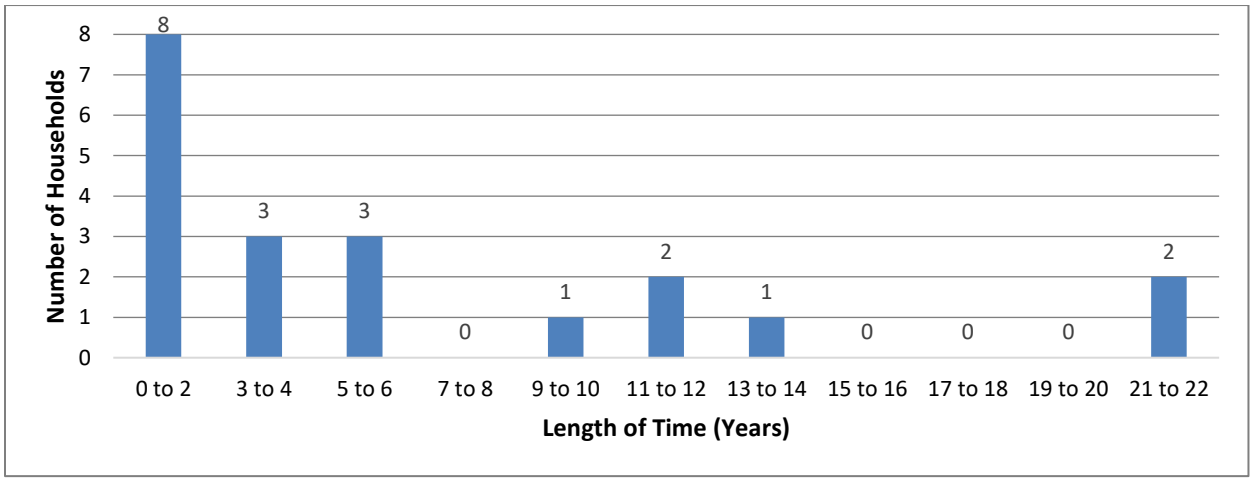

Figure 5-6: Year of Moving into Current Household (n=20)

5.2.2. The Houses

Information about the physical characteristics of the houses in the research sample was collected from the EnerGuide evaluation reports and from the Propertyline™ database from Municipal Property Assessment Corporation (2016). These data will be presented to create profiles of the kinds of houses that were being renovated.

5.2.2.1. House Age

The year of construction of houses in the research sample is displayed in Figure 5-7. On average, these houses were built in 1969, with the median built in 1969, the minimum year built in 1905, and the maximum year built in 2009, with a standard deviation of 29.6. Just over one-half of the sample of houses (n=11) were built before 1975 and 80 percent (n=17) before 1995.

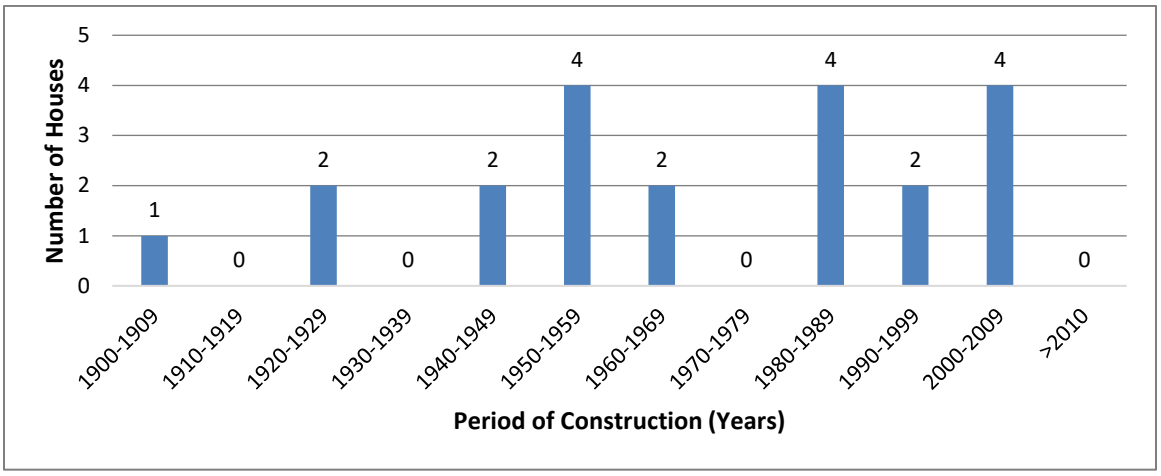

Figure 5-7: Year of House Construction for Research Sample (n=21)

These data are compared to Waterloo Region as a whole in Figure 5-8. The data come from the 2011 National Household Survey (StatsCan, 2013b). Based on the data available, the median period of construction for Waterloo Region is between 1961-1980. Evidently, the research sample contains a greater proportion of houses built before 1960 and a smaller proportion of houses built between 1961-1980 than Waterloo Region as a whole.

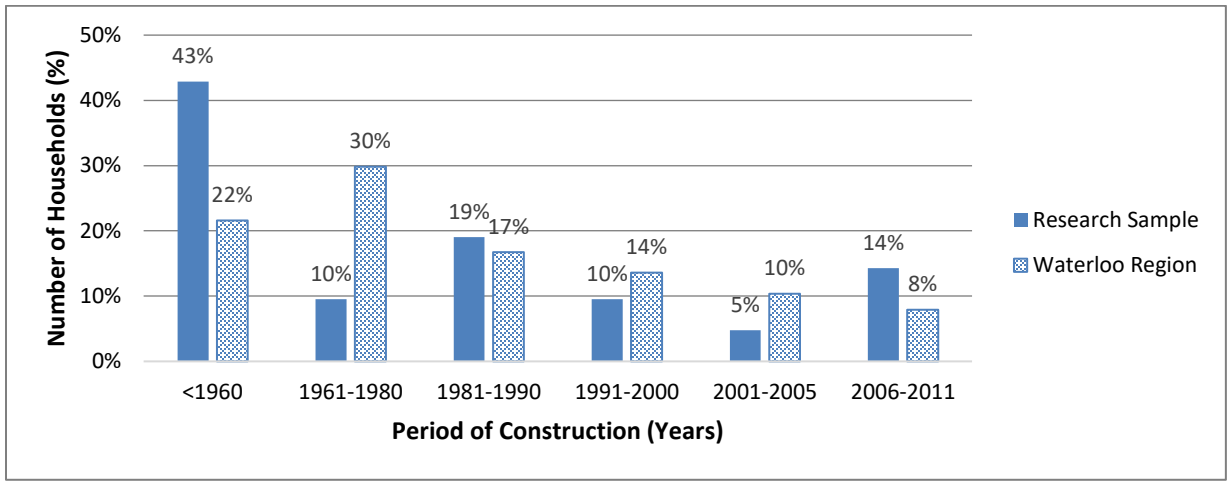

Figure 5-8: Period of Construction for Research Sample and Waterloo Region (n=21)

5.2.2.2. House Type and Build

Nineteen houses in the research sample were single-detached, while one house was semi-detached, and one was a row house, which equates to 90 percent, 5 percent and 5 percent, respectively. This is compared to the Waterloo Region averages of 57 percent of households for single-detached, 7 percent for semi-detached, and 11 percent for row houses, as well as 26 percent in apartments (StatsCan, 2012) and the Ontario averages of 56 percent of households for single-detached, 6 percent for semi-detached and 9 percent for row houses, as well as 30 percent of households in apartments (StatsCan, 2013a). Further, six houses in the sample were one-storey, fourteen houses were two-storeys, and one house was three-storeys tall. Thirteen houses had a finished basement, while eight did not.

5.2.2.3. House Size

On average, the total floor area (above not including basement) of the research sample was 1,821 square feet, with a median of 1,751 square feet, a minimum of 991 square feet and a maximum of 2,942 square feet, with a standard deviation of 625 square feet. The data are presented in Figure 5-9. Comparable data were not found for Waterloo Region, though this is compared to the Ontario average of 1,523 square feet (NRCan, 2010). Twelve households (57%) of the sample were larger than the Ontario average, while nine households (43%) were smaller than the Ontario average. More detailed information about the house size is included in Appendix O.

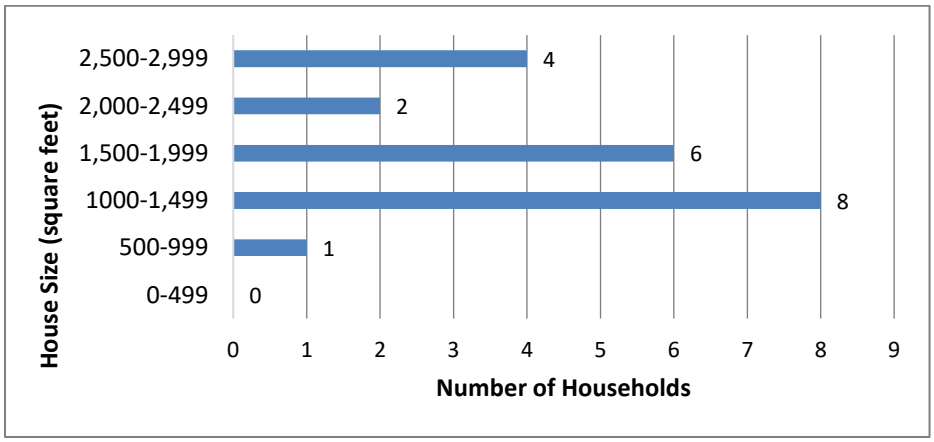

Figure 5-9: House Size by Square Footage Not Including Basement (n=21)

5.2.2.4. Household Energy Consumption

Based on the estimations provided in the evaluation reports, the average household energy consumption values for hot water, lighting and appliances, and space heating were calculated for the 21 households. On average, 63 percent of energy was consumed for space heating, 20 percent of energy was consumed for lighting and appliances, and 17 percent of energy was consumed for hot water heating. This is comparable with the Ontario averages of 65 percent for space heating, 14 percent for lighting and appliances, and 21 percent for hot water heating (NRCan, 2016b).

5.2.2.5. House Heating Systems

According to the EnerGuide evaluation reports, all 21 households were heated with a natural gas furnace[11]. This is compared to 81 percent of households that use a furnace (StatsCan, 2015a) and 76 percent of households that heat their home with natural gas in Ontario (StatsCan, 2015b). With respect to domestic hot water, 17 out of 21 (81%) households utilized natural gas for their domestic hot water system, while four households (19%) used electricity. This is similar to 73 percent of houses that heat their water using natural gas and 23 percent that use electricity in Ontario (NRCan, 2016b).

[11] However, the MPAC data indicated electric baseboard heat for one house. This inconsistency was clarified during the follow-up interview (homeowner indicated a switch from electric heat to a natural gas furnace in 2016).

5.2.3. EnerGuide Home Energy Evaluations

5.2.3.1. EnerGuide Ratings

Each household was provided a pre-retrofit EnerGuide rating, which are presented in Figure 5-10. On average, the pre-retrofit EnerGuide rating was 65, with a median rating of 67, a minimum rating of 48, and a maximum rating of 78, with a standard deviation of 7. Based on the EnerGuide rating chart first presented in Section 2.3.4., two-thirds of the research sample were classified as 'upgraded' or 'energy-efficient upgraded' older houses.

The EnerGuide ratings were given in reference to an average house of the same age. Fifteen out of 21 households received a pre-retrofit rating that was higher than their average comparison, with a minimum of one point higher and a maximum of 18 points. One household received the same pre-retrofit rating as its average comparison. Five households received a pre-retrofit rating that was lower than their average comparison, with a minimum of 1 point lower and a maximum of 9 points lower. Therefore, over two-thirds of the research sample were rated with a higher pre-retrofit rating than an average home of the same age.

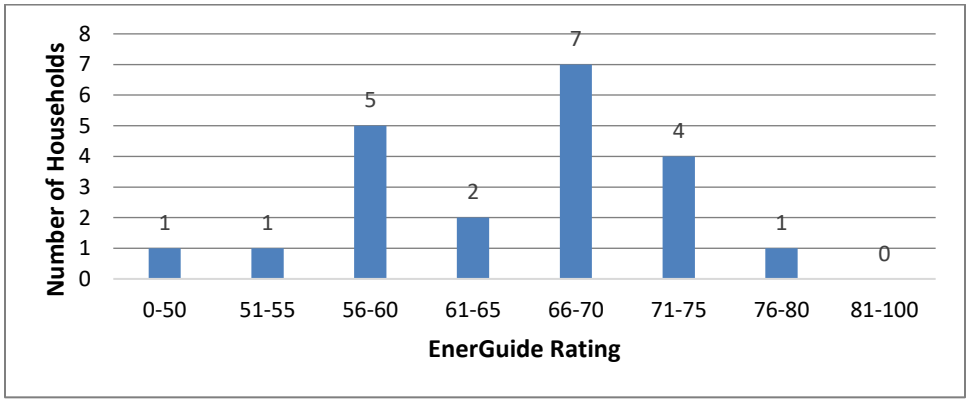

Figure 5-10: Pre-Retrofit EnerGuide Ratings of Research Sample (n=21)

5.2.3.2. Energy-Efficiency Recommendations

Each household was also provided with a list of recommendations to increase the energy-efficiency of their home. Table 5-1 presents the number of recommendations given to each

household[12], divided into two categories: houses constructed before 1970 ('older') and houses constructed after 1970 ('newer'), with the cumulative totals in the farthest right column. The results indicate that, on average, older houses received more audit recommendations than newer homes, with a difference in median of two audit recommendations. The research sample as a whole received 3.8 recommendations, on average, with one-third of households receiving three recommendations.

Table 5-1: Number of Audit Recommendations by Age of House

Number of Audit Recommendations	'Older' houses (n=11)	'Newer' houses (n=10)	Total
1	0	1	1
2	0	2	2
3	3	4	7
4	2	1	3
5	3	2	5
6	3	0	3
Average	**4.5**	**3.1**	**3.8**
Median	5	3	4
Minimum	3	1	1
Maximum	6	5	6
Standard Deviation	1.2	1.3	1.2

The number of times each recommendation was given on the evaluation reports is presented in Table 5-2, again divided into older and newer houses. The reports indicated that draftproofing, basement/crawl space insulation and window/door/skylight replacement were the three most recommended items to the sample as a whole. Further, the results indicate that occupants of older houses, as a whole, received a greater proportion of the recommendations in each of the seven categories, and this was particularly true for exterior wall insulation, basement/crawl space insulation and water heater replacements (≥70% for each). These recommendations are compared to the planned and completed actions in the following sections.

[12] Three recommendation options from the evaluation report (cooling system, ventilation system and water conservation were not included on the surveys and have been excluded from calculations.

Table 5-2: Energy-Efficiency Measure Recommendations by Age of House (n=21)

Audit Recommendation	Older houses (n=11)		Newer houses (n=10)		Total (#)
	#	% of total	#	% of total	
Attic insulation	6	**55**	5	**45**	**11**
Basement/ crawl space insulation	11	**79**	3	**21**	**18**
Draftproofing	11	**52**	10	**48**	**21**
Exterior wall insulation	3	**100**	0	**0**	**3**
Furnace/ boiler replacement	4	**57**	3	**43**	**7**
Water heater replacement	7	**70**	3	**30**	**10**
Window/ door/ skylight replacement	8	**57**	6	**43**	**14**
Total	50	**62.5**	30	**37.5**	**80**

5.3. Initial Survey

5.3.1. Response Rate and Timing of Survey Return

Twenty-one initial surveys were returned from 42 initial survey invitations sent out, representing a response rate of 50 percent. It is important to note that there were 51 coach program participants in total, thus the initial survey results consist of approximately 40 percent of all coach participants. On average, initial surveys were returned 18 days after the first consultation with the Energy Coach, with a median of nine days. Eighteen out of 21 surveys were completed online, while three out of 21 surveys were completed over the phone. A detailed breakdown of response rates and survey timing is available in Appendix J.

At the time that the initial survey was completed, 17 out of 21 participants had met in person, spoken, and/or emailed back and forth with the Energy Coach one time, while four out of 21 participants had met in person, spoken, and/or emailed back and forth with the Energy Coach two (2) or three (3) times.

5.3.2. Motivations and Perceived Challenges

5.3.2.1. Motivations for Pursuing Renovations

Respondents were asked to indicate their household's motivations for pursuing renovations in general from a list of seven motivations, with an 'Other' category included as well. The responses are displayed in Table 5-3. The responses suggest that the top three *Very important* motivations for pursuing renovations were to reduce drafts in the home and make room temperatures more

consistent, to save money on energy bills, and to find out how much energy is used in the home and for what purposes. As well, reducing the household's carbon footprint was highly rated, though the responses were split between *Very important* and *Somewhat important*. The three responses that received the fewest *Very important* ratings were to increase the value of the home, to reduce the time it would take to sell the home, and to find out if there are any health/safety issues in the home. As a note, 17 respondents selected at least two items as *Very important* in their decision to pursue renovations, while three respondents selected one item as *Very important*, and one respondent did not select any items as *Very important*.

Table 5-3: Household's Reasons for Pursuing Renovations (n=21)

	Not at all impor-tant	Some-what unimpor-tant	Neither impor-tant nor unimpor-tant	Some-what impor-tant	Very impor-tant	Had not thought of this before
Find out how much energy we use in our home and for what purposes		1	1	6	12	1
Find out if there are any health or safety issues in our home (e.g. moisture, gas leaks)		2	3	8	5	3
Increase the value of our home	1	3	8	6	2	1
Save money on our energy bills			1	6	14	
Make our home less drafty/ temperatures more consistent between rooms		1	1	3	15	1
Reduce our household's carbon footprint				10	9	2
Reduce time it would take selling our home	3	2	5	3	2	6
Other: "I needed to get a new furnace anyway so one of the catalysts"*						
Other: "Wanted to figure out how to deal with moisture and mold issues in our windows and what we could do to alleviate the problem"				1		

*Respondent did not indicate level of importance for this item.

5.3.2.2. Perceived Ease/Difficulty of Renovation Activities

Respondents were asked to rate the perceived level of ease/difficulty of various renovation activities. If they had not yet completed the activity, they were asked to rate how easy or difficult they thought it would be. The responses are displayed in Table 5-4. The responses to this question were quite mixed, though nearly one-half of respondents indicated that making sure the renovations have been done correctly, accessing incentives, and paying for energy retrofits

were both *Somewhat difficult*, while many thought that deciding to have an energy evaluation and understanding the report were both *Very easy* or *Somewhat easy*.

Table 5-4: Perceived Ease/Difficulty of Various Renovation Activities (n=21)

	Very difficult	Somewhat difficult	Neither easy nor difficult	Somewhat easy	Very easy	I don't know
Deciding to have a home energy evaluation		3	4	5	9	
Understanding my home energy evaluation report		1	3	9	8	
Deciding what renovation to do first	1	7		7	6	
Deciding the order to complete renovations	1	7	1	8	4	
Finding a contractor		3	5	7	2	4
Getting the time to do the renovations	6	5	1	5	3	1
Making sure the renovations have been done correctly	1	10	1	4	1	4
Accessing government incentives	5	9	1	2		4
Paying for energy retrofits	1	11	5	3	1	

5.3.2.3. Concerns about Implementing Recommendations

The initial survey also asked respondents if they had any concerns about implementing the recommended improvements. While the question was related to the challenges in Table 5-4, this question was intended to uncover particular barriers. Seven respondents selected *Yes*, while 14 selected *No*. The next question provided space to elaborate on the concerns, for which all seven respondents who selected *Yes*, and one respondent who selected *No* did. Four themes were developed from the responses, displayed in Table 5-5 with an example quotation for each. The most frequent concern was related to financial challenges, such access to rebates, the cost of renovations, and low or uncertain returns-on-investment, while other concerns included contractor availability, the 'cost' in time and labour, and uncertainty with respect to the effectiveness of the renovations. The full set of responses is available in Table 2 in Appendix L.

Table 5-5: Concerns with Implementing Recommendations from Evaluation Report (n=8)

Theme	Sub-Theme	Example Quotation
Contractors (1)	▪ Availability (1)	"I am concerned that we won't be able to get them done in time to qualify for any rebates, given the schedules of contractors."
'Cost' of resources (2)	▪ Labour (1) ▪ Time (1)	"Draft proofing of pot lights. Cost in time and labour. Draft proofing electrical switches. Uncovering sources of draft under insulation in attic. Cost of labour and time involved. Insulating basement wall. Labour intensive re-fitting appliance electrical and venting outlets. Cost in time and labour."
Financial (8)	▪ Access to rebates (2) ▪ Cost of renovations (3) ▪ Return-on-investment (3)	"The main concern is the cost of the improvements now that most or all government incentive programs are ended."
Uncertainty (1)	▪ Effectiveness of renovations (1)	"The renovations are confusing, some very expensive. How effective is it? What will the benefit be?"

5.3.3. Renovation Plans at the Beginning of the Program

5.3.3.1. Likelihood of Completing Recommendations

Respondents were asked the likelihood that their household would complete some or all of the recommendations from their evaluation report. Approximately 67 percent of respondents as a whole indicated they were *Very likely* to complete some of the recommendations, though less than 10 percent indicated they were *Very likely* to complete all of them. The responses were compared with respect to the number of recommendations each household was given to discern whether any internal differences existed. The results are displayed in Table 5-6.

Table 5-6: Likelihood of Completing Recommendations from the Evaluation Report Based on Number of Recommendations (n=21)

# of Recommendations 'More' 1-3 (n=10) 'Fewer'4-6 (n=11)	**Fewer (1-3)**	**More (4-6)**	**Fewer (1-3)**	**More (4-6)**	**Fewer (1-3)**	**More (4-6)**	**Fewer (1-3)**	**More (4-6)**	**Fewer (1-3)**	**More (4-6)**
Completing <u>some</u> recommendations	1 (10%)	0 (0%)	0 (0%)	0 (0%)	1 (10%)	0 (0%)	2 (2%)	3 (27%)	6 (60%)	8 (73%)
Completing <u>all</u> recommendations	2 (20%)	2 (18%)	5 (50%)	4 (36%)	0 (0%)	0 (0%)	2 (20%)	4 (36%)	1 (10%)	1 (9%)

5.3.3.2. Planned Energy-Efficiency Measures

Respondents were asked to rank – from a list of seven options – their top renovation priorities for the next six months based on the recommendations from the evaluation report and their household's own goals, included as Table 1 in Appendix L. Respondents did not need to rank those options that did not apply to them[13]. For the sample as a whole, draftproofing was the most cited top priority, with eight respondents selecting it as their top priority. Draftproofing was also the most cited priority overall, with 18 respondents including it in their renovation plans. Basement/crawl space insulation was also a common choice, as nine respondents selected it as their second priority, and 17 respondents included it as a priority on their renovation plan.

The average number of energy-efficiency measures planned on the initial survey was 4.2 for the sample as a whole, which is slightly higher than the average number of audit recommendations of 3.8. These averages were also calculated for differences in house age, education level and household income, which are displayed in Table 5-7. The results indicate that older houses received more audit recommendations and planned more energy-efficiency measures than the research sample as a whole, while newer houses received and planned fewer. Similar trends were observed for lower versus higher education and income, respectively.

Table 5-7: Measures of Central Tendency for Audit Recommendations and Planned Measures Based on House Age (n=21)

		Research Sample (n=21)	'Older' homes (n=11)	'Newer' homes (n=10)
Number of Audit Recommendations	Average	**3.8**	**4.5**	**3.1**
	Median	**4**	5	3
	Minimum	**1**	3	1
	Maximum	**6**	6	5
	Standard deviation	**1.4**	1.2	1.3
Number of Energy-Efficiency Measures Planned on Initial Survey	Average	**4.2**	**4.5**	**3.8**
	Median	**4**	5	3.5
	Minimum	**1**	2	1
	Maximum	**7**	7	7
	Standard deviation	**3.8**	1.4	2.0

[13] The follow-up interviews indicated that two respondents should not have included two items in their renovation plans, thus they have been removed from this dataset.

Closer examination of the changes between the number of audit recommendations and the initial survey renovation plan for the sample as a whole indicated that seven respondents included more measures on their renovation plan than were recommended, while eight respondents included the same number of measures, and six respondents included fewer measures. Further, 13 respondents ranked (and thus, included in their renovation plan) at least one energy-efficiency measure, for a total of 20 measures, that had not been included as a recommendation on their evaluation report. The total number of times that each measure was planned on the initial survey is displayed in Table 5-8, divided by whether or not the measure had been recommended.

Table 5-8: Planned Measures Compared to Audit Recommendations for Research Sample (n=21)

Energy-Efficiency Measure	# on Initial Survey Plan (Audit Recommended)	# on Initial Survey Plan (Not Audit Recommended)	Total # Audit Recommended
Attic insulation	8	3	**11**
Basement/crawl space insulation	14	3	**14**
Draftproofing	19	0	**21**
Exterior wall insulation	2	7	**3**
Furnace/boiler replacement	4	1	**7**
Water heater replacement	8	3	**10**
Window/door/skylight replacement	12	3	**14**
Total	**67**	**20**	**80**

Age of House

The number of times that each audit recommendation was planned on the initial survey was compared for older and newer houses, displayed in Table 5-9. The results indicate that, on average, the overall conversion rate (that is, the percentage of audit recommendations that were subsequently planned) was slightly higher for newer homes, with a conversion rate of 87 percent versus 84 percent for older homes. All occupants of older houses planned to complete recommended basement/crawl space insulation and draftproofing, while all occupants of newer houses planned to complete recommended basement/crawl space insulation, water heater replacements and window/door replacement. Moreover, occupants of newer houses planned to complete 12 energy-efficiency measures that had not been recommended to them, especially basement/crawl space and exterior wall insulation. Occupants of older houses planned to complete

eight energy-efficiency measures that had not been recommended, particularly regarding exterior wall insulation[14].

Table 5-9: Planned Measures Compared to Audit Recommendations Based on House Age (n=21)

	# on Initial Survey Plan (Audit Recommended)						# on Initial Survey Plan (Not Audit Recommended)		
Audit Recommendation	'Older' houses (n=11)			'Newer' houses (n=10)			'Older' houses (n=11)	'Newer' houses (n=10)	Total (#)
	Initial Survey	Audit Report	%	Initial Survey	Audit Report	%	Initial Survey	Initial Survey	
Attic insulation	**4**	6	**67**	**4**	5	**80**	2	1	**3**
Basement/crawl space insulation	**11**	11	**100**	**3**	3	**100**	0	3	**3**
Draftproofing	**11**	11	**100**	**8**	10	**80**	0	0	**0**
Exterior wall insulation	**2**	3	**67**	**0**	0	**-**	3	4	**7**
Furnace/boiler replacement	**3**	4	**75**	**2**	3	**67**	0	1	**1**
Water heater replacement	**5**	7	**71**	**3**	3	**100**	1	2	**3**
Window/door/ skylight replacement	**6**	8	**75**	**6**	6	**100**	2	1	**3**
Total	**42**	**50**	**84**	**26**	**30**	**87**	**8**	**12**	**20**

5.3.3.3. 'Other' Renovation Items

Eleven out of 21 participants also wrote in other renovation priorities (both short- and long-term) that were not included on their evaluation report. Many of these were not included on the evaluation report because – as the respondents reported – they were not related to the efficiency of the household. As the majority of these items were not related to energy-efficiency and the exit survey did not follow-up on these additional renovation items, they will be included in Table 3 in Appendix L for completeness but were not included in any calculations.

[14] Similar calculations were done for educational attainment and household income. Analysis of these were not pursued because differences in average values were 0.2 and 0.5, respectively.

5.3.4. Role of Energy Coach

5.3.4.1. Importance of Various Program Attributes

Respondents were asked to rate the importance of various factors in their decision to sign up for the HEC program to probe desired attributes of the program. The responses are displayed in Table 5-10. Approximately one-half indicated that getting help understanding the evaluation report and developing a plan from it, as well as getting help accessing the Union Gas incentive[15], was *Very important* to their decision to sign up for the HEC program.

Table 5-10: Importance of Various Factors to Program Participation (n=21 unless otherwise stated)

	Not at all important	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Very important	Had not thought of this before
Getting help understanding our evaluation report	2	2	1	6	10	
Getting help developing a plan from our evaluation report			3	7	10	1
Getting help finding a contractor	2	2	5	8	3	1
Accessing the Union Gas Incentive (n=20)	2		3	3	11	1
Getting help creating a budget for our renovations (n=19)	3	4	9	3		
Other	1			1	2	1

Six participants listed additional important factors under 'Other', including specific questions about particular renovations, and supplementary energy-efficiency measures such as energy generation and green gardening. One respondent included an item but did not provide an importance rating. Due to the length of some of the responses, they are included as Table 4 in Appendix L.

[15] As overviewed in the Methods chapter, the Union Gas Home Reno Rebate offered a maximum of $2,500 for eligible rebates. Eligibility criteria included an active Union Gas account, a natural gas furnace/boiler, residence in a detached, semi-detached or townhouse home, and location within the boundaries of Southwestern Ontario. Further, a pre- and post-renovation energy assessment was required and at least two renovations must have been completed.

5.3.4.2. Likelihood of Factors to Influence Decision to Proceed with Renovations

Probing a related theme, respondents were then asked the likelihood that various factors would influence their decision to pursue renovations, displayed in Table 5-11. Less than 10 percent of respondents indicated that the availability of the Energy Coach to assist with the renovation process was *Very likely* to influence the decision to proceed with renovations. However, over 40 percent of respondents indicated that the availability of the coach would be *Somewhat likely* to influence their decision to proceed with renovations. Further, approximately 80 percent of respondents suggested that the availability of the Energy Coach to answer technical questions and review the proposed work scope would be *Very likely* (33%) or *Somewhat likely* (48%) to influence their decision to proceed with renovations. Over 60 percent of respondents indicated that incentives would be *Very likely* to influence their decision to proceed with renovations. The other two options yielded mixed responses from the sample.

Table 5-11: Likelihood of Factors Influencing Decision to Proceed with Improvements (n=21)

	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	I don't know
The Energy Coach is available to assist us with the process.	1	3	6	9	2	
The Energy Coach is available to answer technical questions and review the proposed work scope.		1	3	10	7	
The Energy Coach is available to check that the work has been properly completed.		3	6	7	4	1
There are incentives available for eligible improvements.		1	3	4	13	
I am able to receive credit financing for the home energy retrofits.	2	2	6	4	5	2
Other: “Again we are most likely not going to make changes as they don't make financial sense to us.”			1			
Other: “Renovations would be quicker if had credit financing. Cost of energy very likely. The price of natural gas is going down, so will prioritize electricity projects in the meantime.” *					1	
Other: “We made the decision to proceed with renos before coach was available to consult with.”					1	

*This quotation was captured over the phone and recorded as accurately as possible by the researcher.

5.3.5. Impacts of Home Energy Coach Program

5.3.5.1. Changes to the Type, Sequence or Extent of Renovations

Respondents were asked whether their ideas about their home renovations had changed in type, sequence, extent, or in another way, since consulting with the Energy Coach. Respondents could select more than one response. In total, 16 respondents indicated that their ideas had changed, while five respondents indicated that their ideas had not changed. The indicated changes and comments provided are displayed in Table 5-12. The responses indicate that the Energy Coach, on balance, influenced renovation changes in a positive way (eg. to a greater extent).

Table 5-12: Changes to Renovation Plan from Consultations with Energy Coach (n=16)

Renovation Change	Comments
Changes in the type of renovation (5)	"Confirmed our choice of which renovations would be helpful" "Deciding if replacing the fireplace makes sense" "How to insulate the crawl space" "Modified header and overhanging floor insulation process to owner doable" "The coach had done the same kind of insulation we were thinking"
Changes in the sequence/priority of renovation (6)	"Draftproofing before insulation" "Helped us decide exactly where to start for biggest immediate impact" "It seemed wise to sequence the renovations" "Order to complete our renovations" "Relative importance of draftproofing vs. installing an HRV/ERV" "Weather-dependent on foam installation"
Changes in the extent of renovation (5)	"Amount of insulation to add to basement" "Doing attic insulation as well" "Explained air exchange frequency identified in the report and clarified what limits we could expect" "The Energy Coach gave more indication of the cost that renovations would take, while I did not get the same sense during the energy evaluation. My idea of the realistic extent of renos has decreased since the meeting with the Energy Coach." "We were just replacing windows, now we are insulating and replacing water heater"
Other changes (5)	"How to go about doing it" "Materials" "Strategies for window replacement and draftproofing, including cold room" "Value of triple glaze versus double glaze windows" "We were considering adding insulation in our attic but after discussions with the coach it doesn't make sense for us"

5.3.6. Program Evaluation

5.3.6.1. Energy Coach Attributes

Respondents were asked to rate their agreement with a number of statements about their interactions with the coach. The results are displayed in Table 5-13. Over 75% of respondents *Strongly agree* that the Energy Coach was easy to work with, was professional, courteous and considerate with respect to their home and time, and was a trusted source for unbiased information. A large percentage of respondents also *Strongly agree* that the coach was responsive to their inquiries and was helpful in explaining their evaluation report. Overall, the feedback about the Energy Coach was positive.

Table 5-13: Level of Agreement with Various Coach Program Attributes (n=21 unless otherwise stated)

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	I don't know
The Energy Coach is easy to work with.		1		4	16	
The Energy Coach is responsive to our inquiries.			1	6	13	1
The Energy Coach is professional, courteous and considerate with respect to our home/time.			1	4	16	
The Energy Coach is a trusted source for unbiased information.			2	2	16	1
The Energy Coach was helpful in explaining the findings and recommendations in the evaluation report.			1	5	14	1
The Energy Coach was helpful in explaining available rebates. (n=20)		1	8	4	5	2

5.3.6.2. Satisfaction and Expectations

Respondents were asked to rate their overall level of satisfaction with the HEC program. Thirteen respondents rated their level of satisfaction as *Very satisfied*, while eight respondents rated their level of satisfaction as *Somewhat satisfied*. No respondent selected *Somewhat*

dissatisfied for this question. With respect to respondents' expectations, three respondents rated the program as *Exceeding their expectations*, while 15 respondents answered that the program *Met their expectations*, and two respondents indicated that the program had been *Below their expectations*. One respondent did not provide an answer for this question.

Respondents were able to provide additional commentary on their initial expectations and how the program did or did not meet those expectations. Six participants chose to elaborate, with two respondents from each of the 'expectation ratings' providing additional commentary. Two key themes were developed from these data, which were communication skills and information provision by the Energy Coach. The responses displayed a mix of positive and negative feedback. The themes are displayed in Table 5-14 with quotations from both perspectives, and the full set of responses is included in Table 5 in Appendix L.

With respect to communication skills, two respondents had negative feedback, including a lack of direction in leading the conversation and a lack of translation skills, while another respondent indicated that the Energy Coach had been very engaged and interested. With respect to information provision, one respondent indicated that they would have liked greater specificity in contractor recommendations, while three respondents provided positive feedback, suggesting that learning more about energy usage had been a positive experience, that the use of visual aids had been helpful, and that the Energy Coach drawing on personal experience was helpful.

One additional theme was introduced by one respondent, who suggested that the initial consultation should be conducted in the respondent's home so that the Energy Coach has an understanding of exactly what the homeowner is talking about when it comes to the specifics of their renovation. This theme will be returned to later in the Results section.

Table 5-14: Respondent Commentary on Program Expectations on Initial Survey (n=6)

Theme	Sub-Theme	Quotation
Communication (3)	Engaging (+)	"[The] coach was very interested in our questions and eager to discuss different ways of solving the situations our home presented. … [The] coach was interested in us."
	Lack of direction (-)	"We've only had one meeting so far, and it seemed like the coach didn't quite know how to get the conversation going. We haven't done this before, and he didn't offer any strong lead on the discussion. I understand he wants to answer our questions, but I don't yet know what questions to ask."
	Lack of translation skills (-)	"I was excited, but he needs to bring it down to our level. He talked about extra stuff we didn't need to know and couldn't translate. We were sitting there thinking 'Are you understanding this?'. Too much technical info."
Information Provision (3)	Personal experience (+)	"[T]he energy coach was not only talking theory, but had experience in his own home renos."
	Visual aids (+)	"[The coach] was knowledgeable and had insulation display to explain the options."
	Lack of specificity (-)	"I would have liked more specifics when it comes to potential contractors for retrofit work."

5.4. Monthly Surveys

5.4.1. Response Rate and Timing of Survey Return

Thirteen monthly surveys (#1) were returned from 15 monthly survey (#1) invitations, for a response rate of 87 percent. The first monthly survey, therefore, consists of 25 percent of all coach participants. The first monthly survey was returned, on average, 59 days after the first consultation with the Energy Coach, with a median of 43 days. A detailed breakdown of survey response rates and timing is available in Appendix J.

One month after the first monthly survey was administered, an invitation to complete the second monthly survey was sent to four participants. In total, three out of four surveys were returned, for a response rate of 75 percent. This consists of approximately 6 percent of all coach participants. The second monthly survey was returned, on average, 75 days after the first consultation with the Energy Coach, with a median of 66 days.

At the time of the first monthly survey, four out of 13 participants had been in contact with the Energy Coach (either in person, by phone or over email) within the last 30 days, while nine out of 13 participants indicated that they had not been in contact with the Energy Coach over the last

30 days. At the time of the second monthly survey, one participant had been in contact with the Energy Coach (either in person, by phone or over email) within the last 30 days, while the other two participants indicated that they had not been in contact with the coach over the last 30 days.

5.4.2. Monthly Survey #1

On the monthly survey, respondents were asked to fill in a chart with a series of questions about their renovation progress over the last 30 days. The list of renovation activities and the responses are displayed in Table 5-15. Respondents were only asked to select those that applied to them, so the number below each column heading represents the number of respondents that 'agreed' with that heading.

Table 5-15: Renovation Activity in Last 30 Days with Coach Service Helpfulness/Unhelpfulness on Monthly Survey #1 (n=13)

	Completed in last 30 days	Coach service assisted	Coach service was helpful	Coach service was unhelpful
Reviewed home energy evaluation	6	5	6	
Set a timeline for home renovations	5	1	4	1
Contacted a contractor	6			2
Reviewed quotes from multiple contractors	3	1	1	2
Created a budget to complete renovations	5		2	
Accessed government incentive programs	1	1		1
Accessed credit financing				1
Selected a contractor	3			2
Started home renovation	4	1	1	2
Completed home renovation	1			2

Following this, respondents were provided space to elaborate on how the Energy Coach had been helpful or unhelpful for the activities selected above. Ten participants provided additional commentary for this question. The responses provided insight into what aspects the Energy Coach had been helpful with and how the Energy Coach had been helpful.

With respect to what the Energy Coach had been helpful with, all ten responses suggested that the Energy Coach had been helpful in discussing ideas and options for their renovation plan, and this applied to current and future renovations across the respondents. With respect to how the Energy Coach had been helpful, two key themes were developed. Most respondents indicated that

the Energy Coach had been helpful through information provision, such as providing clarification on the audit report findings or specific questions, identifying various options and discussing the costs and benefits of these options, and discussing required planning for future renovation work. Several respondents also suggested that the Energy Coach had helped them to build capacity/skills related to their renovations, such as communicating more effectively with the contractor, completing do-it-yourself (DIY) work, or understanding procedural information around particular renovations. One respondent also suggested that the Energy Coach had provided motivation to get started. Table 5-16 summarizes the key themes found here, and presents an example quotation for each. The full set of responses is included in Table 7 in Appendix L.

Table 5-16: Respondent's Comments on Energy Coach Helpfulness/Unhelpfulness on Monthly Survey #1 (n=10)

Theme	Sub-Theme	Example Quotation
Building Capacity/Skills (5)	Communication (2)	"It also helped us work out what questions to ask while getting quotes from contractors."
	DIY renovations (1)	"Identified what we could do ourselves."
	Procedural information (2)	"Discussion of concerns we had with our house and ways to correct the problems."
Information Provision (10)	Clarification (3)	"Helped clarify the priorities of specific tasks."
	Option evaluation (3)	"The coach helped to determine what items we could change that would save the most amount of energy based on the budget we have to work with."
	Planning (1)	"The coach gave me an idea of the budget that I would need in the future as well as the planning that I would need to complete when I decided to renovate."
	Providing options (3)	"We were able to get ideas of what we could do."
Other (1)	Motivation (1)	"He was helpful in getting me to get off my behind and put everything together to get the project started."

The next question asked what the coach service could do better if the service provided had been unhelpful. Three respondents provided commentary here, though two of these responses suggested that nothing more could be done. One respondent indicated "Nothing", while another indicated that with a lack of incentives, there was nothing the coach could do to be more helpful. A third respondent indicated that they were "feeling a bit lost" but did not indicate how the Energy Coach could have been more helpful.

Next, respondents were asked whether there had been any times over the last 30 days where they had hoped for more help from the coach service. Of the ten closed-ended (Yes/No) responses to this question, only one respondent indicated a desire for more help during the previous 30 days. This respondent indicated that,

> "It would be great to have had a bit more info and advice in terms of timing. We didn't realize it would take this long to get quotes, and confirm a contractor. Given the narrow window for qualifying for rebates, it creates a [quandary]. To have informed discussions with the home coach, we need the energy audit. But the energy audit date sets an unrealistic 'start time' for the renovation window, as we have to assess the report, meet with the coach, make a plan, get quotes, then get the work done, all within three months. I don't see a better way to do it, just flagging it as an issue."

Finally, respondents were provided space to write any additional comments. Two indicated that having the Energy Coach complete a consultation at their home would have been beneficial, which returns to the theme of home-visits introduced on the initial survey.

5.4.3. Monthly Survey #2

The second monthly survey included the same questions and format as the first monthly survey. As discussed, the objective of the monthly survey was to track renovation progress and consultations with the coach over time, so using the same survey was deemed appropriate. The responses are displayed in Table 5-17.

Table 5-17: Renovation Activity in Last 30 Days with Coach Service Helpfulness/Unhelpfulness on Monthly Survey #2 (n=3)

	Completed in last 30 days	Coach service assisted	Coach service was helpful	Coach service was unhelpful
Reviewed home energy evaluation	1	2	2	
Set a timeline for home renovations	2	1	1	
Contacted a contractor*		1	1	
Reviewed quotes from multiple contractors				
Created a budget to complete renovations	2			
Accessed government incentive programs				
Accessed credit financing				
Selected a contractor				
Started home renovation	1	1	1	
Completed home renovation	1			

*One respondent suggested that they would be doing the work themselves rather than hiring a contractor.

One respondent filled out the monthly survey to indicate that their renovations would be put on hold, so none of the questions on the survey were applicable. The other two respondents indicated that the coach service had been helpful over the last 30 days. More specifically, one participant indicated that the coach had been helpful in planning do-it-yourself renovations, while the other participant indicated that the coach had been helpful in determining the renovations that would yield the best energy savings. When asked if the coach service could have provided more help over the last 30 days, one participant selected "Yes" and noted that they would be following up about new rebates/incentives added this year.

5.5. Exit Survey

5.5.1. Response Rate and Timing of Survey Return

Eighteen exit surveys were returned from 21 exit survey invitations, for a response rate of 86 percent. This consists of approximately 35 percent of all program participants. The exit surveys were returned, on average, 90 days after the first consultation with the Energy Coach, with a median of 76 days. A detailed breakdown of response rates and timing is included in Appendix J.

At the time of the exit survey, 11 respondents had been in contact with the Energy Coach one time since signing up for the program, five respondents had been in contact two times, one respondent had been in contact three times, and one respondent had been in contact four times. In total, 28 consultations occurred over the duration of the program across the 18 exit survey respondents. Thirteen consultations took place at the REEP House in the Energy Coach's office, 11 consultations took place over the phone, one consultation took place over email, and three consultations took place at the customer's home.

5.5.2. Renovation Progress at the End of the Program

5.5.2.1. Planned Energy-Efficiency Measures

Respondents were asked to indicate, from seven category options plus an 'Other' category, which items were part of their current renovation plan. The number of times each renovation item was included on the exit survey renovation plan is included in Table 5-18, separated by those households who were recommended the energy-efficiency measure and those that were not for

the 18 exit survey respondents. The results also indicate that seven households included a renovation item that was not recommended on their evaluation report, while nine households only included renovation items that were recommended to them. Notably, exterior wall insulation, attic insulation and window/door replacement were the most cited renovation plans that had not been recommended.

Table 5-18: Exit Survey Renovation Plans by Recommended vs. Not Recommended (n=18)

Energy-Efficiency Measure	# on Exit Survey Plan (Audit Recommended)	# on Exit Survey Plan (Not Audit Recommended)	Total # Audit Recommended
Attic insulation	5	2	**9**
Basement/crawl space insulation	11	1	**13**
Draftproofing	14	0	**18**
Exterior wall insulation	2	3	**3**
Furnace/boiler replacement	3	0	**6**
Water heater replacement	2	1	**8**
Window/door/skylight replacement	8	2	**12**
Total	**45**	**9**	**69**

Exit survey respondents included an average of three (3.0) energy-efficiency measures on their renovation plan[16], which is lower than the average number of audit recommendations of 3.8 and the average number of renovation items on the initial survey of four (4.0) for the 18 exit survey respondents. As a whole, exit survey respondents included 65 percent of all energy-efficiency measures recommended to them in their renovation plans. The measures of central tendency were also calculated based on differences in house age, displayed in Table 5-19.

A closer examination of the differences between the audit recommendations and initial and exit survey renovation plans reveals that three respondents included more energy-efficiency measures than recommendations, while nine respondents included fewer than recommended, and six respondents included the same number. Further, two respondents included more energy-efficiency measures than on their initial survey, while eleven respondents included fewer, and five respondents included the same number.

[16] Three respondents included "other" renovation items, which were capping an unused chimney (1) and cold room insulation (2), and an HRV/ERV installation (1). Including "Other" renovation items, exit survey respondents had included an average of 3.2 renovation items, with a median of 3 renovation items, a minimum of 0 renovation items and a maximum of 7 renovation items, with a standard deviation of 1.7.

Table 5-19: Measures of Central Tendency for Planned Measures on Exit Survey by House Age (n=18)

		Research Sample (n=18)	'Older' houses (n=10)	'Newer' houses (n=8)
# of Energy-Efficiency Measures Planned on Exit Survey	Average	**3.0**	**3.5**	**2.4**
	Median	**3**	4	2.5
	Minimum	**0**	1	0
	Maximum	**5**	5	5
	Standard deviation	**1.5**	1.3	1.5

Age of House

The specific energy-efficiency measures planned at the time of the exit survey (ie. end of the study period) were compared for older and newer houses. The results indicate that newer houses had a higher conversion rate from recommended measure to planned action, though this group received less than one-half of the total recommendations than did older houses. Older houses also included more measures that were not recommended to them than newer houses, particularly related to attic and exterior wall insulation[17]. The full dataset is shown in Table 5-20.

Table 5-20: Planned Measures Compared to Audit Recommendations Based on House Age (n=18)

	# on Exit Survey Plan (Audit Recommended)						# on Exit Survey Plan (Not Audit Recommended)		
Audit Recommendation	'Older' houses (n=10)			'Newer' houses (n=8)			'Older' houses (n=10)	'Newer' houses (n=8)	Total (#)
	Exit Survey	Audit Report	%	Exit Survey	Audit Report	%	Exit Survey	Exit Survey	
Attic insulation	**3**	6	**50**	**2**	3	**67**	2	0	**2**
Basement/crawl space insulation	**8**	10	**80**	**3**	3	**100**	0	1	**1**
Draftproofing	**8**	10	**80**	**6**	8	**75**	0	0	**0**
Exterior wall insulation	**2**	3	**67**	**0**	0	**-**	3	0	**3**
Furnace/boiler replacement	**2**	4	**50**	**1**	2	**50**	0	0	**0**
Water heater replacement	**2**	7	**29**	**0**	1	**0**	0	1	**1**
Window/door/ skylight replacement	**4**	7	**57**	**4**	5	**80**	1	1	**2**
Total	**29**	**47**	**62**	**16**	**22**	**73**	**6**	**3**	**9**

[17] Similar calculations were done for educational attainment and household income. Analysis was not pursued because differences in average values were 0.0 and 0.3, respectively.

5.5.2.2. Progress on Energy-Efficiency Measures

Respondents also provided an indication of their renovation progress, which has been categorized here as 'completed', 'in progress' or 'future'. Renovations were categorized as 'in progress' if the respondent gave an indication that steps had been taken to execute the renovation (such as purchasing materials), if the renovation was ongoing, or if the renovation was to be completed during the 2016 calendar year. Renovations were categorized as 'future' if the respondent indicated the renovation would be completed during 2017. The responses are displayed in Table 5-21.

Overall, at least one energy-efficiency upgrade was 'in progress' or 'completed' by 17 out of 18 respondents to the exit survey, while only one household indicated no completed, in progress or future renovation plans. In total, the renovation activity consisted of 51 energy-efficiency measures in progress or completed, of which 44 were recommendations from the energy audits. Moreover, 11 respondents reported that at least one recommended energy-efficiency measure had been 'completed' at the end of the program, with an average of 1.3 completed measures for the sample as a whole. In total, 24 energy-efficiency measures were completed at the end of the program, of which 20 were recommendations. Overall, exit survey respondents completed 29 percent of the energy-efficiency measures recommended to them within the study period (three months on average).

Table 5-21: Renovation Progress on Energy-Efficiency Measures on Exit Survey (R=Recommended, N/R=Not Recommended) (n=18)

Energy-Efficiency Measure	Completed			In Progress			Future		
	R	N/R	Total	R	N/R	Total	R	N/R	Total
Attic insulation	2	2	4	3	-	3	-	-	0
Basement/crawl space insulation	5	-	5	6	1	7	-	-	0
Draftproofing	4	-	4	10	-	10	-	-	0
Exterior wall insulation	2	2	4	-	-	0	-	1	1
Furnace/boiler replacement	2	-	2	-	-	0	1	-	1
Water heater replacement	1	-	1	1	1	2	-	-	0
Window/door/skylight replacement	4	-	4	4	1	5	-	1	1
Total	**20**	**4**	**24**	**24**	**3**	**27**	**1**	**2**	**3**

The conversion rates (that is, the percentage of audit recommendations that were subsequently completed) for each energy-efficiency measure are displayed in Table 5-22. The highest completed conversion rates were observed for exterior wall insulation, basement/crawl space insulation, furnace/boiler replacements and window/door replacements, which cumulated to nearly one-half of all recommendations. The lowest conversion rate was observed for water heater replacements.

Table 5-22: Conversion Rates for Completed Energy-Efficiency Recommendations and Completed/In Progress Energy-Efficiency Recommendations (n=18)

Energy-Efficiency Measure	Number of Times Recommended (% of Total Recommendations)	Conversion Rate (Completed)	Conversion Rate (Completed + In Progress)
Attic insulation	9 (13)	22%	56%
Basement/crawl space insulation	13 (19)	38%	85%
Draftproofing	18 (26)	22%	78%
Exterior wall insulation	3 (4)	67%	67%
Furnace/boiler replacement	6 (9)	33%	33%
Water heater replacement	8 (12)	13%	25%
Window/door/skylight replacement	12 (17)	33%	67%
Total	**69**	**29%**	**64%**

5.5.2.3. Completed Energy-Efficiency Measures

The research sample as a whole completed an average of 1.3 energy-efficiency measures by the end of the study period. Further, on average, older houses completed more measures than newer houses.

Table 5-23: Measures of Central Tendency for Completed Measures Based on House Age (n=18)

		Research Sample (n=18)	'Older' houses (n=10)	'Newer' houses (n=8)
Number of Energy-Efficiency Measures Completed on Exit Survey	Average	**1.3**	**2**	**0.5**
	Median	**1**	2	0
	Minimum	**0**	0	0
	Maximum	**5**	5	2
	Standard deviation	**1.4**	1.5	0.8

The number of completed energy-efficiency measures was compared based on the age of house, which is displayed below.

Age of House

The results indicate that older homes completed more measures at the end of the study period than newer homes, with 16 completed recommended measures (and 4 additional that were not recommended), for a total conversion rate of 34 percent compared to 18 percent. Among older houses, the highest conversion rates were observed for exterior wall insulation and furnace/boiler replacements. Overall, basement/crawl space insulation was completed most frequently in older houses, followed by draftproofing. Among newer houses, window/door replacement and basement/crawl space insulation saw the highest conversion rates, and window/door replacement was also completed most frequently, though only four measures were completed in total by occupants in newer houses[18]. The full set of calculations is shown in Table 5-24.

Table 5-24: Completed Actions Compared to Audit Recommendations Based on Age of House (n=18)

	# of Completed Actions (Audit Recommended)						**# of Completed Actions (Not Audit Recommended)**		
Audit Recommendation	'Older' houses (n=10)			'Newer' houses (n=8)			'Older' houses (n=10)	'Newer' houses (n=8)	Total (#)
	Exit Survey	Audit Report	%	Exit Survey	Audit Report	%	Exit Survey	Exit Survey	
Attic insulation	**2**	6	**17**	**0**	3	**0**	2	0	**2**
Basement/crawl space insulation	**4**	10	**40**	**1**	3	**33**	0	0	**0**
Draftproofing	**3**	10	**30**	**1**	8	**13**	0	0	**0**
Exterior wall insulation	**2**	3	**67**	**0**	0	**-**	2	0	**2**
Furnace/boiler replacement	**2**	4	**50**	**0**	2	**0**	0	0	**0**
Water heater replacement	**1**	7	**14**	**0**	1	**0**	0	0	**0**
Window/door/ skylight replacement	**2**	7	**29**	**2**	5	**40**	0	0	**0**
Total	**16**	**47**	**34**	**4**	**22**	**18**	**4**	**0**	**4**

5.5.2.4. Factors Influencing Renovation Plans (Other than Energy Coach)

Respondents were also asked to indicate whether any factors played a role in the renovations that were decided upon, other than the Energy Coach, and what those factors were.

[18] Similar calculations were done for educational attainment and household income. Analysis of these was not pursued because differences in average values were 0.2 and 1.3, respectively.

Fifteen responses were received for this question, of which four responses were *No*. One response did not relate to the question and thus was omitted from the results here. Four key themes were developed from the remaining ten responses, displayed in Table 5-25 with an example quotation. The most cited factor was related to financial considerations, including access to rebates, cost of renovations and returns on investment, consistent with the challenges identified on the initial survey. The full dataset is available in Table 8 in Appendix L.

Table 5-25: Factors Influencing Renovation Plan (Other than Energy Coach) (n=10)

Theme	Sub-Theme	Example Quotation
Environmental Concern (2)	▪ Reduce carbon footprint (1) ▪ 'Right thing to do' (1)	"The Energy Audit that indicated the rate of full air exchanges made us determined to have a lower carbon footprint in our home's energy use."
Financial (5)	▪ Access to rebates (1) ▪ Cost of renovations (3) ▪ Return on investment (1)	"Our house was rated as about average for efficiency. After doing the math, it seemed that only draftproofing was worthwhile given our current budget."
Support Network (3)	▪ Architect design ideas (1) ▪ Contractor availability (1) ▪ Information from REEP (1)	"Architect design ideas."
Other (3)	▪ Aesthetics (1) ▪ Capacity/skills through procedural information (1) ▪ Concurrent with other renovations (1)	"Aesthetics of the house was an additional issue."

5.5.3. Perceived Challenges and Enablers

5.5.3.1. Renovation Difficulties and Perceived Challenges

Respondents were asked to rate the ease or difficulty of various renovation activities. The responses are displayed in Table 5-26. The responses for many renovation activities were quite mixed across respondents, though understanding the evaluation report and deciding to start renovations were *Very easy* or *Somewhat easy* for many respondents.

Respondents were then asked if any other challenges had been faced in their renovations. Twelve responses were received for this question, of which four indicated *No*. Four key themes were developed from these responses, which are displayed in Table 5-27. While there was a variety of responses, the two most cited concerns related to contractors and of skills/capacity required to complete the renovations. The full set of responses is included in Table 9 in Appendix L.

Table 5-26: Rated Ease/Difficulty of Various Renovation Activities on Exit Survey (n=18)

	Very difficult	Somewhat difficult	Neither easy nor difficult	Somewhat easy	Very easy	Not applicable
Understanding home energy evaluation report	1		2	7	8	
Deciding to start renovations	1	1	1	8	6	1
Deciding which renovations to do	1	3	1	6	6	1
Deciding the order to complete renovations in	2	1	2	8	3	2
Finding the right information to complete renovations	1	5	3	6	2	1
Finding a trustworthy and reputable contractor	1	4	3	3	2	5
Getting time to complete renovations	3	7	2	2	2	2
Making sure the renovations were done correctly	1	4	5	2	2	4
Accessing government incentives	4	2	1	2	1	8
Paying for energy retrofits	1	8	3	3		3

Table 5-27: Additional Challenges Faced in Renovations (n=8)

Theme	Sub-Theme	Example Quotation
Contractors (3)	▪ Availability (2) ▪ Communication (1)	"Managing the timing of contractor contributions to the project, i.e. my ability to work was held up at one point related to delay in contractor being able to do the work."
Financial (2)	▪ Access to rebates (1) ▪ Cost of renovations (1)	"Cost- expensive! Haven't tried to access incentives, but doesn't look so easy…"
Skills/Capacity (4)	▪ Age (1) ▪ Communication with contractor (1) ▪ Complex DIY renovations (1) ▪ Uncertainty (1)	"I felt like it might have been helpful for the energy coach to talk directly to my contractor since my attempts to communicate were sometimes ineffective because of my lack of understanding of the process."
Other (1)	▪ Aesthetics (1)	"Ensuring consistent aesthetic during a multi-stage renovation."

5.5.3.2. Overcoming Challenges/Difficulties

Respondents were asked to indicate how they were able to overcome those items noted as *Somewhat difficult* or *Very difficult* in Table 5-28. Fourteen responses were collected for this question, though two reiterated the challenges and did not provide an enabling factor, thus were omitted from the results here. Four themes were developed, displayed in Table 5-28. Self-directed research, particularly through internet research but also seeking out contractor advice, was an oft-cited enabler for respondents. Support networks, including contractors, local suppliers and REEP

staff, were also noted by many respondents. Finally, several respondents also indicated that their social networks (eg. family and friends) had provided support to overcome challenges. The full set of responses is available in Table 10 in Appendix L.

Table 5-28: Enablers that Helped Respondents Overcome Challenges (n=12)

Theme	Sub-Theme	Example Quotations
Self-directed research (5)	▪ Contractors (1) ▪ Internet (4)	"Internet searches provided confirmation of our Roxul (tm) decision."
Social networks (3)	▪ Family/friends (3)	"More time when holidays arrive and to recruit friends and family."
Support networks (5)	▪ Contractors (2) ▪ Local suppliers (1) ▪ REEP (2)	"Hoping REEP will still let me know of any government incentives that might be retroactive."
Other/Unspecified (4)	▪ Money (1) ▪ Time (3)	"Change priorities so they can be done." "Finding the money for everything to be done, not an expert on these changes- so hopefully they are correct."

5.5.4. Role of Energy Coach

5.5.4.1. Helpfulness in Overcoming Challenges

Respondents were asked if the Energy Coach had been helpful in overcoming the challenges or difficulties reported and if so, how the coach had provided help. In total, 15 respondents provided a comment. The comments were interpreted with respect to their 'level' of helpfulness, with eight responses suggesting the Energy Coach had been helpful, four responses suggesting the Energy Coach had been somewhat helpful, and three responses suggesting the Energy Coach had not been helpful. The three categories are displayed in Table 5-29 with a sample quotation for each.

Not all respondents indicated 'how' the Energy Coach had been helpful, though the responses provide some insight into the mechanisms. For those that suggested the Energy Coach had been helpful, the responses indicated that the Energy Coach had provided and evaluated various options, directed them to resources, provided specific technical information and was available for multiple consultations as questions arose. For those that suggested the Energy Coach had been somewhat helpful, the responses indicated that the Energy Coach had lacked specificity in direct product recommendations and had provided limited help on the rebate application process. For those that suggested the Energy Coach had not been helpful, the responses indicated that the

Energy Coach had lacked specificity in direct contractor recommendations and used excessive technical jargon. The full set of responses is available in Table 11 in Appendix L.

Table 5-29: Level of Helpfulness of Energy Coach in Overcoming Challenges (n=15)

Level of Helpfulness	Sample Quotations
Helpful (8)	"Yes, deciding which renos to do, the order, and getting specific advice about technical aspects of several of the renovations."
Somewhat helpful (4)	"He was of some help indicating which windows he had used in his own renovation, but not so much that I feel like I can proceed without doing significant research."
Not helpful (3)	"Not good at translating the knowledge and making it accessible to us."

Further, respondents were asked to elaborate on how the Energy Coach could have been more helpful if the services provided had not helped to overcome the stated challenges. Six relevant responses were collected for this question, which were separated into three key themes. These themes are presented in Table 5-30 with an example quotation. The most common response to how the Energy Coach could have been more helpful was to complete a home visit, which was identified by four respondents. The full set of responses is included in Table 11 in Appendix L.

Table 5-30: Suggestions for Energy Coach to be More Helpful with Overcoming Challenges (n=6)

Theme	Sample Quotations
Communication (1)	"Being better at communicating information in ways someone outside the field can understand. Breaking down concrete and realistic steps to take."
Home Visits (4)	"Provide onsite feedback of specific issues the need to be addressed. This would help prioritize the renovation."
Specificity (1)	"Because the variety of window supplier and models is huge, some narrowing down of that field would have been helpful. Outlining a handful of window lines, contractors to install them, and the pros and cons of the different models would have been the most helpful."

5.5.4.2. Rated Helpfulness of Important Program Services from Initial Survey

On the initial survey, respondents were asked to rate the importance of five different items on their decision to sign up for the Home Energy Coach Program, and were also provided space to write in other items. On the exit survey, respondents were reminded of those items that they had indicated were *Very important* or *Somewhat important* and asked to rate how the program had helped achieve each of those. The responses are displayed in Table 5-31 Across three respondents, eight additional items were also written-in as *Very important* or *Somewhat important* to their

decision to sign up for the program. Of the eight items from the three respondents, seven out of eight responses suggested that the coach program had been *Very helpful*, while one out of eight responses suggested that the coach program had been *Somewhat helpful*.

Table 5-31: Rated Helpfulness of Important Program Services on Exit Survey (n=18 maximum)

	Very unhelpful	Somewhat unhelpful	Neither helpful nor unhelpful	Somewhat helpful	Very helpful
Getting help understanding evaluation report (14)	1	1	1	4	7
Getting help developing a plan from evaluation report (14)	1	1	2	7	3
Getting help finding a contractor (9)		3	3	3	
Accessing the Union Gas Incentive (11)	2	1	4	3	1
Getting help creating a budget (3)		2	1		
Discussing practical ideas and visuals on completing the renovations from the evaluation report (1)				1	
Getting a third-party's opinion about options presented by potential contractors (1)					1
Getting help planning to finish your basement in an energy-efficient manner (1)					1
Getting help understanding trade-offs between the options of your plan (ie. HRV vs. ERV, type of insulation to use) (1)					1
Getting help understanding what energy savings make sense to do before considering energy generation (e.g. solar panels) (1)					1
Getting help with materials to achieve energy efficiency (1)					1
Reviewing evaluation report to determine which items could be done without a contractor (1)					1
Sourcing foam insulation that could be owner-installed (1)					1

5.5.5. Impacts of Home Energy Coach Program

5.5.5.1. Changes to the Type, Sequence or Extent of Renovations

Respondents were asked if they planned to complete different renovations than they had intended after receiving their evaluation report. Nine responses suggested that their current renovation plans differed, while three responses suggested their renovation plans would be

extended into the future. The next question asked whether or not the Energy Coach had influenced the decision. The responses which indicated that the Energy Coach influenced the decision are displayed in Table 5-32. With respect to changes in the type of renovation, the responses suggest that the Energy Coach influenced them to complete more renovations. Regarding changes in the sequence/priority of renovations, two responses suggest that the Energy Coach influenced them to complete renovations that would have greater impact first, and one response suggests that the Energy Coach influenced fewer renovations as the existing equipment in their home was satisfactory. With respect to the extent of the renovations, the responses suggest that the Energy Coach influenced respondents to complete 'more' renovations (eg. install greater insulation value).

Table 5-32: Changes to Renovation Plan from Consultations with Energy Coach (n=10)

Change	Details on Renovation Change	Details on Influence of the Coach
Change in type of renovation (3)	"I insulated the cold room and sealed it. Also, I modified the basement wall insulation to be a wet wall. I also capped the unused fireplace chimney."	"Yes, during our face to face to meeting in Nov/Dec."
	"New tasks: draftproofing, plan to add an HRV/ERV."	"Helped me evaluate … type of insulation to add to the basement walls. Helped me evaluate type of HRV/ERV."
	"Type differed - used Roxul Board (tm) rather than Styrofoam board due to Roxul's higher fire rating, and similar moisture barrier rating. Chose to use Roxul Batts in studded walls for their higher fire rating."	"Coach influenced decision in first meeting by pointing our DIY possibilities and potential materials to consider."
Change in sequence/ priority of renovation (2)	"The evaluation helped us prioritize, and do our basement and attic insulation earlier. It also showed the wall insulation was less important than attic/basement."	"The evaluation was very helpful, and then [the coach's] visit to our house helped define final plans, and next steps."
	"Hoping to still replace some doors and windows and add further insulation to the attic at some future time."	"The coach influenced the priority to which I gave the renovations as money was limited and I wanted to do what was most important."
	"We are not doing renovations we thought we would immediately (new furnace)."	"Said it was fine."
Change in the extent of renovation (4)	"Decided to insulate entire bedroom as well as bathroom."	(No response provided)
	"Extent: amount of insulation to add to basement."	"Helped me evaluate amount … of insulation to add to the basement walls."
	"I increased the insulation value [in the basement] to R28 using 2 layers of Roxul batt insulation."	"Yes, during our face to face to meeting in Nov/Dec."
	"Upgraded attic insulation from r-20 to r-50 to take advantage of rebate program."	"Yes, he said it would be the best thing we could do to make our home more efficient."

Two other changes noted by respondents were changes to the type and sequence of renovations, for which the Energy Coach did not influence the decision. Rather, for one respondent, the Energy Coach encouraged the respondent to do the work themselves, and for the other, the incentive from Union Gas prioritized their renovation. The responses are displayed in Table 5-33.

Table 5-33: Changes to Renovation Plans Not Related to Consultations with Energy Coach (n=2)

Change	Details on Renovation Change	Influencing Factor
Change in type of renovation (1)	"Adding to the attic insulation was not something I had intended on doing and was the first recommendation from the Home energy report. It will be the first renovation I do."	"The energy coach did not influence my decision to do it. He made it seem more reasonable to do it myself, which reduces the cost of the retrofit."
Change in sequence/ priority of renovation (1)	"Doing basement sooner than planned."	"More the $$ incentive from Union gas."

5.5.6. Program Evaluation

5.5.6.1. Energy Coach Attributes

Respondents were asked to rate their agreement on various Energy Coach attributes based on the consultation sessions. The responses are displayed in Table 5-34. The results indicate that the majority of respondents *Strongly agree* that the Energy Coach was easy to work with. Many respondents also *Strongly agree* or *Somewhat agree* that the coach provided information that they would not have found on their own. As well, many participants *Strongly agree* or *Somewhat agree* that the Energy Coach was a source of unbiased information. The responses also suggest that many respondents found the coach's availability to be convenient.

Table 5-34: Rated Agreement/Disagreement with Various Statements about the Energy Coach on Exit Survey (n=18 unless otherwise stated)

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Not applicable
The Energy Coach was easy to work with.		1		2	15	
The Energy Coach was not available for consultations at a convenient time for me.	6	5	3	1	1	2
The Energy Coach provided me with information about my renovations that I would not have found on my own.		2		9	7	
The Energy Coach often used language I did not understand.	7	5	2	3	1	
The Energy Coach was a trusted source for unbiased information.		3		5	10	
The Energy Coach didn't understand my renovation priorities.	7	6	2	2		1
The Energy Coach helped me decide on the work scope for my home.	1	3	5	6	2	1
The Energy Coach was not helpful in reviewing my work proposals.	3	6	2			7
The Energy Coach helped me access incentives that I would not have otherwise known about.	3	2	5	4	2	2
The Energy Coach did not motivate me to complete more renovations that I had planned.	1	8	1	5	1	2
My household renovations would have taken longer to complete without the help of the Energy Coach. (n=17)	1	3	4	4		5

5.5.6.2. Satisfaction and Expectations

As on the initial survey, respondents were asked to rate their overall satisfaction with the program and indicate how it measured in relation to their expectations. Nine respondents indicated that they were *Very satisfied*, while seven respondents were *Somewhat satisfied*, and two respondents were *Somewhat dissatisfied*. Further, three respondents indicated that the program

had *Exceeded their expectations*, while 12 respondents indicated the program had *Met their expectations*, and three indicated that the program had been *Below their expectations*.

As on the initial survey, respondents were provided space to elaborate on how the program had been above or below their expectations. Eight respondents elaborated on this question, and the responses are displayed in Table 5-35. As on the initial survey, there was a roughly even division of those respondents who elaborated on this question, as three had selected *Exceeded my expectations*, two had selected *Met my expectations*, and three had selected *Below their expectations*. Three themes were developed from the responses, representing both positive and negative feedback.

Table 5-35: Respondent Commentary on Program Expectations on Exit Survey (n=8)

Theme	Sub-Theme	Quotation
Building Capacity/Skills (1)	Encouraged DIY (+)	"DIY openness of the coach encouraged us in our renovation plans and scope."
Information Provision (5)	Options evaluation (+)	“The coach was great in explaining and answering our questions and giving us a feeling on how much value we would get out of doing any specific changes to our home in terms of energy savings."
	Visual aids (+)	“The types of insulation were on display at the office."
	Lack of rebate assistance (-)	"Only thing, I would like it for them to sit with me to apply for rebates…"
	Lack of specificity (-)	"I was hoping for more direct advice in selecting products and suggesting reliable contractors."
	Lack of translation into action (-)	"I hoped for more assistance clarifying the report and helping us translate that into constructive action."
Personalization (2)	‘Standard’ rather than personal (-)	"It wasn't as intensive or personalized as I expected."
	‘Standard’ rather than personal (-)	"The service itself was interesting, but I received a standard report and fairly standard advice about my home without being able to access any monetary incentives."

5.5.6.3. Program Improvement Suggestions

On the exit survey, respondents were asked to indicate any suggestions for program improvement. Ten responses were received, though only eight provided a concrete suggestion for program improvement. From these eight responses, five themes were developed, displayed in Table 5-36. The full set of responses is available in Table 14 in Appendix L.

Table 5-36: Program Improvement Suggestions from Respondents (n=10)

Theme	Sub-Theme	Example Quotation
Communication (2)	Initiative from coach (1)	“More communication (we didn't quite know how much we could get in touch with the coach. I realize now we could have asked a lot more than we did -- but we were so busy with organizing the reno that we didn't really have time to be checking in.)”
	Scheduling (1)	"Going through an intermediary to set up calls with the coach."
Extension (2)	Longer duration (2)	"It would have been more helpful for me if the Home Energy Coach was offered a little longer. His availability was primarily over the winter which is when renovations are less likely to be carried out. If he was available through to the fall I would have more likely engaged his services after the initial consult."
Information Provision (1)	Specificity (1)	"More specific information about the renovation as opposed to general information."
Method/Location of Consultation (2)	Home visits (2)	"Earlier home visits.”
Rebates (2)	Application process (1)	"Only thing I would like it for them to sit with me to apply for rebates…"
	Union Gas (1)	"Expand Union Gases directive."

5.5.6.4. Recommendation to Family/Friends

When asked if they would recommend the Home Energy Coach program to family or friends, 15 out of 18 (83%) respondents suggested that they would recommend the program, and one other respondent wrote that they would recommend the program on the condition of government grants being available. One respondent indicated that they would not recommend the program, and one respondent did not provide an answer.

5.5.6.5. Program as a Fee-for-Service

When asked if they would be willing to pay for the services provided by the HEC program, ten out of 18 (56%) respondents said that they would, while seven respondents said they would not, and one respondent did not provide an answer. Respondents were also asked how much they would willing be pay on a per-consultation basis (approximately 45 minutes), for which nine respondents provided an answer. The responses ranged from $25 to $100, with an average of approximately $55 and a median of $50.

5.6. Semi-structured Interviews

5.6.1. Response Rate and Timing of Interviews

Seven respondents to the exit survey indicated that they would be willing to participate in a follow-up interview on the exit survey. Interview invitation emails were sent to each of the seven respondents approximately six weeks after the exit survey had been returned, with a follow-up email several days later. Five of the seven responded with their willingness, while two did not respond to the invitation emails. Interviews were subsequently completed with these five between May 25, 2016 and June 1, 2016.

The interview length, on average, was 25 minutes and 55 seconds, with a median time of 27 minutes and 40 seconds, a minimum length of 18 minutes and 24 seconds and a maximum length of 30 minutes and 5 seconds. On average, the interviews took place 141 days after the interviewee's first consultation with the coach, with a median of 126 days, a minimum of 75 days, a maximum of 215 days and a standard deviation of 67 days.

5.6.2. Motivations

The follow-up interviews asked several questions about the interviewee's motivations for signing up for the HEC program. While some of the responses were similar to the options on the surveys, additional reasons were uncovered during the interviews. The themes are displayed in Table 5-37 with a sample quotation. Evidently, each respondent had a slightly different motivation for signing up for the program.

5.6.3. Developing the Renovation Plan

Interviewees were asked how they developed the priorities for their renovation plan from the recommendations on their evaluation report. The responses were mixed for this question, as some interviewees suggested that they already had an idea of what they wanted to fix in the house, or that the renovations were concurrent with other work being done in the house, while others indicated that the work was prioritized based on what could be completed as do-it-yourself work. Most interviewees also mentioned that maximizing the energy savings for lower cost was also a

priority. The themes developed for this question are presented in Table 5-38 with example quotations.

Table 5-37: Additional Motivations for Signing Up for Home Energy Coach Program (n=5)

Theme	Sample Quotations
Developing renovation priorities (2)	"Largely because we have an older house, we wanted to work out in what order we should do the work, and what would have the most impact for us."
Do-it-yourself support (1)	"It was just to find someone that could give me specific advice around the renovations. I don't work as a contractor but I have some handy skills. But I just don't have knowledge and I use the computer to try to search for do-it-yourselfer solutions, but … I need someone to critique those."
One-on-one support (1)	"I suppose I generally think coaches are a good idea. … I'm a psychologist so I suppose I believe the best types, some of the most effective transfers of information and effective programs are where there's a possibility of a one-on-one kind of customized approach to any challenge."
Supporting program partners (1)	"I'm an alumnus from Waterloo, so I said sure I'll go with them. … I saw you were doing the work on it, so supporting a Masters student, I thought, why not?"
Third-party advice (1)	"One thing I really liked was that it's a third party thing, so if I were to go to an insulation company, it's in their best interest to sell me what's best for them. As opposed to having an independent third-party give us advice."

Table 5-38: Factors Influencing the Renovation Priorities from the Audit Recommendations (n=5)

Theme	Example Quotations
Concurrent with other renovations (1)	"We were doing some renovations already to a master bathroom. … The master bedroom and bathroom are in an attic, … and wildly poorly insulated … so it seemed like a natural place to start in terms of insulation."
Do-it-yourself capacity (2)	"I looked for things that seemed doable for me."
Existing ideas (2)	"We already had some ideas of what we were wanting to do."
Maximizing energy-efficiency for low cost (4)	"I looked for the things that … had the most substantial impact on our energy use. And then it was a whole bunch of practical things, … how that meshed with the energy savings that could be accrued from that."

Interviewees were asked if the Energy Coach had played a role in shaping their renovation plan, for which all interviewees indicated the Energy Coach had. The responses from four interviewees were consistent with responses given on the exit survey, though the interview highlighted that the Energy Coach had also influenced the other interviewee to add an insulated door to the cold room, as they had not thought of that idea before and it was not illuminated on the evaluation report. All interviewees indicated that their renovation plan would not look the same if they had not consulted with the Energy Coach.

5.6.4. Executing the Renovation Plans

The interviewees were asked how they approached their renovation and how they decided on the materials and methods to use for their renovations. The interviews indicated that the work was being completed in one of three ways: by a contractor only, by DIY only, or by a combination of both. Those that completed the renovations using a mix of contractor and DIY work also showed variation within the group, as two households had the contractor complete most of the work with the exception of draftproofing, while the other household completed most of the work and hired a contractor only for water heater installation.

Interviewees also indicated that the decisions regarding materials and methods were influenced by a number of sources, including the Energy Coach, contractors, experts in the field of particular renovations, hardware store employees, personal experience/research and recommendations from family/friends. For most decisions, more than one information source was used.

Finally, interviewees provided insight into how the Energy Coach could have provided more support in these decisions, including more specific product and contractor recommendations, and providing a third-party opinion to work through the opinions of contractors or material suppliers. The responses for these questions are consolidated and presented in Table 5-39.

5.6.5. Role of Energy Coach

5.6.5.1. Value of Energy Coach

Interviewees were asked whether or not they would work with an Energy Coach in the future. All five interviewees indicated that they would. Related to this, interviewees were asked to indicate what 'value' they would assign an Energy Coach in the renovation process. Interviewees indicated that, particularly if homeowners were motivated to renovate to save energy, an Energy Coach would be valuable in the process. Common responses included helping to sort out the overload of information to figure out what renovations are priority and exactly what is needed to accomplish them. These responses are in line with feedback from the surveys that suggested an Energy Coach in the planning stage of the renovation was helpful to develop the renovation plan.

Table 5-39: Overview of Renovation Work for Interview Sample (Materials, Methods, Role of the Energy Coach) (n=5)

Work	Contracted Work	DIY Work	Decisions on Materials/Methods	More Support from Energy Coach Desired?
Contractor Only (1)	Attic insulation Basement insulation Draftproofing Windows and doors		**Insulation**: Energy Coach (esp. insulation display), contractors and insulation experts **Draftproofing, Windows and Doors**: Contractor	**Draftproofing, Windows and doors**: "If there were specific products, I would definitely do it." **Insulation**: "One of the reasons I would have loved to have any follow-up appointment at my house. … I don't really know how to deal with that hole (in the basement). … My contractor has one idea about how to deal with it, and the insulation people had another idea…"
Contractor + DIY (3)	Basement insulation HRV/ERV installation	Draftproofing	**Insulation**: Energy Coach (esp. insulation display) and insulation experts **HRV/ERV**: Energy Coach and contractor **Draftproofing**: Energy Coach and hardware store employees	**HRV/ERV**: "Where I'm at now is fine, … but this is the one thing where I actually talk to the contractors, so it might be nice to talk to him again." **Insulation, Draftproofing**: No
	Water heater replacement	Draftproofing Insulation Windows and doors Other (cold room, chimney capping)	**Water heater replacement**: Union Gas incentive, family recommendation **Exterior wall insulation**: Internet research, previous experience **Basement insulation**: Energy Coach **Draftproofing, Other**: Energy Coach	Not applicable for insulation, draftproofing and water heater replacement as these decisions were made before participant signed up for program.
	Attic insulation Basement insulation Windows and doors	Draftproofing	**Insulation**: Contactors, internet research, Energy Coach **Windows and doors**: Unspecified (not Energy Coach) **Draftproofing**: Energy Coach	**Insulation**: "It would be helpful if there was a preferred list of contractors, or highly recommended contractors. … Though that could be problematic from the organizations point of view … but from my point of view that would be good." **Windows and doors, Draftproofing**: No
DIY Only (1)		Basement insulation Draftproofing Windows and doors	**Insulation**: Personal experience, research **Draftproofing**: Personal experience **Windows and doors**: Energy Coach	**All renovations**: No

5.6.5.2. Valued Attributes of an Energy Coach

One of the concepts probed in the follow-up interviews was the definition of a successful Energy Coach. The five interviewees provided useful insight into their interpretations of a successful Energy Coach. As well, throughout the interview, several respondents highlighted important characteristics in response to other questions. From these responses, five key attributes were developed. These include: awareness of homeowner's goals and capacity (financial, procedural), knowledgeability of numerous options, the ability to transfer that knowledge into applicable solutions, objectivity in advice and personability. These themes are displayed in Table 5-40 with an example passage.

Table 5-40: Key Attributes of an Energy Coach (n=5)

Theme	Example Quotation
Awareness of homeowner goals and capacity (4)	"Practicality in terms of affordable and for me as a do-it-yourselfer, practical solutions that I might be able to manage."
Knowledgeability (5)	"One would be knowledgeability, knowing what the options are."
Objective/third-party advice (3)	"I like the idea of having an independent third-party to bounce ideas off after talking to contractors."
Personable (3)	"The last thing … is personability, and the ability to listen and work with a person in terms of communication and that sort of stuff."
Transferability of knowledge (4)	"I want someone who doesn't try to take one solution and cram it into every different situation, someone who is able to assess different situations."

5.6.6. Program Evaluation

5.6.6.1. Structure of the Consultations

The interviews provided insight into some of the positive and negative aspects of the consultations, which were separated into two themes related to the atmosphere and the information provision. Three interviewees indicated that the atmosphere had been comfortable and inviting, and that the Energy Coach was responsive to specific questions. With respect to information provision, feedback was mixed, as interviewees indicated that the Energy Coach was able to provide new ideas, but one interviewee indicated that they had been given a lot of information but lacked direction on how to proceed. These themes are presented in Figure 5-41 with sample quotations.

Table 5-41: Feedback on Positive and Negative Aspects on the Structure of Consultations (n=5)

Theme	Sub-Theme	Example Quotations
Atmosphere (5)	Inviting (2)	"Really comfortable atmosphere in terms of asking questions, and I didn't feel rushed, and I felt welcome. … It felt open that I could call back if I remembered anything else I wanted to ask."
	Responsive to questions (3)	"For me I had an agenda and he was responsive to the agenda that I had."
Communication (1)	More proactive (1)	"It was a lot of self-direction from us, so we had to reach out if we needed him, we had to set up the meetings, and given all the other stuff we had to juggle as part of the renovation, we probably did not reach out as much as we should have. … Being a little more proactive from the coach's side would be helpful."
Information Provision (5)	New ideas (4)	"I'd go on with a big list of questions prepared … Sometimes he'd be able to see holes and stuff I'd overlooked and he'd be able to jump in and go through that stuff. I thought it was good."
	Lack of direction (1)	"There was a lot of information at the start about steps we could take, but then we were kind of left to ourselves and got a little bit lost when it came to actually implementing it."

The topic of home-visits was revisited during the follow-up interviews, as the survey results suggested that some homeowners may have found that option beneficial. Four interviewees suggested that home visits would be a beneficial addition to the program, though the opposing view was also expressed.

The next chapter will provide a discussion of these findings in relation to the research purpose and objectives of this thesis, and with respect to findings from the academic literature.

Chapter 6: Discussion

6.1. Introduction

As a reminder, the purpose of this thesis was to document the experiences of homeowners taking part in the Home Energy Coach program and explore the impacts of the Energy Coach on the renovation activity of these participants. Four research objectives were put forward:

1. To describe the kinds of households that were attracted to the Home Energy Coach (HEC) program and their motivations for participating.
2. To document the renovation plans of participants as they moved through the renovation process.
3. To explore the influence of the Energy Coach on the renovation plans of participants.
4. To identify lessons that can be learned from participants to reshape similar interventions moving forward.

Section 6.2. discusses the characteristics of the research sample, thus achieving the first part of the first objective. Section 6.3. discusses the sample's motivations for pursuing renovations and joining the HEC program, thus achieving the second part of the first objective. Section 6.4. discusses the renovation plans of respondents at the beginning of the program and at the end of the program, thus achieving the second research objective. Section 6.5. discusses the findings related to the development and execution of the renovation plans and the role of Energy Coach in these decisions, thus achieving the third research objective. Next, Section 6.6. discusses feedback related to program improvement suggestions and comments on lessons learned, thus answering the fourth research question. Then, Section 6.7. evaluates the HEC program with respect to the program's primary objective. Finally, Section 6.8. discusses the limitations of this research and highlights the researcher's cautions with the findings.

6.2. Characteristics of Research Sample

This thesis presented a demographic profile of a sample of the first participants in the Home Energy Coach Program, a pilot program employed in Waterloo Region. As Crosbie and Baker (2010) argue, it is essential to understand the types of people that take part in particular interventions to

understand what types of people were over and underrepresented in the sample. This section discusses the first part of the first research question, pertaining to what kinds of households and houses were attracted to the HEC program.

The majority of the households in the research sample were well-educated homeowners of older, single-detached houses. Almost all of the research sample had received some form of post-secondary education, and one-half of the sample had received a graduate degree, suggesting that the research sample is more educated than the greater population. This trend has been demonstrated in the literature, as higher education often correlates with 'greener' groups in the population (Fawcett & Killip, 2014; Murphy, 2014). Further, the results also indicate that, on average, the research sample occupied older homes, with the average and median house having a construction date of 1969. This result is not surprising, as the marketing campaign for the HEC program targeted older homes that would benefit from thermal upgrades more than newer homes.

The median annual household income before tax was between $100,000-149,999, though nearly one-fifth of the sample did not provide a response. Therefore, these additional responses may have changed the median income range to be higher or lower. Further, the quality of data would have been improved if the income had been provided with narrower ranges. Notwithstanding these limitations, the findings suggest that the research sample was more wealthy than the greater population of Waterloo Region, another trend that has been observed in the literature (Fawcett & Killip, 2014; Murphy, 2014).

The results also indicate that many respondents have recently moved into their house, with nearly 40 percent within the last two years and nearly 70 percent since 2010. This trend has been observed in the literature, as households often decide to undertake renovations during particular 'trigger' points in life, such as moving into a new home or changes to household structure (Fawcett & Killip, 2014). However, what is arguably of greater interest is those households that decided to renovate their homes after having lived in the home for a much longer period of time. Six households had been occupied by the current owners for ten years or more, with two of these households occupied for over 20 years. One motivation for these households may have been that sufficient equity was acquired to afford renovations. However, no 'trigger' points were identified

among the households in this group, and further research would be needed to uncover whether any existed.

With respect to geographic distribution of the research sample, the results indicated that the City of Waterloo was overrepresented in the research sample, while the City of Cambridge was underrepresented, almost by the same margin. This trend is not surprising for a number of reasons. First, the City of Waterloo is in closer geographic proximity to the primary program delivery agent, REEP Green Solutions. It may be that the farther distance from the City of Cambridge to the Energy Coach's office was a barrier for some homeowners that preferred to have their consultations in person. It may also be the case that REEP Green Solutions, among the other program partners, has a more established reputation in the City of Waterloo (and the City of Kitchener, which comprised a large proportion of program participants as well), thereby attracting participants through social networks. Further, more promotional and marketing efforts were provided to the City of Waterloo compared to the City of Cambridge by the REEP marketing team, as evidenced by additional materials distributed to the University of Waterloo and uptown Waterloo shops. Nevertheless, it is important to acknowledge the importance of greater inclusion of all population subgroups, as Cambridge comprises a substantial proportion of the Region's population.

6.3. Motivations and Challenges

This section of the Discussion section will discuss the research sample's motivations for pursuing renovations and for participating in the HEC program, accomplishing the second part of the first objective of this thesis. As well, the challenges and concerns identified by the research sample will be presented.

6.3.1. Motivations for Pursuing Renovations

The results indicate that many respondents in the research sample found home comfort concerns, cost savings, and learning more about energy use in the home to be *Very important* factors in their decision to pursue renovations. Notably, reducing the household's carbon footprint was also important to most respondents, though the ratings were split between *Very important* and *Somewhat important*. These motivations are consistent with those seen in Ingle et al.'s (2012) study on the Seattle City Lights audit program. Further, the majority of respondents selected at least two

motivations that were *Very important* in their decision to pursue renovations, which is consistent with Wilson et al.'s (2013) argument that the decision-making process to undergo renovations is complex and often includes a variety of factors. This is also supported by findings in Fawcett and Killip's (2014) investigation of energy-efficiency home renovators in the UK, who found that homeowners did not make renovation decisions solely based on economics, but rather based on multiple motivations such as concerns for the environment, increased home comfort and energy savings.

6.3.2. Motivations for Program Participation

The results suggest that one-half of the research sample rated getting help understanding the evaluation report, developing a plan from the report and accessing the Union Gas incentive as *Very important* factors in their decision to sign up for the HEC program. At the end of the program, respondents were asked how helpful the HEC program had been in meeting those needs, for which the responses showed mixed results. Approximately one-half of respondents indicated that the Energy Coach had been *Very helpful* or *Somewhat helpful* in understanding and developing a plan from the evaluation report, though only one-third of respondents rated the Energy Coach as *Very helpful* or *Somewhat helpful* with respect to accessing the incentive. It is worth acknowledging that the list of potential choices for program motivation was quite limited in scope, and that it may be the case that respondents were unable to select the factors that were important in their decision to sign up for the program. While respondents were provided with an 'Other' category to write in their own responses, it is possible that respondents did not make use of this.

Interestingly, five respondents did include responses in the 'Other' category for a total of nine additional factors that were important in their decision to sign up for the program. When asked how helpful the HEC program had been at meeting those needs, eight out of nine responses suggested that the HEC program had been *Very helpful* in meeting those needs. This may indicate that when respondents joined the program with specific needs in mind, those needs were met more effectively than those that did not have (or at least, did not indicate on the survey) highly specific needs. Overall, a suggestion for future research is to incorporate more options in the

motivations to sign up for the program, such as those put forward by the five 'Other' respondents, to better understand the range of reasons that participants sign up for this kind of program.

The follow-up interviews also uncovered several different motivations for signing up for the program, including specific do-it-yourself renovation help, supporting the university as an alumnus, and for advice from an independent third-party. While these are the views of only a few program participants and cannot be generalized to others in the program, these responses provide insight for other motivation 'options' that could be included in future research on similar programs. The two latter motivations also shed light on the role of collaboration in attracting potential participants to the program, supporting the work of Berry (2010) and Stern and Aronson (1984), for example.

Respondents were also asked to indicate whether any factors related to the HEC program would be likely to influence the decision to proceed with renovations. Many respondents indicated that the availability of the Energy Coach to assist with the process and to check that the work had been completed properly were *Somewhat likely* or *Neither likely nor unlikely* to influence their decision, though most respondents indicated that the availability of the Energy Coach to answer technical questions and review the proposed work scope would be *Very likely* or *Somewhat likely* to influence their decision. This suggests that the availability of an Energy Coach would not be the most influential factor in the decision to proceed with renovations, but would have some influence on the decision. Not surprisingly, the availability of incentives was *Very likely* to influence the decision for many respondents, which is supported by many in the literature (Murphy, 2014; Wilson, 2014; Palmer et al., 2013; Ingle et al., 2012; Novikova et al., 2011).

6.3.3. Challenges

The results suggest that the research sample faced a number of challenges, though the most cited factor was related to finances. One-half of the research sample indicated that paying for energy retrofits was difficult, which included an even share of households above and below the regional average income. Further, six out of ten respondents eligible for government incentives indicated that accessing them was difficult (eight respondents had selected n/a for this question) and many also indicated that the Energy Coach had not been helpful in accessing them. Prioritizing the renovations was also rated as *Somewhat difficult* for one-third of respondents. Overall, the

challenges and concerns identified by the research sample are consistent with the barriers in the academic literature (eg. Wilson & Dowlatabadi, 2007; see Section 2.2.3. for more sources). The surveys and interviews did not seem to uncover any barriers that had not previously been identified in the literature.

6.4. Renovation Plans

This section discusses the renovation plans of the research sample as they moved through the program, the second objective of this thesis.

6.4.1. Renovation Plans at the Start of the Program

The renovation plans at the beginning of the program/study period indicated that all households in the research sample were planning to complete at least one energy-efficiency upgrade, and 80 percent of the sample were planning to complete three or more improvements. Most households were planning to complete draftproofing (n=18), basement/crawl space insulation (n=17) and window/door/skylight replacement (n=15). Far fewer households were planning to complete exterior wall insulation (n=8) and a furnace/boiler replacement (n=6), though these items were also less frequently recommended. Overall, households were planning to complete an average of 4.2 energy-efficiency measures, which is higher than the average number of audit recommendations of 3.8 (though the median of 4 was the same for these).

Eight of the households in the research sample included the same number of energy-efficiency measures as were recommended on their evaluation report and six were planning to complete fewer. Perhaps more interestingly, seven households included more energy-efficiency measures than were recommended to them, and in total 13 households included at least one energy-efficiency measure on their plan that had not been recommended to them, which has been documented by others in the literature (Murphy, 2014; Hoicka, 2012). Exterior wall insulation was the most frequently cited planned measure that had not been recommended, followed by an equal number for attic and basement/crawl space insulation, water heater replacements and window/door replacements. It may also be possible that the number and type of measures selected on the initial survey may be inaccurate for some due to a misinterpretation of the question. While the question stated that respondents did not have to rank those items that did not apply to them, it

is possible that these respondents ranked all items even if they were not applicable. The follow-up interview provided clarification for two respondents, who indicated that only five measures should have been chosen. These changes were made accordingly. Thus, it is hypothesized that the question may have been misread for three respondents who selected seven energy-efficiency measures. This may explain why the average number of energy-efficiency measures on the initial survey was higher than the average number of recommendations. It may also be the case that respondents had planned on completing a particular energy-efficiency measure and falsely recalled that the item had been recommended to them.

Caution must also be drawn for a second reason, as the list of energy-efficiency measures on the surveys did not include all of the possible recommendations on the evaluation report[19]. Though an 'Other' option was included in which respondents could have indicated these other priorities (and several respondents did), nevertheless some items may be missing. This does not explain why the average number of initial renovation items was higher than the average number of audit recommendations; rather, this may have made the average initial renovation items even higher. Nevertheless, it is a limitation that must be acknowledged.

The initial survey also indicated that many homeowners had other renovation priorities (both short- and longer-term) that were not necessarily related to energy-efficiency, as captured by the 'Other' option for the renovation plan. This observation is supported in the literature, as homeowners often undertake renovations for reasons other than energy-efficiency, such as aesthetics or home comfort (Gram-Hanssen, 2014; Wilson et al., 2013; Maller & Horne, 2011).

6.4.2. Changes to Renovation Plans

The surveys provided an indication of the nature of renovation plan changes over the course of the program. Sixteen respondents to the initial survey and ten respondents to the exit survey (17 different respondents = 81%) indicated that their renovations had changed in type, sequence/priority and/or extent since their consultations with the Energy Coach.

[19] There were 10 possible recommendations on the evaluation report, and only 7 were included on the surveys. The missing items were: cooling system, heating system and water conservation.

The results suggest that the Energy Coach influenced the changes to renovation plans in both 'positive' and 'negative' ways, meaning that the number of renovation items and the extent of the renovation was not always necessarily greater. For example, two initial survey respondents indicated that the consultations with the Energy Coach led them to complete fewer renovations based on the costs and benefits of the renovation, while three respondents indicated that the Energy Coach had influenced them to complete renovations to a greater extent. Further, four respondents to the exit survey indicated that the Energy Coach influenced them to complete more renovations than they had planned, while two respondents noted that they planned to complete fewer renovations since the consultations. The mechanism of this influence is discussed further in Section 5.5. The 'negative cases' provide important insight into the factors that influenced the respondent away from undergoing renovations. In these particular cases, the respondents indicated that the Energy Coach had discussed the costs and benefits of the renovation and that it did not make sense to proceed with the renovation based on that evaluation. Therefore, providing more information to overcome the information barrier was not always correlated with positive action, as found by others in the literature (Murphy, 2014; Frondel & Vance, 2012).

6.4.3. Renovation Plans and Progress at the Time of the Exit Survey

6.4.3.1. Planned Energy-Efficiency Measures

On average, the number of energy-efficiency measures included on the exit survey was three (median of 3), which is lower than the average and median number of audit recommendations and initial survey renovation plans for the 18 exit survey respondents. This may be (at least in part) due to inaccurate reporting on the initial survey, for reasons such as question ambiguity, confusion, forgetfulness or dishonesty on the part of the respondent. However, it may be more likely that as respondents began to make progress toward completing renovations, the number of renovations that could be realistically completed went down based on any combination of the challenges identified, such as financial barriers or uncertainty in completing the renovations. In the literature, Novikova et al. (2011) found that households often modify the initial retrofitting plan to include fewer renovation items.

Looking at the differences in renovation plans at the end of the study period by age of house, some notable differences were apparent. The average number of planned energy-efficiency measures was higher for occupants of older houses than occupants of newer houses. Since occupants of older houses were given nearly two-thirds of the total number of audit recommendations, it may be reasonable to assume that they would complete more, on average, than occupants of newer houses. Moreover, the conversion rate from audit recommendation to planned action was slightly higher for newer houses. However, examining the differences in completed energy-efficiency measures at the end of the study period may be more illuminating than only looking at planned measures, as respondents may have overestimated the number of energy-efficiency measures that would actually be implemented for various reasons, such as unrealistic goal-setting or 'impressing' the researcher.

6.4.3.2. Progress on Energy-Efficiency Measures

The results suggest that many households in the research sample had made progress on their renovations by the end of the program/study period. Seventeen out of 18 exit survey respondents indicated that at least one energy-efficiency upgrade was 'in progress' or completed during the program, which was, on average, three months in length.

Moreover, 11 out of 18 exit survey respondents indicated at least one measure had been completed, with an average of 1.3 completed measures, at the end of the study period (three months on average). In total, 24 measures were completed by this sample, of which 20 were recommended through the energy audits, which represents a conversion rate of 29 percent. The results indicate that occupants of older houses completed the majority of the total completed measures at the end of the study period.

The work of Hoicka (2012) provides a basis for comparison for the research sample as a whole, as this work investigated the follow-through of recommendations from an EnerGuide evaluation with a potential for financial incentives up to $5,000 (however, these were performance-based on an energy rating scale rather than specific to the energy-efficiency measure). In that study, Hoicka (2012) found that households (n=85) had completed an average of 2.0 recommendations (with a median of 2) three months after the energy audit based on follow-up

EnerGuide evaluations. The lower rate of audit recommendation follow-through in this thesis may be attributed to a number of factors, including lower financial incentives, seasonality, and a smaller sample size. Perhaps more importantly, however, was an announcement by the Ontario government in February 2016, which announced the development of a $100-million program that would help homeowners with furnace, water heater and insulation upgrades, though details on the start date, eligibility criteria or incentive amounts were not released (Ontario Ministry of Energy, 2016). Therefore, some households may have stalled their renovations in anticipation of further information and, potentially, greater financial assistance.

The completed energy-efficiency upgrades for the research sample are also lower than results achieved in the Small Town Energy Program with their Energy Coach, who achieved a conversion rate of 64 percent from audit recommendation to implemented upgrade across their community (Wilson, 2014). However, there are several important differences that must be acknowledged. First, the STEP program ran for three years, which is a much longer period of time than the six months the HEC was offered. Further, the HEC ran primarily over the winter months, whereas the STEP program was offered long enough to lessen the impact of seasonal fluctuations in program participation or renovation activity. Renovation activity may be lower in winter months than other periods in the year (especially for work that is completed on the external part of the house), which may explain why a substantial proportion of renovation work was planned for the spring and summer months after the HEC program officially ended. Indeed, several respondents explicitly stated that renovation work was on hold until warmer weather. Therefore, a conversion rate that includes energy-efficiency measures that are completed and in progress may be a more appropriate comparison with respect to the amount of time afforded to complete the renovations. Indeed, when factoring in energy-efficiency measures in progress, the conversion rate is 64 percent which is consistent with the findings in the STEP program. Second, the high conversion rate for the STEP program was achieved in the ‘mature’ program (Wilson, 2014), while the HEC program was offered as a pilot. Third, the extent of the financial incentives available for STEP program participants was far greater than the incentives available in the HEC program, and financial concerns were identified by many survey respondents.

Looking more closely at the renovation progress of the research sample, the most frequently completed or in progress renovation items were consistent with the most frequently recommended items: basement/crawl space insulation, draftproofing, and window/door/skylight replacement. This finding adds support to the literature on energy audits as a useful tool to overcome the information barrier of identifying the areas where energy-efficiency improvements are needed most. More specifically, basement/crawl space insulation achieved a conversion rate of 38 percent, while draftproofing achieved 22 percent and window/door/skylight replacement achieved 33 percent. Again, if renovation work in progress is included in this calculation, conversion rates for these three upgrades are above 75 percent. Interestingly, exterior wall insulation achieved a conversion rate of 67 percent, though this upgrade was only recommended to three households. The remaining energy-efficiency upgrades achieved conversion rates between 13 to 33 percent, with in progress conversion rates between 25 to 56 percent. Murphy (2014) looked at ten different audit recommendations in her sample and found that the highest rate of conversion was 54 percent for one energy-efficiency upgrade, while the rest of the upgrades ranged from 10 to 40 percent. However, the elapsed time between audit and implemented measure was not reported in that study.

However, it is also interesting to note the four completed energy-efficiency measures that had not been recommended, a trend that has been found in other studies on audit recommendation implementation (Murphy, 2014; Hoicka, 2012). In the present study, attic insulation and exterior wall insulation were the two measures that were completed but not recommended, which differs from Hoicka (2012) who found that window/door replacement was the most frequent measure completed but not recommended. Murphy (2014) argues that this highlights the complex decision-making process in household renovations and calls into question the information barrier as the critical barrier to overcome. Evidently, even with personalized recommendations on appropriate energy-efficiency investments, the information provided to households (eg. by the auditor, the evaluation report, the Energy Coach) is sometimes ignored or overruled. The follow-up interviews provided some insight into the decision to pursue a non-recommended measure for one respondent, as this household had other renovations underway and decided to add extra insulation while the walls were exposed. Similarly, Ingle et al. (2012) found

that some participants in their audit study chose renovations that made sense in the context of other home improvements. Therefore, it may be possible that, for some households, other renovation goals led to the decision to include particular renovation items. This highlights the need for a continued dialogue after the initial energy audit to better understand the complexities of developing a renovation plan from a list of energy-efficiency recommendations.

6.5. Developing and Executing the Renovation Plan

As discussed in Section 5.4.2., many respondents to the surveys indicated that the Energy Coach had influenced their renovation plans in type, sequence/priority and extent. The surveys obtained some useful feedback to suggest how the Energy Coach had been influential in the development of the renovation plan and throughout the renovation process.

6.5.1. Factors Influencing the Renovation Plan

The surveys and interviews asked respondents what factors were most important in the renovations that they decided to proceed with. For many respondents, financial considerations were very important in deciding the priority of renovations, including the upfront cost of the renovation, access to rebates and the return-on-investment. This is consistent with findings from Novikova et al. (2011), who found that many households change their renovation plans based on the financial attractiveness of renovations.

However, financial considerations were not the only factor important in these decisions. For some respondents, other factors such as environmental considerations, practical considerations (renovations that could be DIY) and renovations that were concurrent with additional renovations were prioritized. These findings are supported by Ingle et al. (2012) who found similar considerations in their study.

6.5.2. Influence of Energy Coach in Renovation Plan

The surveys suggested that the Energy Coach had been helpful in developing the renovation plan for many respondents, and this was seen across all the surveys. Most responses indicated that the Energy Coach had been helpful through information provision, including helping to clarify the recommendations on the evaluation report, helping to evaluate the pros and cons of various

options in terms of unique considerations and other concerns, providing new ideas or approaches to plans, and helping to plan for future renovations. These are analogous to findings from O'Connor et al. (2004) who found that patient decision aids in healthcare settings helped to increase knowledge on various options and develop plans that incorporated the patient's concerns. In addition, several respondents indicated that the Energy Coach had helped provided information for DIY renovations, which encouraged them in the scope of their renovations. The majority of exit survey respondents indicated that the Energy Coach had provided them with information about their renovations that they would not have found on their own, and the initial and exit surveys indicated that many respondents agreed that the Energy Coach was a trusted source for unbiased information. This provides support that the Energy Coach was successful at creating trusted relationships with participating households, which is an important barrier to be overcome (eg. Darby, 1999; Coltrane et al., 1986).

Not only was the Energy Coach helpful in deciding which renovations would and would not be completed, but many respondents also indicated that the Energy Coach had helped to decide on how the renovations would be completed. The influence of the Energy Coach was again helpful through information provision, as discussed above. However, the exit survey and follow-up interviews highlighted that the Energy Coach was not the only source of information for the decision-making on the materials and methods to be used in the execution of their renovations. For most renovation decisions, interviewees indicated that they had consulted a number of different sources, including the Energy Coach, material suppliers, contractors, family/friends and REEP staff. This is consistent with findings from Nair et al. (2010), who found that interpersonal sources, contractors, material suppliers and energy advisers were ranked as the most important sources of information among homeowners undertaking building envelope energy-efficiency renovations in their sample. However, the interviews highlighted that one key role of the Energy Coach may have been a source of clarification, or sense-making, of the information received from multiple data sources. This is illustrated by the following quotation from a homeowner that was unsure of how to fix an insulation hole in the basement:

> "I would have loved to have a follow-up appointment at the house, because I don't really know how to deal with that hole … My contractor has one idea about how to deal with it,

> and the insulation people had another idea. And I'm just not sure what's necessary to do the right thing energy-wise and not spend $10,000 on a hole".

The problem facing this homeowner relates back to the information barrier in the literature, whereby homeowners may become stalled in their renovations when faced with an overload of (competing) information and feel a sense of uncertainty and helplessness in how to fix the problem (Kaplan, 2000; Kaplan & Kaplan, 1999). Therefore, the role of the Energy Coach as an unbiased, objective perspective may have helped to evaluate the options presented by various sources by overcoming the barriers of trust or uncertainty. The Energy Coach, as a trusted source of information, may be able to make sense of competing information so that the homeowner is able to make an informed decision and follow-through with the renovation. This adds support to the literature on trusted relationships as key variables in communication and information transfer (eg. Darby, 1999; Coltrane et al., 1986).

In addition to information provision, some respondents suggested that the Energy Coach had been helpful in the execution of their renovation by helping to build skills and capacity. For some respondents, this came in the form of specific advice about completing DIY renovations. The follow-up interviews highlighted that for some respondents, the Energy Coach provided them with procedural information regarding complex DIY renovations, but two interviewees were also encouraged to complete draftproofing themselves even though most other work would be completed by a contractor. Previous research found that draftproofing or similarly small projects are often outside of homeowners' capability or comfort level but are not substantial enough to justify hiring a contractor (Sanquist et al., 2012), therefore the guidance from the Energy Coach may have provided enough support for these activities to be completed by the homeowner. For example, one interviewee said, about draftproofing:

> "That was one of the best things the home coach did, he said 'Here are some really easy things you can do yourself' and it made an instant difference. It was great."

For other respondents, the Energy Coach helped to build the ability to communicate more effectively with contractors and material suppliers by helping to identify the important questions to ask. This finding adds to the literature on tools that may help to overcome barriers of uncertainty with contractor and product quality and reliability.

6.5.3. Energy Coach Program as a Supportive Environment

While the themes of a supportive environment (Parnell & Popovic Larsen, 2005a) were not explicitly investigated through the surveys or follow-up interviews, the responses can provide insight into whether or not the HEC program provided the four components of that model.

The first component of the supportive environment model is exploration, meaning that the program is open and accessible to homeowners as they develop questions based on their evaluation report. Feedback from the surveys and interviews suggested that Energy Coach was open to answering questions, ranging from general to specific, and provided information in response to homeowners own questions.

The second component of the supportive environment is participation, meaning that the program encourages active participation of the homeowner in the development of their renovation plan. By definition, the HEC program was intended to be an open-ended advice service whereby homeowners could come in with their evaluation report and renovation goals, and co-create a renovation plan that would be practical and feasible to execute. Feedback from the surveys and interviews indicated that homeowners were able to develop a renovation plan based on an evaluation of the audit recommendations in terms of costs and benefits and how practical that was with respect to their own circumstances (eg. with respect to budget, time, etc.).

The third component of the supportive environment is procedural information, meaning that homeowners are provided with specific information about how to undertake the renovations. Many respondents indicated that the Energy Coach had provided information with respect to how to complete particular renovations (most notably for DIY renovations), though some others suggested that the Energy Coach had provided procedural information on communicating with contractors.

The fourth component of the supportive environment is social interaction, meaning that homeowners are able to interact with members in their social networks (eg. family, friends, peers). The HEC program did offer monthly information sessions related to particular aspects of home renovations, though these events were not investigated on the surveys or interviews. It is suggested

that any future work on energy coaching programs explicitly investigate the potential role of these information/workshop sessions to better understand their influence in the renovation process.

Taken together, the responses from the surveys suggest that the first three components of a supportive environment were evident in the HEC program, though these components were not explicitly studied with the research sample and these comparisons are based on the researcher's interpretation of the survey responses in relation to these components.

6.6. Reflections and Lessons Learned

6.6.1. Program Satisfaction

The results suggest that, on balance, the program met participants' expectations and they were satisfied with the program. However, a closer examination of the ratings between the initial and exit survey responses may provide insight into how the program suited homeowners over time. In terms of the program meeting expectations, three respondents decreased their rating between the initial and exit survey, while two respondents increased their rating, and twelve maintained the same rating. Further, in terms of program satisfaction, four respondents decreased their rating between the initial and exit survey, while only one respondent increased their rating, and thirteen stayed the same. Taken together, many respondents maintained the same rating, and a few changed their rating; one more person changed toward a negative rating than a more positive one over time. Interestingly, all but one respondent who decreased their rating had only consulted with the Energy Coach one time, while two out of three respondents that increased their rating had had more than one consultation. It is unclear whether additional consultations influenced the change in rating. Future research is required to probe those changes more specifically and to test whether more consultations results in higher satisfaction.

Feedback about the coach himself was also, on balance, positive. Most of the respondents agreed that the coach was easy to work with, was professional and courteous with respect to their home and time, and was a trusted source for unbiased information.

6.6.2. Program Improvement Suggestions

The surveys and interviews highlighted some areas for program improvement that will be discussed below. It must be remembered that these suggestions do not reflect all households in the research sample. Rather, the objective of this thesis was to uncover and explore new ideas from a number of households so that future programs can incorporate these findings into more effective program design.

6.6.2.1. Home Visits

One of the recurring themes in the surveys and interviews was the desire for home visits from the Energy Coach. This feedback was shared with REEP and the Energy Coach midway through the program to answer this call. Therefore, not all households were offered the chance to have a home-visit; rather, only three households made use of the home-visit. One survey respondent indicated that:

> "The home visit was very helpful (essential) in finalizing our unique reno process and detail."

This theme was explored in the follow-up interviews, which indicated that four out of five interviewees expressed their desire for a home visit, particularly early in the consultation process. On the other hand, one interviewee was unsure of whether or not they would make use of it and may represent a 'negative case'. This interviewee appeared to be confident in completing renovations themselves and indicated that they were 'straightforward', therefore the scope of the renovation project may be a determinant in whether a home visit is necessary. This is not a surprising finding, as the literature supports face-to-face, vivid and personalized interactions (Fischer, 2008; Parnell & Popovic Larsen, 2005a, 2005b).

From the perspective of the Energy Coach, conducting home visits with all program participants is costly (eg. time, money), and may limit the number of homeowners a coach is able to assist in a given amount of time. Further, the respondents in this program did not have to pay for the coach service. Moving forward, however, such funding may not be available and the option of a home-visit would likely increase the price of this program. However, a home-visit could be an optional service provided, for an extra fee.

6.6.2.2. Utilize REEP Demonstration Space

Across the surveys and interviews, several homeowners indicated that the insulation display in the Energy Coach's office had been helpful to visualize the different options and make a decision. As Fischer (2008) argues, interactive and visual displays are important tools in effective information transfer. Therefore, there is an opportunity to make use of other resources in the REEP demonstration house. As one interviewee noted:

> "I would have loved somebody - the Energy Coach or anybody there – to take me around the (REEP) house and show me specifically what were the things done and the different energy savings that the house included."

Therefore, the REEP space offers a distinct advantage of interactive and visual aids that could be more formally incorporated into future program design. While this suggestion was not explicitly recognized by many respondents in the sample, the literature on effective information transfer suggests that utilizing visual tools is important.

6.6.2.3. Specificity in Recommendations

Several survey respondents indicated that they had hoped for more specific recommendations with respect to products and contractors. These responses suggest that these homeowners faced barriers of uncertainty with respect to choosing quality contractors and barriers of information overload. However, there are legal issues that limit the HEC program's ability to provide specific recommendations on contractors or products, as the federal government prohibits the endorsement of specific products or contractors during the EnerGuide evaluation process (NRCan, 2016e).

One potential solution that was utilized in the STEP program was the use of a technical consultant who provided quality assurance and quality control checks on completed renovation work (Wilson, 2014). The technical consultant provided homeowners with a sense of security and trust that the contractors were conducting work professionally and fairly. Further, the consultant acted as an incentive for contractors to conduct their work at high standards, as their industry peer would be evaluating and reporting on their work (Wilson, 2014). Therefore, a technical consultant

(or the Energy Coach) could take on the role of 'external auditor' to ensure that work was being completed properly.

6.6.3. Moving Forward

The exit survey respondents provided an indication of the next steps for the HEC program based on whether or not they would recommend the program and pay for the service. The majority of respondents (83%) indicated that they would recommend the program to family or friends. This is an important finding, as "recruitment of participants … that occurs through social networks can enlarge the pool of potential participants relative to conventional marketing techniques" (Berry, 2010, p. 67).

Respondents were also asked whether the HEC program was a service they would be willing to pay for, and less positive results were received for this question. Only 56% of exit survey respondents indicated their willingness to pay, and on average the value was approximately $55. This is an important finding because, since the funding came to end at the end of March 2016, future iterations of the HEC program may entail a fee for the homeowner which may limit the number and kind of homeowners that decide to take part in the program.

6.6.4. Lessons Learned

This thesis shed light on the important attributes of an Energy Coach that were identified through follow-up interviews with five participants, which included knowledge of various options and an ability to transfer that knowledge to particular contexts, an awareness or understanding of homeowners' goals and personal capacities/restraints, the ability to provide independent/objective advice, and a personable, friendly nature. Many of these attributes reflect the important qualities of effective information transfer.

The surveys and interviews highlighted the variable nature in the renovation process among the households in the research sample. Overall, each household had unique renovation priorities, faced unique renovation challenges, and planned to complete their renovation in different ways over different amounts of time. Therefore, the services provided by the Home Energy Coach program should be flexible and adaptive to the unique circumstances of each household

renovation. More broadly, programs of this nature should acknowledge the heterogeneity in renovation pathways among potential participants to encourage participation from all types of households and people.

6.7. Evaluating the Success of the HEC Program

The primary objective of the HEC program was to support the implementation of energy-efficiency measures following a home energy audit (specifically, the EnerGuide evaluation). Therefore, a basic measure of success could be determined by measuring the number of households that completed an energy-efficiency upgrade in the time that the program was offered. As discussed, 11 out of 18 (56%) exit survey respondents had completed at least one measure at the end of the program, and 17 out of 18 (94%) exit survey respondents had at least one measure completed or in progress at the end of the program. While these statistics do not reflect the entirety of HEC program participants, the fact that most of the research sample made progress on at least one energy-efficiency measure indicates that the HEC program had achieved their primary objective. However, without the availability of utility consumption data, it is not possible to discern whether any measurable differences in consumption resulted from the energy-efficiency measures completed by the research sample. Nevertheless, the findings from this thesis can add to the growing body of literature on strategies and tools for climate change mitigation.

6.8. Researcher Cautions

It must be cautioned again that, due to the small sample size in this study, the results from this report cannot be generalized to larger groups or populations. However, as this thesis set out using an exploratory research approach, generalizable findings were not part of the research objective. Rather, this thesis sought to provide insight on the early impressions of the Home Energy Coach Program and can provide valuable insight into the successes of the program and areas that may be improved for the future.

It is important to acknowledge the self-selection bias present in the sample. Only those interested in learning more about the research study were sent an invitation email, which amounted to 42 out of 51 program participants. Further, only those that were interested in responding to the online survey provided feedback. Therefore, over half of the homeowners in the

program did not provide feedback and as such, the responses collected from the 21 respondents are not necessarily representative of other program participants. The same self-selection bias exists for the follow-up interviews, as respondents were asked their willingness to participate in an interview, and only those that agreed were contacted. The interviewees comprised many of the most educated households, including three Masters degrees and one earned doctorate. As well, four of the interviewees had completed more than one consultation with the Energy Coach, representing four out of seven exit survey respondents that had completed more than one consultation. Therefore, the views expressed by the interviewees may not be a portrayal of other program participants.

Chapter 7: Conclusion and Recommendations

7.1. Introduction

The purpose of this thesis was to document the experiences and renovation process of homeowners participating in the Home Energy Coach program and to explore the influence of the Energy Coach in the renovation plans of these households. The Energy Coach in this thesis was designed to help facilitate renovation activity following an energy audit to contribute to reduced GHG emissions and associated co-benefits among the residential sector in Waterloo Region, Ontario, Canada.

As the literature review described, there exist many economically and technically feasible energy-efficiency improvements for residential dwellings, yet the uptake of these measures remains relatively low due to barriers such as a lack of information, financial constraints and uncertainty in renovation decisions. Energy audits seek to provide personalized recommendations so that households are equipped with adequate information to implement energy-efficiency improvements, yet the impacts of audits appear mixed. Some researchers argue that a lack of appropriate guidance and support following the audit helps to explain the mixed results. Therefore, an energy audit program was designed which offered free consultations with an Energy Coach who would help explain the findings from the evaluation report, develop a renovation plan and provide guidance and support in executing the renovations.

This thesis took an exploratory approach to investigate this pilot program, and set out with four research objectives. These were:

1. To describe the kinds of households that were attracted to the Home Energy Coach (HEC) program and their motivations for participating.
2. To document the renovation plans of participants as they moved through the renovation process.
3. To explore the influence of the Energy Coach on the renovation plans of participants.
4. To identify lessons that can be learned from participants to reshape similar interventions moving forward.

This chapter will present some conclusions from surveys, interviews and secondary data collected for a maximum of 21 HEC program participants, in relation to the four research objectives in Section 7.2., followed by industry, policy and community program implications in Section 7.3., and recommendations for future research in Section 7.4. Finally, Section 7.5. provides brief concluding remarks.

7.2. Drawing Conclusions about the Research Questions

As a reminder, it is cautioned that the findings presented in this thesis are only with respect to the research sample and not to the larger population.

With respect to demographic profiles, the research sample was well-educated, wealthy and lived in older, single-detached homes. This sample was motivated to renovate for a number of reasons, including home comfort, cost savings, environmental concerns and learning more about energy use, and most households were strongly motivated by more than one factor. Further, this sample was motivated to participate in the HEC program for a number of reasons, including understanding and developing a plan from the evaluation report and accessing the Union Gas incentive (though this excluded residents in Kitchener, as these households were not eligible). The research sample identified a number of challenges related to implementing energy-efficiency renovations, and these were largely financial barriers, which is consistent with audit literature. These findings add to the literature on motivations for and barriers to the adoption of energy-efficiency measures in the residential sector.

The results demonstrated that by the end of the program, approximately 60 percent of exit survey respondents had completed at least one energy-efficiency improvement, and almost all had made progress on at least one energy-efficiency improvement. The latter may be a more accurate indicator of completed renovation activity, as the program was offered for only six months, while studies in the literature are often one to three years. Most of the upgrades related to draftproofing, basement/crawl space insulation and window/door/skylight replacements. Overall, the conversion rate from audit recommendation to completed upgrade at the time of the exit survey was 29 percent for the 18 respondents.

While the renovation activity of the sample cannot be solely attributed to the interactions with the Energy Coach, it is positive to note renovation activity in such a high proportion of the research sample. Further, there is evidence from the surveys to suggest that the Energy Coach did have an impact on the development of the renovation plans for many homeowners. More specifically, many respondents indicated that the Energy Coach had been a valuable source of unbiased information. Respondents appreciated being able to review their plans and obtain a critical evaluation of the costs and benefits of particular energy-efficiency measures so that decisions could be made the maximize the impact on energy and cost savings, while balancing other renovation goals and priorities.

Lessons can be learned from the HEC program on the variability in renovation process among the households in the research sample. Evidently, each household balanced unique renovation priorities and constraints, and planned to complete their renovation in different ways over different time periods. This heterogeneity necessitates that the services provided by the HEC program (or others like it) be adaptive to and conscious of the unique circumstances of each household renovation.

7.3. Implications for Industry, Policy and Community Programs

7.3.1. Implications for Industry

From a high-level perspective, partnerships among diverse stakeholders such as in the HEC program demonstrated the potential to engage with a notable number of participants in a short timeframe through a number of recruitment avenues. Over 50 households joined the HEC program in the six months the program was offered, which was primarily over the winter months when renovation activity is lower. Additionally, some respondents noted that their reason for participation in the program extended beyond cost savings or environmental concerns, such as supporting the university partner as an alumnus, or receiving independent, third-party advice. Therefore, industry organizations such as utility companies that are delivering energy-efficiency programs should consider partnerships with various stakeholders, such as community-based organizations or academic institutions to broaden the recruitment avenues and appeal to the

diverse motivations of potential participants. This recommendation echoes those of other researchers as well (Berry, 2010; Kennedy et al., 2001; Coltrane et al., 1986).

On a more practical level, however, the cost-effectiveness of an Energy Coach may not appear desirable from a purely financial standpoint in the early stages of program development. Only a modest proportion of households indicated that they would be willing to pay for the services of an Energy Coach. However, there may be an opportunity to offer various 'levels' of engagement with the Energy Coach depending on the particular needs of the homeowner. For example, some homeowners may be satisfied with a one-time consultation to address a limited number of specific questions, while other homeowners may desire more intensive consultations with the Energy Coach, such as multiple/longer consultations or home-visits. Therefore, one solution is to offer a variety of services for different fees so that homeowners can select the option that is most suited to their needs, thereby increasing the effectiveness of program delivery. In addition, industry organizations can train existing staff/employees, such as energy auditors, as an Energy Coach that could be 'deployed' when needed.

7.3.2. Implications for Policy

As identified in the literature and underscored by respondents in the research sample, financial barriers such as the cost of renovations, access to rebates and returns-on-investments are major obstacles in the pursuit of energy-efficiency investments. Therefore, to facilitate energy-efficiency renovations in the residential sector and achieve GHG emission targets from local to national levels, government entities must recognize the importance of financial assistance in these endeavours. Even with support and guidance from an Energy Coach to interpret the findings from an energy audit into actionable items, financial barriers continued to present insurmountable barriers for many homeowners in the research sample. The federal government has announced that an incentive program will be available for homeowners completing upgrades to furnaces, water heaters and insulation, though the specific details of the rebates have not been provided (Ontario Ministry of Energy, 2016).

As more information is provided to homeowners on the rebate incentive program from the federal government, there may be an opportunity to combine this financial support from the

government with the guidance and support from an Energy Coach to facilitate greater energy-efficiency investments in the residential sector. This would require an investment in energy coaching services, which is believed to be complementary to the Ontario government's Climate Change Action Plan (2016—2020) initiative to invest in jobs that support a low-carbon economy (MECC, 2016), and more broadly, the call for a greater skilled workforce in high-quality building retrofits from the IPCC's (2014) report on climate change mitigation in buildings. Moreover, the provincial government also included plans to introduce a free energy audit program that mandates all pre-sale houses to receive an energy audit in 2019. It is recommended that the program considers including an energy coaching service to provide guidance and support to homeowners looking to undertake energy-efficiency investments before selling their home or upon purchasing their home, as these are identified as critical points in time when renovation activity is more likely (Wilson et al., 2013). This echoes the recommendations of Parnell and Popovic Larsen (2005), who developed the Everyday Householder Centred Framework (and advocated for a 'supportive environment') in response to mandatory home energy reports in the UK.

Should an energy coaching service be pursued, it is recommended that the Energy Coach possess several key characteristics. First, the Energy Coach would have a background in Building Sciences (as well as familiarized with EnerGuide for Houses rating and evaluation system) and have practical experience in transferring or translating that knowledge into unique renovation contexts. Second, the Energy Coach would possess an open-minded attitude and be encouraging of homeowners' own renovation goals and priorities, so that renovation activity can be balanced between energy-efficiency and the wants/needs of the homeowner. Third, the Energy Coach would be approachable, friendly and comfortable facilitating one-on-one discussions. Finally, it is recommended that the Energy Coach (or the program itself) be part of a collaborative team that includes a range of stakeholders, including community-based organizations such as non-profits with an established base in the community (or communities).

7.3.3. Implications for Community Programs

The findings from this research have implications for community programs as well. Beyond audit programs that seek to increase the efficiency of the housing stock through energy-efficiency

investments, related domains such as water conservation and storm-water management may find applications for a coaching service. For example, the Region of Waterloo offers a free home audit program to increase the use of water efficient technology and subsequently reduce daily water consumption (Region of Waterloo, 2016). In conjunction with this program, Waterloo Region may consider offering a Water Coach to provide follow-up information and guidance for implementing any water efficiency recommendations. The City of Guelph also has a number of rebates available for homeowners who implement water-saving technologies (City of Guelph, 2015). Similarly, a Water Coach could be used as a supplementary service to assist homeowners in completing these upgrades. The same idea could also apply to other water conservation programs in other jurisdictions more broadly.

7.4. Recommendations for Future Research

The findings from this thesis provide support for the multi-faceted decision-making process of household renovations, as demonstrated in the literature. The households in the research sample were motivated to pursue renovations for a number of diverse reasons, and were restrained by financial considerations, competing interests and uncertainty in their renovations, which adds supporting evidence to the body of literature on complexity in motivations and barriers in household renovations. The findings from the present study also call into question the utility of framing interventions solely around an information barrier based on a rational economic actor model, as households often ignore recommendations provided through energy audits for various reasons.

Beyond that, the findings from this thesis provide important insight into the potential role of an Energy Coach in the transition process from energy audit recommendation to implemented energy-efficiency measure, specifically, or in household renovations more broadly. In the HEC program, the Energy Coach helped many households to interpret the recommendations from the energy audit into ideas or solutions that were practical based on the unique considerations of each household by taking on the role of independent third-party advisor. In theory, the Energy Coach was able to address more components of the information barrier than audits alone are capable of, as the dialogue between homeowner and expert was continued after the evaluation report was received. Therefore, households troubled or confused by the recommendations could seek out

clarification from the Energy Coach, could be directed to supplementary resources, and could engage in the active development of a renovation plan that adhered to their own unique circumstances. Feedback from the surveys suggested that the Energy Coach was capable of performing these services and helped to overcome these barriers.

Moving forward, there is an opportunity to deepen the understanding of the impacts of the Home Energy Coach Program, specifically, or similar programs, more broadly, by three proposed additions to the research agenda:

1. The qualitative data collected from the surveys and interviews would be strengthened by the collection of utility consumption data for a number of reasons. Utility data would allow researchers to quantify actual changes to energy consumption as participants move through the program. As well, this would also enable comparisons between estimated energy savings from the energy audit and realized energy savings to evaluate the effectiveness of the audit procedure at providing accurate recommendations. Finally, this would also help to discern whether any rebound effects occurred as a result of improved efficiency to the house.

2. Future data collection would be improved by a longer timespan for data collection so that data collection methods (eg. surveys, interviews) could be employed at more formal renovation milestones (eg. receiving an audit, developing a renovation plan, contacting contractors or acquiring DIY resources, completing the renovations) that reflect the pace of the homeowner. In the present study, homeowners were all administered the exit survey at the same time despite their renovation progress, which limits the ability to compare between households.

3. Future investigations on energy interventions, such as the HEC program, would benefit from the presence of a control group to better understanding any causal relationships between the role of the Energy Coach and renovation activity undertaken. This investigation could also incorporate findings from non-participants, or participants that decide not to join the program, to determine the barriers to program participation or pursuing renovations to improve the effectiveness of reaching non-participant populations.

7.5. Conclusion

In conclusion, many households in the research sample made progress on or completed at least one energy-efficiency recommendation through the Home Energy Coach program. While the renovation activity of the research sample cannot be solely attributed to the Energy Coach, the program achieved modest results in the short time period it was offered, which was predominantly over the winter months. Respondent feedback on the HEC program was, on balance, positive, as was feedback about the Energy Coach himself. Many of the responses collected on the surveys and interviews suggested that the HEC program offered components of a supportive environment, including exploration, participation, and procedural information. Future research should build on the foundations developed here to evaluate the impact of an energy coach program on a broader scale and over a longer period of time.

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Appendices

Appendix A: Promotional Materials for Home Energy Coach Program

The promotional materials were developed by the Communications Team at REEP Green Solutions. These materials were printed on posters and handout cards, which were distributed to hardware stores in Waterloo Region, other local businesses in Uptown Waterloo, and the Environment buildings at the University of Waterloo.

We've added a **Home Energy COACH** to our team

Live in a more comfortable home and save money!

Renovating? Making home improvements? Our Home Energy Coach can guide you

Start with an EnerGuide Home Evaluation

An EnerGuide Home Evaluation by a Certified Energy Advisor has always been a great way to learn how energy efficient your home is and what can be improved.

Now we can offer you more!

Introducing the Home Energy Coach

We're now offering a **Home Energy Coach** to help you develop a game plan for improving your home's energy efficiency and then execute it.

After consulting the Coach, you can enjoy a comfortable, healthy home without wasting energy or money.

If your home was built before 1975, you could learn how to save 25% of its energy costs.

Get FREE advice from our Home Energy Coach

Working with the Home Energy Coach is **FREE** with purchase of an Energuide home evaluation.

What exactly does a Home Energy Coach do?

The Home Energy Coach:

- Reviews and explains the recommendations and findings of your EnerGuide Home Evaluation.
- Explains your eligibility for any available home energy improvement rebates.
- Provides you with advice and resources on how to select a contractor for your home improvement project and can assist with reviewing quotes.
- Assists you in identifying how your home improvement project can best meet other goals for your home such as rooms that get too hot or cold, problems with moisture or improving your home's value.
- Identifies other energy savings opportunities including lighting, high efficiency water fixtures, heating controls and appliance upgrades.

reep Green Solutions

In partnership with

MINDSCAPE INNOVATIONS

SCALED PURPOSE

Wondering if our coach can help you?

We offer a free orientation session to help you decide if your home can benefit from a home energy evaluation and to decide if you would like to work with the coach.

Does your home qualify?

Yes! All homes qualify.

All homeowners can benefit from having an energy evaluation and from the advice of the Home Energy Coach —especially if you are making major improvements.

The older the home the more you can benefit by reducing the gap between today's standards for energy efficient construction and those in place when your home was built.

Homes built between 1945 and 1975 are great candidates especially when new owners take possession and want to update them.

A large number of these homes were built to accommodate post Second World War housing needs and those of the baby boom. Now these homes require work so that their energy costs remain affordable.

Act now!

Pilot program runs until **March 2016.**

LEARN MORE or BOOK A CONSULTATION

reepgreen.ca/HomeEnergyCoach

519-744-9799 > Press 1

Is your home contributing to climate change?

22% of local GHG emissions in Waterloo Region come from the use of electricity and fuel consumption in our homes

Be part of the solution!

Learn about our community's plan:
ClimateActionWR.ca

Funded by Natural Resources Canada *Financé par Ressources naturelles Canada* Canada

STEPS TOWARDS A COMFORTABLE HOME

FREE ORIENTATION with the Coach
Should you have a home energy evaluation?

Initial ENERGUIDE HOME EVALUATION
Standard fees apply

Home Energy Coach Services
FREE with purchase of an EnerGuide Home Evaluation

REVIEW recommendations for your home

Set PRIORITIES for home improvements

DECIDE how to do the work
- What work will you do yourself?
- Identify contractors you can consider
- Determine what to have quoted
- Review the three quotes received
- Select contractor

Create a BUDGET to complete work
- Identify and apply for incentives
- Include savings estimates

Identify FINANCING needs & possible sources

In 2016, we expect to unveil an innovative method for financing your projects.

EXECUTE YOUR GAME PLAN

Informal EVALUATION of impact of the work

Follow up ENERGUIDE HOME EVALUATION
Standard fees apply

ENJOY a comfortable home and save money!

NEW! Free advice from our Coach

Save money and make your home comfortable with our

Home Energy COACH

Our Home Energy Coach helps you develop a game plan for your home and then execute it.

FREE with purchase of an EnerGuide Home Evaluation

LEARN MORE

reepgreen.ca/HomeEnergyCoach **519-744-9799 > Press 1**

PRESENTATIONS & OPEN HOUSE

December 5

Home energy efficiency 101

January 9

Avoid moisture in your basement

February 6

Tips on finishing your basement

March 5

How to make good window choices

Presentation: 1:30 p.m.

Open House 2—3:30 p.m.

REEP House for Sustainable Living
20 Mill St., Kitchener

Register in advance at: **reepgreen.ca**

reep Green Solutions

In partnership with

MINDSCAPE INNOVATIONS

SCALED PURPOSE

Funded by Natural Resources Canada
Financé par Ressources naturelles Canada
Canada

Appendix B: Sample EnerGuide Home Energy Evaluation Report

ecoENERGY
an ecoACTION initiative

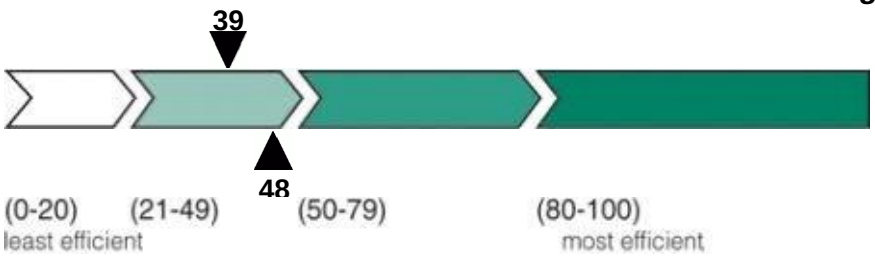
Energy Efficiency Evaluation Report

File number: 1190D0000

EnerGuide Rating

Property Owner:

Home Owner
123 Main Street
Kitchener, Ontario



House type: Single detached

No. of storeys: Two

No. of RO windows: 26
RO = rough opening

Air conditioner: No

Heating system: Natural gas Boiler

Domestic hot water: Natural gas

Air leakage rate @ 50 Pa: 12.23 ACH
ACH = number of air changes per hour

Equivalent Leakage Area: 2708 cm ^{2}

The results of your pre-retrofit energy evaluation show that your house rates 39 points on the EnerGuide scale. If you implement all of the recommendations in this report, you could reduce your energy consumption by up to 15% and increase your home's energy efficiency rating to 48 points. The average energy efficiency rating for a house of this age in Ontario is 42, whereas the highest rating achieved by the most energy efficient houses in this category is 83.

The sooner you start your renovations, the sooner you will benefit from the energy savings. And let's not forget how reduced energy consumption helps protect the environment.

Did you know that when you reduce the amount of energy used in your home, you also reduce the production of greenhouse gases (GHG) such as carbon dioxide? By improving your home's energy efficiency rating to 48 points, you will reduce its GHG emissions by 2.2 tonnes per year!

The ecoENERGY Retrofit - Homes program stopped accepting bookings for pre-retrofit evaluations as of March 31, 2010. If there is a complimentary grant program offered by a province, territory, municipality, utility or other organization, your file will be transferred to them in accordance with your consent.

Note: If you notice any discrepancies with the above description of your home, contact your service organization immediately.

Service Organization: REEP Green Solutions
Telephone: 519-744-9799

Date of evaluation: March 31, 2016
Date of report: March 31, 2016

Certified Energy Advisor: Jim Carnegie

_____
Certified Energy Advisor Signature

HOT2000v10.51

1. YOUR HOME ENERGY ACTION CHECKLIST

This is your checklist of recommended retrofits to improve the energy efficiency of your home. Included is information on the potential for energy savings and EnerGuide rating improvement. **For more information on implementing the recommended retrofits, read carefully the 'Recommended Energy-Saving Measures' section of this report. Any reference in this report regarding the eligibility for, or availability of, grants under the ecoENERGY Retrofit - Homes program should be disregarded.**

Before undertaking upgrades or renovations, find out about the appropriate products and installation techniques, and ensure that all renovations meet local building codes and by-laws. NRCan does not endorse the services of any contractor, nor any specific product, and accepts no liability in the selection of materials, products, contractors or performance of workmanship.

Note: Some provinces, territories, municipalities and utilities offer complimentary grants and other incentives for reducing energy use. For information on other energy-saving programs, visit ecoaction.gc.ca and follow the links to ecoENERGY Retrofit's "Grants and Rebates" Web page for consumers or call 1 800 O-Canada (1-800-622-6232).

Retrofits

	Potential for Energy Savings*	Potential Rating Improvement
* One (1) star = lowest savings / five (5) stars = highest savings		
ATTIC/ROOF INSULATION Increase the insulation value of your attic from the current level, which is evaluated at RSI 4.9 (R-27.9), to achieve a total minimum insulation value of RSI 8.8 (R-50).		0.2 points
BASEMENT/CRAWL SPACE INSULATION Seal all of your basement header area and increase all of its insulation value by a minimum of RSI 3.5 (R-20).		4.3 points
AIR SEALING Improve the air tightness of your house by 23 % to achieve an air change rate per hour of 9.44 at a pressure of 50 Pa.		3.5 points
WINDOWS AND DOORS Replace 25 window(s) / skylight(s) with models that are ENERGY STAR® qualified for climate zone B.		0.9 points

When replacing ANY of the equipment listed in this report, the new equipment should have an efficiency rating higher than that of the original equipment.

2. THE ENERGUIDE RATING SYSTEM

The EnerGuide rating system is a standardized method of evaluation that lets homeowners compare their house's energy efficiency rating to similar sized houses in similar regions. The EnerGuide rating considers the house's estimated annual energy consumption based on an in-depth evaluation of the house's characteristics such as location, size, equipment and systems, insulation levels, air tightness, etc. In addition, standardized conditions are used when calculating the rating in order to compare the efficiency of one house to another. These conditions include: a complete air change approximately every three hours; four occupants; a fixed thermostat setting of 21°C on main floors and 19°C in the basement; average hot water consumption of 225 litres per day; average national electricity consumption of 24 kWh per day; and regional weather data that is averaged over the last 30 years.

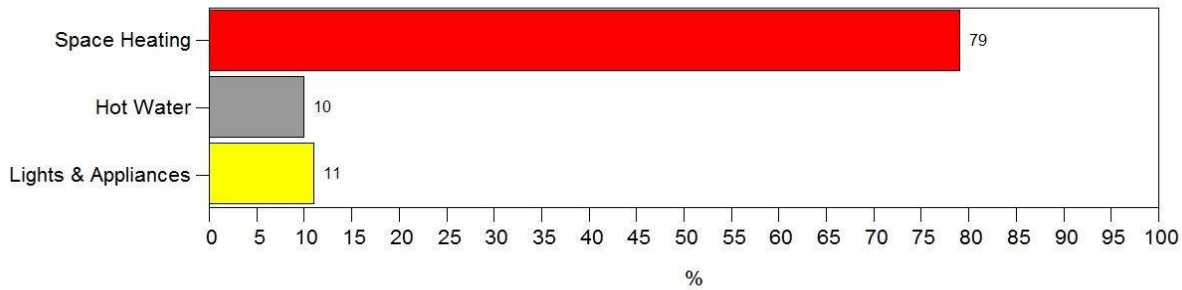
Figures 1 through 3 show the results of your energy evaluation based on the standardized conditions. The results may not entirely reflect your household since your actual energy consumption and future savings are influenced by the number of occupants, their day-to-day habits and lifestyles.

3. ENERGY CONSUMPTION

Houses lose heat to the outdoors during the heating season primarily through air leakage and conduction, such as the transfer of heat through the basement and exterior walls, upper floor ceilings, windows and doors (the 'building envelope'). Canada's demanding climate and modifications made to the house, such as drilling holes in walls for new wiring, pipes and lights, all play a part in reducing the efficiency of the building envelope over time. Houses need to be regularly maintained and upgraded to ensure greater energy efficiency, comfort and savings.

Figure 1 breaks down your house's estimated annual energy consumption for space heating, hot water and lights and appliances.

Figure 1. Estimated Breakdown of Energy Consumption



4. SPACE HEATING ANALYSIS

Figure 2 shows the estimated %age of energy used for the space heating of your home.

- The right side of the top bar shows the %age of energy you could save if you were to implement all of the upgrades recommended in this report, excluding changes to the space heating equipment. You could save up to 19 % by performing all of the recommended non-space heating system upgrades.
- The right side of the bottom bar shows the %age of energy you could save if you were to implement all of the upgrades recommended in this report, including any space heating system upgrades. You could save up to 19 % by performing all of the recommended upgrades.

Figure 2. Estimated Percentage of Potential Energy Savings

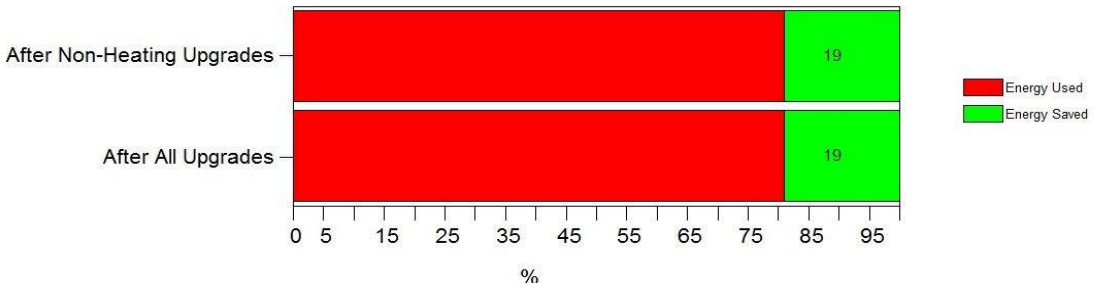


Figure 3 shows where the energy used for space heating is lost from your home. This energy is measured in gigajoules (GJ), where 1 GJ is equivalent to 278 kilowatt-hours (kWh) or 948,000 Btu.

The red bars show the areas where you are losing energy now. The longer the bar, the more energy you are losing. The green bars show the estimated energy loss after you complete your renovations. The larger the difference between the red and the green bars, the greater the potential for energy savings and comfort improvements.

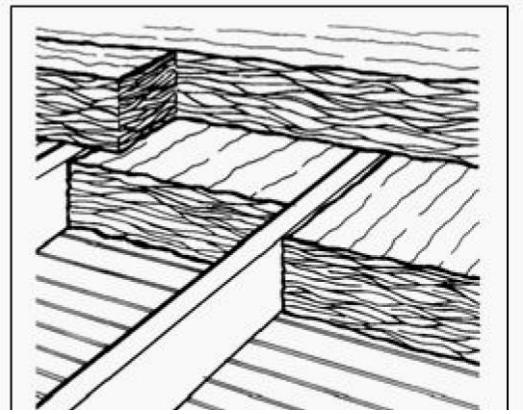
Figure 3. Breakdown of Heat Loss through Building Envelope

Important Information Concerning Vermiculite Insulation

Older vermiculite insulation installed in homes may contain amphibole asbestos, which can cause health risks if disturbed and inhaled. If the insulation is contained in the walls or attic spaces and is not disturbed or exposed to the home or interior environment, it poses very little risk. Vermiculite insulation was not detected during the energy evaluation of your home. However, if you find vermiculite insulation during renovations, avoid disturbing it in any way. If you suspect it might be in your home and you plan to undertake renovations (including insulation or air sealing work) that may cause the vermiculite insulation to be disturbed, contact professionals who are qualified to handle asbestos before you proceed with the renovations. For a listing of qualified professionals, look in the Yellow PagesTM under 'Asbestos Abatement & Removal'. For information on vermiculite insulation that contains amphibole asbestos, refer to the Health Canada fact sheet It's Your Health - Vermiculite Insulation Containing Amphibole Asbestos. Visit http://www.hc-sc.gc.ca/hl-vs/iyhvsv/prod/insulation-isolant-eng.php or call Health Canada at 1-800-443-0395 to order a copy.

5. RECOMMENDED ENERGY-SAVING MEASURES

Attic Insulation



Your upper attic [REAR PORTION] now has about R28 of insulation. The Ontario Building Code now requires a minimum level of R40 for new houses (R50 if electrically heated). I recommend that add to what you have now to reach at least the target of R50 as listed on the *Your Home Energy Action Checklist* above. In addition to reducing energy use, increasing the insulation level of your attic will keep your house warmer during the winter and cooler during the summer. Effective insulation and air sealing slow the movement of heat and air, and help prevent moisture accumulation in the attic.

When insulating attics, the importance of draftproofing first cannot be overstated. Before insulating, seal all openings and penetrations to stop interior air from entering the attic. Seal gaps around ceiling light fixtures, plumbing stacks, wiring, chimneys and the tops of interior walls. Install weatherstripping around the hatch or door, and use hooks with eye bolts or a latch to hold the hatch firmly against the weatherstripping.

Ensure that soffit venting is not blocked by the insulation. Baffles may need to be installed against the underside of the roof along the soffits to ensure proper ventilation.

As is important with the installation of all products, follow the manufacturer's instructions and check with your local building authorities for information on fire safety requirements. **Do not install insulation or flammable material against or over heat sources, such as masonry or metal chimneys and recessed**

lighting fixtures. Consult with chimney experts regarding appropriate barriers to keep adequate clearance to these structures before beginning air sealing and insulating the attic area.

For more information on insulating attics, consult NRCan's publication entitled *Keeping the Heat In*, and Canada Mortgage and Housing Corporation's *About Your House* and *Renovating for Energy Savings* fact sheets.

Windows

I recommend that you replace selected windows with ENERGY STAR qualified windows. When replacing your windows, make sure that the models you select match your climate zone. Refer to the section of this report entitled *Your Home Energy Action Checklist* to determine your climate zone and the number of windows recommended for replacement. You told me that you're considering replacing some or all of your windows [for various reasons, such as to improve aesthetics, reduce maintenance, increase house resale value, improve comfort, energy efficiency or safety, or to replace broken or inoperable windows.] Remember that the selection of new windows for your home will affect energy efficiency and comfort levels for years to come. Low-E coatings, triple glazing, inert gas fills, and better edge spacers and frames offer improvements in solar control, thermal comfort and energy efficiency.

ENERGY STAR® qualified windows, which are rated for four climate zones, are among the most energy efficient in the marketplace. They will help keep your home comfortable year-round and reduce noise from the outside. Depending on the amount of humidity in your home, there may be less condensation on your windows during cold weather.

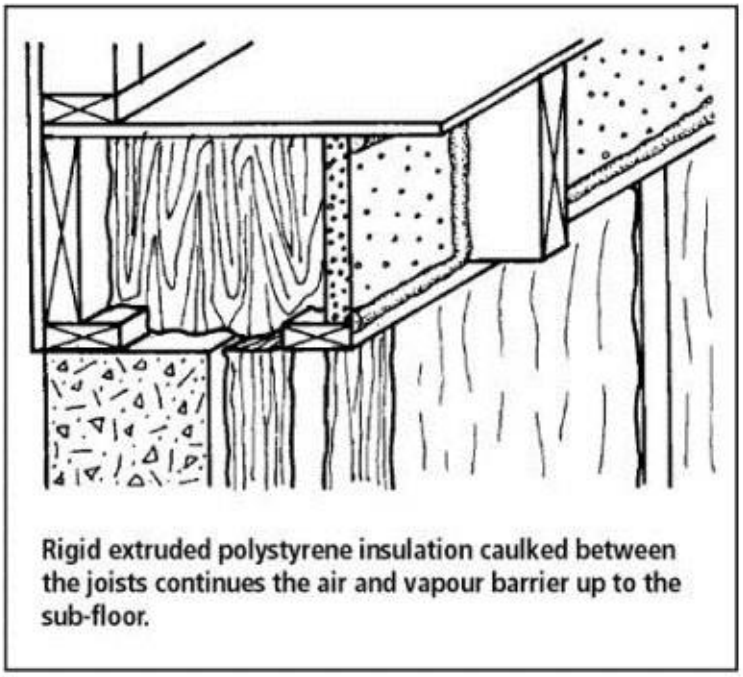
For information on purchasing energy-efficient windows, refer to NRCan's publication entitled *EnergyEfficient Residential Windows, Doors and Skylights* at http://oee.nrcan.gc.ca/publications/infosource/home/index.cfm. For information on ENERGY STAR qualified windows, doors and skylights, go to www.energystar.gc.ca, and click on *Information for general consumers* and then *Windows, doors and skylights*.

Basement Header

I recommend adding insulation to the header space in the basement. R20 RECOMMENDED. This is the area where the first floor joists sit on the foundation wall, and is highly susceptible to air leakage and heat loss. Except for foundations where the joists are embedded in the foundation wall or that exhibit signs of moisture, the basement header area should be sealed and insulated.

First, seal all of the joints along the header joist, the floor above, the bottom plate, the foundation wall, as well as any openings and penetrations, using latex acrylic caulking or silicone. For large joints and openings, use urethane foam sealant. Then fill the space between the joists with batt insulation, ensuring that there is no air space behind the insulation and that any water pipes are on the warm side of the insulation. Next, install a piece of low-permeability, rigid, foam board insulation, such as extruded

polystyrene, polyurethane or polyisocyanurate, which has been cut to fit tightly between the joists. Seal the edges of the rigid insulation with a compatible, non-hardening sealant. If the basement walls below are insulated and have a polyethylene air and vapour barrier, this barrier should be sealed to the rigid insulation with material such as acoustical sealant.



Rigid extruded polystyrene insulation caulked between the joists continues the air and vapour barrier up to the sub-floor.

Another very effective method to seal and insulate the basement header is to have a contractor apply spray foam insulation to the entire area.

Note that if a foam product (spray foam or foam board) is used, building codes may require that it be covered with a fireresistant material, such as drywall. Check with your local building authorities.

Caution:

It is not recommended to insulate between joists that are embedded in a stone, brick, or concrete foundation wall. Air circulation may be necessary in this area to prevent moisture buildup and the deterioration of the joist ends. In these cases, it is best to simply seal the joints along the foundation, joists and floor. However, regional building codes may require the header area to be insulated. Check with your local building authority.

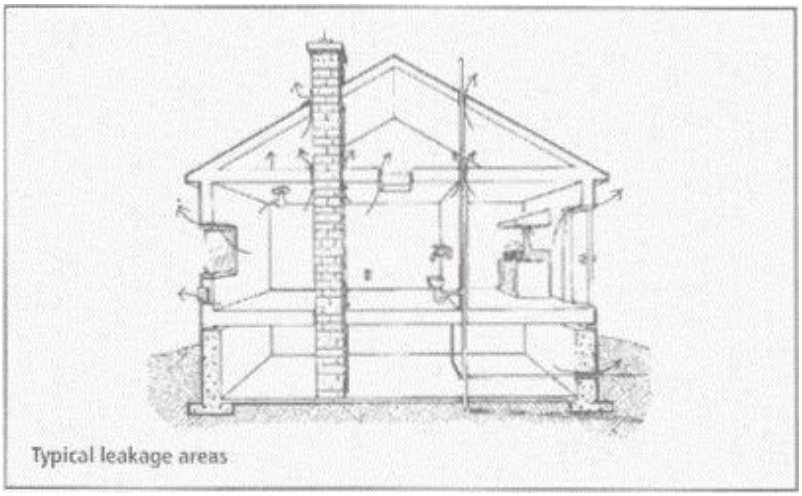
For more information on insulating basements, refer to the NRCan publication entitled *Keeping the Heat In* and Canada Mortgage and Housing Corporation's *About Your House* and *Renovating for Energy Savings* fact sheets.

You have some Draftproofing to do

The last page of this report summarizes the result of the blower door test and shows your house could benefit from some draftproofing work. Reducing air leakage is often the most cost-effective measure a homeowner can undertake. In addition to reducing heat loss, draftproofing improves comfort, protects the building structure and other materials from moisture damage, and reduces the amount of dust and noise that enters from the outdoors. It can also reduce air conditioning loads and energy costs.

These are the main leaks observed during the blower door test for you to work on.

- Door leading to attic. Seal around edges with weatherstripping
- front facing door on second floor
- window frames
- door to front bedroom closet
- at microwave vent duct rear and side doors on main floor
- hole in header [in basement] near the gas pipe entry
- vent hole behind boiler
- at plumbing stack pipe in north corner of basement
- cold room door in basement


Typical leakage areas

Draftproofing can be a do-it-yourself project. Weatherstripping reduces air leakage by sealing gaps around moveable parts of windows and doors. Correctly installed, high quality weatherstripping is a cost-effective way to reduce air leakage. Check weatherstripping annually and replace worn materials before the cold weather sets in.

Interior-grade caulking is used on the interior to seal small cracks and penetrations on the inside surface of your walls, ceilings and floors. Exterior-grade caulking is used on the exterior to keep out rain, snow, wind as well as insects and rodents. Urethane foam is very good for filling larger joints and cavities but must be protected from the elements and flame sources.

For information on draftproofing your home, consult NRCan's publications entitled *Air-Leakage Control, Improving Window Energy Efficiency and Keeping the Heat In*, and Canada Mortgage and Housing Corporation's *About Your House, and Renovating for Energy Savings* fact sheets.

6. ENERGY-SAVING TIPS

Although these actions may not be eligible for an incentive, they will help you save energy and money:

- Install and use a programmable electronic thermostat (set the heating temperature to 20°C while you are at home and 17°C at night and when you are away). For each degree of setback, you can save up to 2 % on your heating bills.
- When replacing lighting, appliances, electronics and office equipment, look for ENERGY STAR® qualified products. ENERGY STAR qualified products use less than half as much energy in standby mode (i.e. when they are turned "off"). For more information, go to http://energystar.gc.ca. You can also look for the EnerGuide label to help you select the most energy-efficient model. For more information, visit http://energuide.gc.ca.
- Replace your light bulbs with ENERGY STAR® qualified ones, such as compact fluorescents. They last longer and reduce electricity consumption.

- Insulate the first two metres of the hot and cold water pipes with insulating foam sleeves or pipe wrap insulation. By doing so you will save on your water heating costs and will reduce your water consumption. Besides saving energy, water will arrive at the faucets warmer or colder. Insulating cold water pipes will also avoid condensation from forming on the pipes. This prevents dripping on the ceiling finish or the basement floor. For a fuel-fired water heater, maintain a 15-centimetre (6-inch) clearance between the water piping insulation and the vent pipe.
- Install low-flow showerheads (rated at less than 9.8 litres per minute [L/min]) and faucet aerators. Fix leaky faucets and outside hose bibs.

7. INFORMATION RESOURCES

Home Energy Efficiency

Natural Resources Canada (NRCan) publishes a variety of publications that can help you improve the energy efficiency of your home. These publications are available online at oee.nrcan.gc.ca/publications or by calling the order desk at 1-800-387-2000.

Renovation Publications

Canada Mortgage and Housing Corporation (CMHC) publishes a large number of renovation planning fact sheets that are available at no cost. There are also some excellent in-depth publications for sale. Visit cmhcschl.gc.ca or call 1-800-668-2642 to order your material of interest.

Hiring a Contractor

Before you have any work done, request quotations in writing from professional contractors and obtain a written contract. CMHC has a very useful fact sheet on this subject, *Hiring a Contractor*, which includes a draft contract. Visit cmhc-schl.gc.ca or call 1-800-668-2642 to order.

Mold

If you suspect mold growth in your home, it is recommended that the mold damaged area(s) be cleaned thoroughly or removed and properly disposed of. To control and reduce the potential for mold growth, maintain indoor humidity at appropriate levels, and remedy water infiltration and leakage issues. Refer to the CMHC fact sheet *About Your House: Fighting Mold - The Homeowner's Guide* for information on proper mold identification and cleaning procedures. Visit cmhc-schl.gc.ca or call 1-800-668-2642 to order.

Radon

Radon is a radioactive gas that is colourless, odourless and tasteless. Radon is formed by the breakdown of uranium, a natural radioactive material found in soil, rock and groundwater. When radon is released from the ground into the outdoor air, it gets diluted to low concentrations and is not a concern. However, in enclosed spaces, like houses, it can sometimes accumulate to high levels, which can be a

risk to the health of you and your family. For more information, refer to the CMHC publication *Radon – A Guide for Canadian Homeowners* or visit the Health Canada web site at http://www.hc-sc.gc.ca/ewh-semt/radiation/radon/indexeng.php.

Humidity Control

A relative humidity (RH) level of between 30 and 55 % is recommended in the home. If you have a humidifier or dehumidifier, ensure that it is regularly cleaned and maintained, and that the humidistat is set at an appropriate humidity level. You can use a hygrometer to measure relative humidity and the CMHC fact sheet *Measuring Humidity in Your Home* gives good advice. In addition, dehumidifiers can help reduce moisture levels especially in basements.

GET STARTED TODAY!

Now that you have the tools to improve your home's energy efficiency, you can look forward to enjoying the added comfort of your ecoENERGY improved home. Not only will you benefit from increased comfort, you will also save on your energy bills year after year. And let's not forget your reduction of greenhouse gases!

Final Comments

Please do feel free to contact me if I can provide any further advice during your work. When your work is done I will return for a shorter visit to measure the improvements and process your grant application. I enclose your Energuide rating label. Please post it on your electrical panel covering the small one I left during the visit. Thank you for your business!

Appendix C: Research Study Invitation Emails

REEP Green Solutions Initial Survey Invitation Email (drafted by researcher)

Dear [insert participant name],

Thank you for being among the first to work with our new Home Energy Coach!

We encourage you, the homeowner, to help us assess the Home Energy Coach service by participating in a research study being delivered by Andrea Bale, a Master's student in the Environment and Resource Studies department at the University of Waterloo. She is working under the supervision of Prof. Ian Rowlands and in collaboration with REEP for her project.

The research team will be sending out 3-6 short online surveys over the next several months to understand how our coaching service has worked for you. This study has been reviewed by and given ethics clearance through a University of Waterloo Research Ethics Committee. Below you will find a link that will provide you with the online consent form to participate in this research and the first online survey.

http://hecprogram.limequery.com/index.php/survey/index/sid/555499/newtest/Y/lang/en

If you decide you do not wish to participate, please let us know so that we can avoid any follow-up emails regarding this study.

Thank you for your time and consideration. If you have any questions, feel free to call the office at 519-744-9799 or respond to this email.

Yours Sincerely,
REEP Team

Researcher Initial Survey Invitation Email

Dear [insert participant name],

You are receiving this email because you are among the first to work with the Home Energy Coach! Since this program is being offered for the first time, it is important to assess how the program is working - especially from the perspective of homeowners like you.

I am very interested in learning about your experience with the Home Energy Coach and invite you to read more about my research study below. I am a Masters student in the Environment and Resource Studies department at the University of Waterloo, working under the supervision of Prof. Ian Rowlands and in collaboration with REEP for my project.

I will be sending out 3-6 short online surveys over the next several months to understand how the coaching service has worked for you. This study has been reviewed by and given ethics clearance through a University of Waterloo Research Ethics Committee. Below you will find a link that will provide you with the online consent form to participate in this research and the first online survey.

http://hecprogram.limequery.com/index.php/survey/index/sid/555499/newtest/Y/lang/en

If you decide you do not wish to participate, please let me know so that I can avoid any follow-up emails regarding this study.

Thank you for your time and consideration. If you have any questions, feel free to respond to this email or call 647-448-7744 and I would be happy to answer them!

Yours Sincerely,

Andrea Bale, *MES Candidate*
University of Waterloo
School of Environment, Resources and Sustainability
647-448-7744
abale@uwaterloo.ca

Research Monthly Survey #1 Invitation Email

Dear [insert participant name],

You are receiving this email because you completed the first survey of my study last month, titled "Home Energy Coach Program: lessons learned from a pilot study in Waterloo Region, Ontario". As a reminder, I am a Masters student at the University of Waterloo investigating the Home Energy Coach Program to expand our knowledge on how such programs can be delivered most effectively to homeowners. Your feedback is very valuable for understanding the coach program from a homeowner perspective!

This email is an invitation to complete the next survey in my study. This survey is short and should take less than 10 minutes of your time. The link is provided below:

http://hecprogram.limequery.com/index.php/survey/index/sid/885137/newtest/Y/lang/en

If you decide you do not wish to participate, please let me know so that I can avoid any follow-up emails regarding this study.

Thank you for your time and consideration. If you have any questions, feel free respond to this email or call 647-448-7744 and I would be happy to answer them!

Yours Sincerely,

Andrea Bale, *MES Candidate*
University of Waterloo
School of Environment, Resources and Sustainability
647-448-7744
abale@uwaterloo.ca

Research Monthly Survey #2 Invitation Email

Dear [insert participant name],

Thank you for your continued participation in my study, "Home Energy Coach Program: lessons learned from a pilot study in Waterloo Region, Ontario". Your feedback is very valuable for understanding the coach program from a homeowner perspective!

This email is an invitation to complete the next survey in my study. This survey contains the same questions as the monthly survey you completed one month ago, and is intended to help document your renovation process and interactions with the coach. This survey is short and should take less than 10 minutes of your time. The link is provided below:

http://hecprogram.limequery.com/index.php/survey/index/sid/735496/newtest/Y/lang/en

If you decide you do not wish to participate, please let me know so that I can avoid any follow-up emails regarding this study.

Thank you for your time and consideration. If you have any questions, feel free respond to this email or call 647-448-7744 and I would be happy to answer them!

Yours Sincerely,

Andrea Bale, *MES Candidate*
University of Waterloo
School of Environment, Resources and Sustainability
647-448-7744
abale@uwaterloo.ca

Researcher Exit Survey Invitation Email

Dear [insert participant name],

Thank you for your continued feedback on the Home Energy Coach program! This email is an invitation to complete the last survey in my research study. The survey will ask questions about your renovations and your experience with the Energy Coach overall. As a reminder, my project is titled "Home Energy Coach Program: lessons learned from a pilot study in Waterloo Region, Ontario" and focuses on exploring how such programs can be delivered most effectively to homeowners like you.

If you are interested in completing the final survey, please follow the link below:
[link here]

If you decide you do not wish to participate, please let me know so I can avoid follow-up emails regarding this study.

As always, thank you for your time and consideration. If you have any questions, please feel free to respond to this email or call 647-448-7744 and I would be happy to answer them.

Yours Sincerely,

Andrea Bale, *MES Candidate*
University of Waterloo
School of Environment, Resources and Sustainability
647-448-7744
abale@uwaterloo.ca

Appendix D: Information and Consent Forms

Survey Information and Consent Form

Title of Project: Home Energy Coach Program: lessons learned from a pilot study in Waterloo Region, Ontario

Project Objective

My name is Andrea Bale and I am a graduate student at the University of Waterloo. I am currently working toward the completion of my Master's thesis under the supervision of Prof. Ian Rowlands in the Department of Environment and Resource Studies. We are very happy to be part of this innovative pilot program, and are excited to invite you to participate in a project we call "Home Energy Coach Program: lessons learned from a pilot study in Waterloo Region, Ontario".

As you may know, this project is being launched for the first time in Waterloo Region and is a collaborative initiative between many partners, including REEP Green Solutions, Mindscape Innovations, Scaled Purpose, Kitchener Utilities, the University of Waterloo, and Green Communities Canada. As part of this program, selected homeowners have been offered free consultation sessions with an energy coach to assist in the renovation process – from setting priorities, deciding how to do the work, and helping homeowners take action. Since this is a pilot program, your feedback on your experiences with the energy coach and with the program is very important! Your feedback can provide valuable information that we can use to help improve future programs in the community.

Your Involvement

The study will involve 3-6 surveys over the course of your involvement in the program. Once you complete your home energy evaluation, you will be asked to complete an initial survey to help understand your goals and priorities for your home renovations. Next, you will be sent the link to short monthly surveys where you will be asked to provide feedback on your meetings with the energy coach and your renovation progress to date. Lastly, you will be asked to complete an exit survey that will ask questions about your overall experience with our coach, and any ways that we could improve this program for the future.

Each of the surveys will be available through a secure website by Lime Survey, with computer servers located in Canada. Your data will be removed from Lime Survey within five business days of your completion of the survey. If you prefer not to complete the surveys on the web, please contact one of us and we will make arrangements to provide you with another method of participation.

As part of our evaluation to assess the impact of the coach service, we would also like permission to access your Application Form submitted to REEP Green Solutions at the beginning of the program so that we can avoid asking the same questions on our surveys. As well, to help understand how the coach can help you after your home energy evaluation, we would also ask that you share the Evaluation Report from your home energy audit. The release of this information in not mandatory

if you do not wish to do so. With your consent, REEP Green Solutions will provide your application information and your evaluation report.

Participation in the Study

Participation in this study is voluntary and will involve approximately 15 minutes of your time to complete the initial survey, 5-10 minutes per monthly survey, and 15 minutes for the exit survey. You may decline answering any questions you do not want to. You are also free to withdraw from the study at any time. There are no known or anticipated risks to your participation in this study.

Confidentiality

All personal information collected during the course of this research project is confidential and will not be shared outside of the research team. The other partners involved in this project, namely REEP Green Solutions, Mindscape Innovations, Scaled Purpose, Kitchener Utilities and Green Communities Canada will have access to information and data collected from these surveys, though it will be stripped of any identifying information and grouped with other responses. No individual or household will be personally identified in any way in any written reports, presentations or publications arising from this project. Your name or address will not be used to identify your data or quotations from the surveys; instead, we will refer to you and your data as 'Household A' (for example).

All electronic information collected from your surveys will be password-protected and kept for a period of 3 years on Andrea Bale's hard-drive. Hard-copies of any information you provide to Andrea Bale will be kept in a locked filing cabinet in Andrea Bale's office for a period of 3 years, at which time it will be confidentially shredded.

If you have any questions about participation in this study, please feel free to discuss these with Andrea Bale, or later, by contacting Prof. Ian Rowlands at 519-888-4567, ext. 32574 or irowlands@uwaterloo.ca. If you are interested in receiving a copy of the executive summary of the study outcomes, which should be available by August 2016, please contact Andrea Bale. I would like to assure you that this study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. However, the final decision about participation is yours. Should you have comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin in the Office of Research Ethics at 1-519-888-4567, ext. 36005 or maureen.nummelin@uwaterloo.ca.

Thank you for your assistance with this project.

Yours sincerely,

Andrea Bale, *MES Candidate*
University of Waterloo
School of Environment, Resources and Sustainability

647-448-7744
abale@uwaterloo.ca

Should you have any questions for the other collaborators on this project, please find their contact information below.

REEP Green Solutions:
Mary Jane Patterson (e): mjpatterson@reepgreen.ca (t): 519-744-6583 x229
Dave Blake (e): dblake@reepgreen.ca (t): 519-744-6583 x233

University of Waterloo:
Paul Parker (e): pparker@uwaterloo.ca (t) 519-888-4567 x32791
*Prof. Parker is also a member of REEP's Board of Directors.

Consent to Participate

By giving your consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study. (If you do not wish to participate, please close your web browser now.)

- ☐ Yes
- ☐ No

I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

- ☐ Yes
- ☐ No

I agree to release my Application Form, collected by REEP Green Solutions, to the research team.

- ☐ Yes
- ☐ No

I agree to release the Evaluation Report that was prepared from my home energy audit to the research team.

- ☐ Yes
- ☐ No

I agree that Andrea Bale may share my de-identified and aggregate survey responses with the partners on this project.

- ☐ Yes
- ☐ No

Interview Information and Consent Form

Dear [participant name],

I am writing to you with respect to the Home Energy Coach Program survey research you have been participating in. You may recall that you completed an online survey during April 2016.

Thank you for participating in the survey portion of my study. On the survey, you indicated that you would be willing to participate in a follow-up telephone interview. This letter is intended to provide you with more information and, should you agree to participate, to schedule a mutually convenient time for the interview.

The interview should take approximately 10-15 minutes of your time and will be conducted by a graduate student, Andrea Bale, from the School of Environment, Resources and Sustainability. The interview will cover more in-depth questions about your consultations with the energy coach, and any areas that you feel the program could be improved.

If you agree to participate, I would like to suggest some times to complete the interview. If yes, do any of these work for you? Please feel free to suggest others.

Example: Monday, March 7th, 2016 – 8:30am, 9:00am
Example: Wednesday, March 9th, 2016 – 9:00am, 9:30am

If you do not wish to participate, you can simply indicate this to me in a return email.

We would like to remind you that participation in this interview is voluntary and completely optional. Participation will not impact your relationship with the energy coach, REEP Green Solutions, or any other partners on this project. Further, you may decide to withdraw from this study at any time without any negative consequences by contacting the researcher.

With your permission, the interview will be audio recorded to facilitate collection of information, and later transcribed for analysis. All information you provide is considered completely confidential. Your name will not appear in any report resulting from this study. However, with your permission anonymous quotations may be used. As well, data collected during this study will be retained for 2 years in a locked office. Only researchers associated with this project will have access. There are no known or anticipated risks associated with participation in the interview.

If you have any questions regarding this study, or would like additional information, please contact the researchers. Further, we would like to remind you that this study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. However, the final decision about your continued participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin in the Office of Research Ethics at 1-519-888-4567 x36005 or maureen.nummelin@uwaterloo.ca.

Sincerely Yours,

Andrea Bale, *MES Candidate*
University of Waterloo
School of Environment, Resources and Sustainability
647-448-7744
abale@uwaterloo.ca

Verbal Consent Form

Researcher: Hello, may I please speak with [**homeowner name**]?

Homeowner: Yes, this is [**homeowner name**].

Researcher: My name is Andrea Bale and I am a Master's student from the University of Waterloo, working with Prof. Ian Rowlands. I'm calling about the Home Energy Coach program follow-up interview we scheduled.

As a reminder, we're interested in your feedback on the Home Energy Coach program and your interactions with the energy coach. We are greatly appreciative of your time. The interview should take approximately **15 minutes** of your time.

Before we begin, I would like to ask you a few questions about recording and using the data collected during this interview. [Record answers for each participant]

1. Do you agree to participate in this interview?
2. Do you agree to have the interview recorded for transcription purposes?
3. Do you agree to the use of anonymized quotations in any publication that may come out of this research?

With your permission, I'll turn the tape recorder on now. [Turn on tape recorder] …I'm going to put you on speaker phone, but there is no one else in the room. I'm also going to be taking some notes by hand, which you may hear in the background.

Before we get started, do you have any questions? … [Interview begins]

Appendix E: Feedback/Appreciation Letter

Dear [insert participant name],

I would like to thank you for your participation in this study entitled "Home Energy Coach Program: lessons learned from a pilot study in Waterloo Region, Ontario". As a reminder, the purpose of this study is to evaluate the successes and shortcomings of the coaching service among homeowners in Waterloo Region. The data collected from your surveys will contribute to program improvements in the future.

Please remember that any data pertaining to you as an individual participant will be kept confidential. Once all the data are collected and analyzed for this project, Andrea Bale plans on sharing this information with the research community through seminars, conferences, presentations, and journal articles. If you are interested in receiving more information regarding the results of this study, or would like a summary of the results, please provide your email address, and the information will be sent to you upon completion of the study, expected by August 2016.

In the meantime, if you have any questions about the study, please do not hesitate to contact me (contact details below) or Prof. Ian Rowlands at 519-888-4567, ext. 32574 or irowlands@uwaterloo.ca. As with all University of Waterloo projects involving human participants, this project was reviewed by, and received ethics clearance through a University of Waterloo Research Ethics Committee. Should you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin, the Director, Office of Research Ethics, at 1-519-888-4567, ext. 36005 or maureen.nummelin@uwaterloo.ca.

Thank you again for your participation in this study.

Yours sincerely,

Andrea Bale, *MES Candidate*
University of Waterloo
School of Environment, Resources and Sustainability
647-448-7744
abale@uwaterloo.ca

Appendix F: Copy of Initial Survey

"Home Energy Coach Program Feedback – Initial Survey"

PART I: INFORMATION AND CONSENT FORM

□ With full knowledge of all foregoing, I agree, of my own free will, to participate in this study. (If you do not wish to participate, please close your web browser now.)

□ I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

□ I agree to release my Application Form, collected by REEP Green Solutions, to the research team.

□ I agree to release the Evaluation Report, prepared from my home energy audit, to the research team.

□ I agree that Andrea Bale may share my de-identified and aggregate survey responses with the partners on this project.

Please provide your name and email address in the space below.

Name: _____ Email: _____

PART A: GENERAL BACKGROUND

1) Please rate how important each of following was in your household's decision to pursue renovations.

	Very unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Very important	Had not thought of this before
To find out how much energy we use in our home and for what purposes						
To find out if there are any health or safety issues in our home (e.g. moisture, gas leaks)						
To increase the value of our home						
To save money on our energy bills						
To make our home less drafty/						

temperatures more consistent between rooms						
To reduce our household's carbon footprint						
To reduce the time it would take selling our home						
Other						

2) Please complete your household's planned home energy retrofit timeline by filling in the month and year for each activity.

Home Energy Evaluation		Consultation with Energy Coach		Complete Initial Retrofits		Complete All Retrofits	
Month	Year	Month	Year	Month	Year	Month	Year

3) Please rate how easy or difficult each of the following tasks were. If you have not yet completed them, how easy/difficult do you think they will be?

	Very difficult	**Somewhat difficult**	**Neither easy nor difficult**	**Somewhat easy**	**Very easy**	**I don't know**
Deciding to have a home energy evaluation						
Understanding my home energy evaluation report						
Deciding what renovation to do first						
Deciding the order I should complete my renovations						
Finding a contractor						
Getting the time to do the renovations						
Making sure that the renovations have been done correctly						
Accessing government incentives						
Paying for energy retrofits						

PART B: YOUR EVALUATION REPORT

4) How likely is your household to implement some of the energy efficiency improvements that were recommended in your evaluation report at some point in the future?

	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely
Likelihood					

5) How likely is your household to implement all of the energy efficiency improvements that were recommended in your evaluation report at some point in the future?

	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely
Likelihood					

6) Based on your household's renovation goals and the recommendations from your evaluation report, what are your top priorities to complete in the next 6 months from the list below? Please rank these priorities in the list below, with 1 being the top priority, and 7 being the lowest priority. *You do not need to rank those that do not apply to you.*

__ Basement/Crawl Space Insulation
__ Exterior Wall Insulation
__ Attic Insulation
__ Draftproofing
__ Furnace/Boiler Replacement
__ Water Heater Replacement
__ Window/Door/Skylight Replacement or Sealing

7) Does your household have any other renovation priorities that were not included on your evaluation report?
□ Yes (please specify): _____ □ No

8) Does your household have any concerns about implementing the recommended energy efficiency improvements? □ Yes □ No

9) If you answered yes to the above question, what are your household's biggest concerns?
_____
_____

PART C: HOME ENERGY COACH PROGRAM

10) Please rate how important each of the following were in your household's decision to sign up for the Home Energy Coach Program.

	Very unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Very important	Had not thought of this before
Getting help understanding our evaluation report						
Getting help developing a plan from our evaluation report						
Getting help finding a contractor						
Accessing the Union Gas Incentive						
Getting help creating a budget for our renovations						
Other						

11) How likely is each of the following to influence your household's decision to proceed with making improvements?

	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	I don't know
The Energy Coach is available to assist us with the process.						
The Energy Coach is available to answer technical questions and review the proposed work scope.						
The Energy Coach is available to check that the work has been properly completed.						
There are incentives available for eligible improvements.						
I am able to receive credit financing for the home energy retrofits.						

PART D: ENERGY COACH SERVICE

12) How often has your household been in contact with our Energy Coach since signing up for the program?

□ We have had no contact with the Energy Coach since signing up for the program.
□ We have met in person, spoken, and/or emailed back and forth 1 time
□ We have met in person, spoken, and/or emailed back and forth 2-3 times
□ We have met in person, spoken, and/or emailed back and forth more than 3 times

13) Please rate how much your household agrees with each of the following statements with respect to our Energy Coach based on your interactions to date.

	Strongly disagree	**Somewhat disagree**	**Neither agree nor disagree**	**Somewhat agree**	**Strongly agree**	**I don't know**
The Energy Coach is easy to work with.						
The Energy Coach is responsive to our inquiries.						
The Energy Coach is professional, courteous and considerate with respect to our home/time.						
The Energy Coach is a trusted source for unbiased information.						
The Energy Coach was helpful in explaining the findings and recommendations in the evaluation report.						
The Energy Coach was helpful in explaining available rebates.						

14) Have your ideas about your home renovation actions changed based on discussions with the Energy Coach? □ Yes □ No

15) If yes, what changed? Please elaborate on your answers in the space provided.

□ The type of renovation

_____

□ The sequence/priority of renovation

_____

□ The extent of renovation

_____

□ Other

_____

16) Please rate your household's overall satisfaction with the Home Energy Coach Service, based on your participation to date.

	Not at all satisfied	Somewhat dissatisfied	Neither satisfied or dissatisfied	Somewhat satisfied	Very satisfied
Satisfaction					

17) Please rate the Home Energy Coach Service based on your initial information and associated expectations.

□ The services provided have exceeded my expectations.
□ The services provided have met my expectations.
□ The services provided have been below my expectations.

18) If the Home Energy Coach Service was below your expectations, please let us know how we can make improvements:

_____
_____
_____

PART E: DEMOGRAPHIC QUESTIONS

In this section, we ask some questions about your household demographics. This information is important to our understanding of where the coach's impact is greatest, and where it may need improvements. Remember that you do not need to answer any questions that you wish not to. Please also remember that this information will be kept confidential.

1. What is the total number of people living in your household on a permanent basis? ____.

2. Please indicate below the number of household members in each age range.

0-18	_____	36-40	_____	56-60	_____	76-80	_____
19-24	_____	41-45	_____	61-65	_____	81-85	_____
25-30	_____	46-50	_____	66-70	_____	86-90	_____
31-35	_____	51-55	_____	71-75	_____	91-100	_____

3. What is your age?

□ < 25 years old	□ 41-45 years old	□ 61-64 years old	□ 81-85 years old
□ 25-30 years old	□ 46-50 years old	□ 65-70 years old	□ 86-90 years old
□ 31-35 years old	□ 51-55 years old	□ 71-75 years old	□ 91-95 years old
□ 36-40 years old	□ 56-60 years old	□ 75-80 years old	□ 96-100 years old

4. What is the highest level of education completed by any member of your household?

□ No certificate, diploma or degree

- □ High school diploma or equivalent
- □ Apprenticeship or trades certificate or diploma
- □ College or other non-university certificate or diploma
- □ University certificate or diploma below bachelor level
- □ Bachelor's Degree
- □ Master's Degree
- □ Degree in medicine, dentistry, veterinary medicine or optometry
- □ Earned doctorate
- □ Other (please specify): _____

5. Which of the following best describes your household's annual income before taxes?
   - □ Less than $25, 000
   - □ Between $25, 000-49,999
   - □ Between $50, 000-74,999
   - □ Between $75, 000-99,999
   - □ Between $100, 000-149,999
   - □ Greater than $150, 000

6. What decision-making role do you usually play in the following activities?
   a. Controlling the thermostat temperature
      □ Primary decider □ Contributor □ Not engaged in the decision
   b. Purchasing new household appliances
      □ Primary decider □ Contributor □ Not engaged in the decision
   c. Running appliances at particular times during the day
      □ Primary decider □ Contributor □ Not engaged in the decision

Thank you for completing this survey! If you have any questions, please feel free to contact Andrea Bale at abale@uwaterloo.ca or 647-448-7744, or Prof. Ian Rowlands at irowlands@uwaterloo.ca or 519-888-4567, ext. 32574.

Appendix G: Copy of Monthly Survey

"Home Energy Coach Program Feedback – Monthly Survey"

1. Have you had contact with our energy coach over the last 30 days? If yes, how many times?
   ☐ No ☐ Yes, once ☐ Yes, 2-3 times ☐ Yes, more than 3 times

2. Please fill in the chart below by checking the applicable boxes for each column question. You will use this chart to answer 4 questions. For each question, please check all that apply.

	a. Which activities have you completed in the last 30 days?	**b. Which activities did the energy coach service help you with?**	**c. For which activities did you find the coaching service helpful?**	**d. For which activities did you find the coaching service unhelpful?**
Reviewed your home energy evaluation report	☐	☐	☐	☐
Set a timeline for your home renovations	☐	☐	☐	☐
Contacted a contractor(s)	☐	☐	☐	☐
Reviewed quotes from multiple contractors	☐	☐	☐	☐
Created a budget to complete your renovations	☐	☐	☐	☐
Accessed government incentive programs	☐	☐	☐	☐
Accessed credit financing	☐	☐	☐	☐
Selected a contractor	☐	☐	☐	☐
Started your home renovation	☐	☐	☐	☐
Completed your home renovations	☐	☐	☐	☐

3. For those activities you rated the coaching service "helpful", how did the coaching service help?
   _____

4. For those activities you rated the coaching service "unhelpful", what could the service do better?
   _____

5. Were there any times over the last 30 days that you would have liked more help from this service?
   ☐ Yes ☐ No If yes, please elaborate below:
   _____

6. Do you have any additional comments?
   _____

Appendix H: Copy of Exit Survey

"Home Energy Coach Program Feedback – Exit Survey"

Thank you for taking the time to answer this survey. As a pilot project, the Home Energy Coach Program needs help from homeowners to shape this service into something meaningful and impactful for the community. Your feedback is greatly appreciated and will be used to improve future programs like this!

PART A: YOUR HOUSEHOLD RENOVATION PROCESS

1) To help increase our understanding of the homeowner renovation process, it would be helpful to know your current renovation plan. Please indicate the type of renovations that are part of your **current renovation plan** and briefly provide details on the nature of the renovation and your expected timeline.

Type of Renovations	Part of current renovation plan	Details
Example: Basement/crawl space insulation	*Yes*	*Insulating the basement walls and adding drywall. Hope to be done by the summer.*
Attic insulation		
Basement/crawl space insulation		
Draftproofing		
Exterior wall insulation		
Furnace/boiler replacement		
Water heater replacement		
Window/door/skylight replacement		
Other		

2) Did you complete/do you plan to complete different renovations than you had intended once you received your Home Energy Evaluation Report? If so, in what way? (eg. Did/do your renovations differ in type, extent or sequence?)

   _____

3) If yes to the above, did the Home Energy Coach influence your decision? If yes, when did the coach influence your decision and how so?

   _____

4) Did factors other than the Home Energy Coach play a role in the renovations that you decided to proceed with?

   _____

5) Please rate how easy or difficult each of the following was in your household renovations process. If you did not complete them, please select “Not applicable”.

	Very difficult	Somewhat difficult	Neither easy nor difficult	Somewhat easy	Very easy	Not applicable
Understanding my home energy evaluation report						
Deciding to start my renovations						
Deciding which renovations to do						
Deciding the order in which to complete my renovations						
Finding the right information to complete my renovations						
Finding a trustworthy and reputable contractor						
Getting the time to complete the renovations						
Making sure that the renovations were done correctly						
Accessing government incentives						
Paying for energy retrofits						

6) From the question above, you noted that some activities were **somewhat** or **very difficult** during your renovation process. How do you think you were able to overcome these challenges? (eg. Help from family/friends, internet searches, community programs etc.)

_____

7) In addition to the factors mentioned above, were there factors that you considered to be challenges that you faced in your renovations?

_____

8) Was the Energy Coach **helpful** in overcoming any of these challenges? If so, how was the Energy Coach helpful? (eg. directing you to resources, helping to create a workplan etc).

_____
_____

9) If the Energy Coach was **not helpful** in overcoming some of these challenges, how could the Coach have been more helpful to you? Please be as specific as possible.

_____

10) If you could begin your renovations again, is there anything that you would find helpful to know from the beginning to make the process easier for your household?

_____

PART B: HOME ENERGY COACH SERVICE

1) How many times have you interacted with the Energy Coach since your household signed up for the program?
□ None □ Once □ Two times □ Three times □ More than three times

2) How/where did your interactions take place? _____

3) Would you have preferred another method of interacting with the coach? □ Yes □ No
If yes, please elaborate in the space provided:

_____

4) Please rate your agreement with the following statements based on your interactions with the Home Energy Coach. (Please note that 'me' refers to you and your household.)

	Strongly disagree	**Somewhat disagree**	**Neither agree nor disagree**	**Somewhat agree**	**Strongly agree**	**Not applicable**
The Energy Coach was easy to work with.						
The Energy Coach was not available for consultations at a convenient time for me.						
The Energy Coach provided me with information about my renovations that I would not have found on my own.						
The Energy Coach often used language that I did not understand.						
The Energy Coach was a trusted source for unbiased information.						
The Energy Coach didn't						

understand my renovation priorities.						
The Energy Coach helped me decide on the work scope for my home.						
The Energy Coach was not helpful in reviewing my work proposal(s).						
The Energy Coach helped me access incentives that I would not have otherwise known about.						
The Energy Coach did not motivate me to complete more renovations than I had planned.						
My household renovations would have taken longer to complete without the help of the Energy Coach.						

PART C: YOUR HOUSEHOLD BEHAVIOURS

1) Did the Home Energy Coach provide you with any behavioural advice to help you save energy in your home (eg. unplugging appliances when not in use, doing laundry during off-peak hours)?
   _____

2) Please fill in the chart below with your **household thermostat (heating/air conditioning) temperature settings** before and after your renovations. If you do not use your thermostat in a particular season (eg. do not have air conditioning, so do not set it in the summer), leave those boxes blank.

	Winter – Day	**Winter – Night**	**Spring – Day**	**Spring – Night**	**Summer – Day**	**Summer – Night**	**Fall – Day**	**Fall – Night**
Pre- Renovation								
Post- Renovation								

3) Are there any household behaviours that you have changed as a result of your meetings with the Home Energy Coach (eg. unplugging appliances when not in use, doing laundry during off-peak hours)? _____

PART D: OVERALL PROGRAM EVALUATION

1) On your initial survey, you indicated that "x", "y" and "z" were very important in your decision to sign up for the Home Energy Coach program. Based on your experience to date, how would you rate the program in helping you achieve those?

	Very unhelpful	Somewhat unhelpful	Neither helpful nor unhelpful	Somewhat helpful	Very helpful
Very important/somewhat important 1					
Very important/somewhat important 2					
Very important/somewhat important 3					

2) Please rate your household's overall satisfaction with the Home Energy Coach Service, based on your participation to date.

	Not at all satisfied	Somewhat dissatisfied	Neither satisfied or dissatisfied	Somewhat satisfied	Very satisfied
Satisfaction					

3) Please rate the Home Energy Coach Service based on your initial information and associated expectations.
   - □ The services provided have exceeded my expectations.
   - □ The services provided have met my expectations.
   - □ The services provided have been below my expectations.

4) If the Home Energy Coach Service was above or below your expectations, please elaborate in the space provided. What are your expectations, and how did the service perform above or below these?

   _____
   _____

5) If you could change any aspects of the program, what would they be?

   _____

6) Would you recommend this program to your family or friends? Why or why not?

   _____

7) Is the Home Energy Coach a service you would pay for? If yes, what is the most you would be willing to pay for this service, on a **per-consultation basis (approximately 45 minutes)**?

   _____

PART E: FOLLOW-UP

1) Would you be willing to participate in a short (~20 minute) interview with University of Waterloo graduate student Andrea Bale to answer some more in-depth questions about the Home Energy Coach program?
   □ Yes □ No

Appendix I: Follow-up Interview Guide

The interview guide that was employed for the five semi-structured interviews is presented below. The square brackets at the end of some questions indicate the key theme that question was designed to probe. The two questions in bold font indicate the questions that were 'different' for each interviewee, based on the responses from their surveys.

Introductory Questions

1. How did you hear about the Home Energy Coach Program? At what stage of your renovation did you sign up for the program? [Description of Participants]
    a. *(If they heard about the program before getting a home energy evaluation)* Did the availability of the Energy Coach factor in to your decision to have a home energy evaluation?
    b. *(If they heard about the program after getting a home energy evaluation)*

2. What were your household's reasons for signing up for the Home Energy Coach Program? [Motivations]

3. Was there anything specific that you were hoping to get out of your consultations with the Energy Coach? [Motivations]
    a. Do you feel that that was achieved during your consultation sessions?

4. Did you have different expectations about the services the program offered (for any reason)?
    a. Were your expectations 'inappropriately' set by REEP, by the program advertising, etc.?

Consultation Process

5. How many consultations did you have with the Energy Coach? [Interactions – triangulation]
    a. *(If they did not make use of all three available consultations)* Is there any particular reason you did not make use of all three free consultations?

6. Can you describe, generally, the structure of your consultation(s) with the Energy Coach? [Interactions]
    a. Were you satisfied with the structure of consultation meeting with the Energy Coach?
    b. What was helpful about the consultations?
    c. Is there anything you would change about the structure of the consultations?

7. Would you say that the coach took a dominant role in "leading" the consultation, or let you lead the discussion? [Interactions]
    a. Was this, in your view, appropriate?
    b. Which would be preferable to you, and why?
    c. Were you able to discuss all of the issues important to your household?
        i. If not, why not?
    d. Were there any important issues that arose that you otherwise might not have thought of?

8. Was the option of a 'home-visit' (the Energy Coach coming to your house) made available to you?
    a. Is yes, did you choose to make use of that option? Why or why not?

9. What – if any – follow-up did you receive from the Energy Coach after your consultation(s)? [Interactions]
    a. Were you satisfied with the follow-up?
    b. What follow-up would be most helpful to you?
    c. Was there anything that was unexpectedly helpful from the follow-up? Was anything a 'waste of time' in the follow-up?
    d. Is there anything that you would change about the follow-up from the Energy Coach?

<u>Renovation Plans and Progress</u>

10. On your evaluation report, you were given several recommendations from the Energy Advisor. How did you develop a prioritized renovation plan from those recommendations?
    a. What factors helped to develop a plan?
    b. Did the Energy Coach play a role in shaping your renovation plan? [Interactions/Impacts]
        i. If yes, how so? Please be as specific as possible.
    c. Would your renovation plan look the same if you had not consulted with the Energy Coach? [Impacts]
        i. How would it look different?
            1. For those things that you wouldn't have done without speaking with the coach, did those turn out positively or negatively?
    d. Are there things the coach should have pushed, but did not?

11. **Additionally, there were some differences in your renovation plans from your initial and exit survey, so I wanted to ask some questions to clarify the differences.**

a. **[Include discrepancy here]. What factors made you decide to add/remove that from your renovation list?**
    i. **Did the coach impact your decision to add/remove it from your list? How so?**

12. If you could do your plan again, what would you have done but didn't do? Conversely, what did you do, but wouldn't do again?

13. In hindsight, did the Energy Coach 'direct you' in the right direction?

14. Were there any times when you did not follow the advice of the Energy Coach? Why not?

15. **On your exit survey, you indicated that you have made progress on a number of renovation activities. I'd like to go through each renovation item and discuss how you decided on the particular method for each. [Interactions, Impacts]**
    a. **[Renovation Item 1]**
        i. **Are you completing the renovation yourselves, or is a contractor completing this work?**
        ii. **How did you decide on the materials and method to use?**
            – **What resources did you use?**
        iii. **Did the Energy Coach impact your decision-making process? How so?**
            – **Would you have liked any more support from the Energy Coach in this decision? If so, how?**
    b. **[Renovation Item 2]**
        i. **Are you completing the renovation yourselves, or is a contractor completing this work?**
        ii. **How did you decide on the materials to use?**
            – **Resources?**
        iii. **Did the Energy Coach impact your decision-making process? How so?**
            – **Would you have liked any more support from the Energy Coach in this decision? If so, how?**

16. As a reflection, how would you describe your level of knowledge about your home renovations before signing up for the Home Energy Coach Program?
    a. Did the coach impact your level of knowledge? [Impacts]
        i. If so, in what way?
        ii. Do you think that you would have found this information without the Energy Coach? [Triangulation]

17. How would you describe your level of confidence with your home renovation being completed properly before signing up for the Home Energy Coach Program?
    a. Did the coach impact your level of confidence? [Impacts]
        i. If so, in what way?

Reflections

18. How would you describe a "successful" energy coach? [Exploration]
    a. What key attributes/characteristics would a successful coach have?

19. What "value" would you set on the energy coach portion of this process? Is this something that you would consider a "staple" in the home energy evaluation and renovation process?

20. Do you think you would like to work with a home energy coach in the future, should your household decide to complete any other renovations?

21. Do you have any other feedback you want to provide to the future development of the Home Energy Coach Program?

Appendix J: Response Rates for Surveys and Interviews

Survey Response Rates

	Initial Survey				Monthly Survey #1				Monthly Survey #2				Exit Survey			
Code	Survey Sent? (Y/N)	Survey Returned? (Y/N)	Time Between (Days)		Survey Sent? (Y/N)	Survey Returned? (Y/N)	Time Between (Days)		Survey Sent? (Y/N)	Survey Returned? (Y/N)	Time Between (Days)		Survey Sent? (Y/N)	Survey Returned? (Y/N)	Time Between (Days)	
			Survey Invite and Return	Survey Return and Initial Consult			Survey Invite and Return	Survey Return and Initial Consult			Survey Invite and Return	Survey Return and Initial Consult			Survey Invite and Return	Survey Return and Initial Consult
HH1	Y	Y	45	48	Y	Y	5	92	N	N			Y	N		
HH2	Y	Y	0	1	Y	Y	3	37	N	N			Y	Y	4	75
HH3	Y	Y	43	46	Y	Y	30	117	N	N			Y	Y	4	128
HH4	Y	Y	9	22	Y	Y	13	66	Y	N			Y	Y	3	155
HH5	Y	Y	1	1	Y	Y	0	34	Y	Y	0	64	Y	Y	6	98
HH6	Y	Y	0	14	N	N			N	N			Y	Y	26	201
HH7	Y	Y	0	1	Y	Y	1	36	N	N			Y	Y	1	51
HH8	Y	Y	7	9	N	N			N	N			Y	Y	7	29
HH9	Y	Y	0	10	N	N			N	N			Y	Y	6	39
HH10	Y	Y	28	29	Y	N			N	N			Y	N		
HH11	Y	Y	12	32	Y	Y	1	67	N	N			Y	Y	1	77
HH12	Y	Y	2	7	Y	Y	7	43	N	N			Y	Y	7	56
HH13	Y	Y	30	33	Y	Y	0	73	Y	Y	0	96	Y	Y	6	116
HH14	Y	Y	5	8	N	N			N	N			Y	Y	32	58
HH15	Y	Y	0	3	Y	Y	0	31	Y	Y	0	66	Y	Y	0	110
HH16	Y	Y	0	3	N	N			N	N			Y	Y	0	26
HH17	Y	Y	0	3	Y	Y	1	33	N	N			Y	Y	0	61
HH18	Y	Y	64	64	Y	Y	5	104	N	N			Y	Y	13	140
HH19	Y	Y	0	3	Y	Y	0	34	Y	N			Y	N		
HH20	Y	Y	4	7	Y	N			N	N			Y	Y	16	133
HH21	Y	Y	22	24	N	N			N	N			Y	Y	32	62
	Average		12.95	17.52	**Average**		5.08	59	**Average**		0	75.33	**Average**		9.11	89.72
	Median		4	9	**Median**		1	43	**Median**		0	66	**Median**		6	76
	Minimum		0	1	**Minimum**		0	31	**Minimum**		0	64	**Minimum**		0	26
	Maximum		64	64	**Maximum**		30	117	**Maximum**		0	96	**Maximum**		32	201
	Standard deviation		18.62	18.25	**Standard deviation**		8.39	29.95	**Standard deviation**		0	17.93	**Standard deviation**		10.58	48.27

Appendix K: Dataset Available for Research Sample

Code	Initial Survey	Monthly Survey #1	Monthly Survey #2	Exit Survey	Interview	Application Form	Evaluation Report	MPAC Data
HH1	Y	Y	N	N	N	Y	Y	Y
HH2	Y	Y	N	Y	Y	Y	Y	Y
HH3	Y	Y	N	Y	N	Y	Y	Y
HH4	Y	Y	N	Y	Y	Y	Y	Y
HH5	Y	Y	Y	Y	N	Y	Y	Y
HH6	Y	N	N	Y	N	Y	Y	Y
HH7	Y	Y	N	Y	N	Y	Y	Y
HH8	Y	N	N	Y	N	Y	Y	Y
HH9	Y	N	N	Y	Y	Y	Y	Y
HH10	Y	N	N	N	N	Y	Y	Y
HH11	Y	Y	N	Y	Y	Y	Y	Y
HH12	Y	Y	N	Y	N	Y	Y	Y
HH13	Y	Y	Y	Y	N	Y	Y	Y
HH14	Y	N	N	Y	N	Y	Y	Y
HH15	Y	Y	Y	Y	N	Y	Y	Y
HH16	Y	N	N	Y	Y	Y	Y	Y
HH17	Y	Y	N	Y	N	Y	Y	Y
HH18	Y	Y	N	Y	N	Y	Y	Y
HH19	Y	Y	N	N	N	Y	Y	Y
HH20	Y	N	N	Y	N	Y	Y	Y
HH21	Y	N	N	Y	N	Y	Y	Y

Appendix L: Full Dataset for Surveys

Section 1: Initial Survey

Table 1: Ranked Renovation Priorities in the Next Six Months on Initial Survey (n=21)

Energy-Efficiency Measure	1st	2nd	3rd	4th	5th	6th	7th	Total Times Ranked
Attic insulation	2	2	7					**12**
Basement/crawl space insulation	3	9	1	2	2			**17**
Draftproofing	8	4	5	1	1			**18**
Exterior wall insulation	2	1	1	2	1	1		**8**
Furnace/boiler replacement	2			1		2	1	**6**
Water heater replacement		2		4	3	2	1	**12**
Window/door/skylight replacement	4	2	3	4	2			**15**

Table 2: Concerns with Implementing Recommended Improvements (n=8)

Question A8/9: *Does your household have any concerns about implementing the recommended energy efficiency improvements? If you answered yes to the above question, what are your household's biggest concerns?*

Respondents' Comments	Theme and Sub-Theme(s)
"Draft proofing of pot lights. Cost in time and labour. Draft proofing electrical switches. Uncovering sources of draft under insulation in attic. Cost of labour and time involved. Insulating basement wall. Labour intensive re-fitting appliance electrical and venting outlets. Cost in time and labour."	**Cost in resources** Labour, Time
"Given that I will have had to pay $500 total for pre and post evaluation without guarantee of meeting the threshold, I am concerned I may not qualify for any rebate. Also, I was aware of the federal election and the possibility of further rebates/incentives being soon available so would have preferred to wait a little longer however, I am currently between jobs and had time to do the renos so decided we had to proceed in any case."	**Financial** Access to rebates, Cost of renovations
"I am concerned that we won't be able to get them done in time to qualify for any rebates, given the schedules of contractors."	**Contractors** Availability **Financial** Access to rebates
"None of the recommended improvements make sense in terms of ROI."	**Financial** Return-on-investment
"Not going to spend more than will be reimbursed."	**Financial** Return-on-investment
"The main concern is the cost of the improvements now that most or all government incentive programs are ended."	**Financial** Cost of renovations
"The renovations are confusing, some very expensive. How effective	**Financial** Cost of renovations

is it? What will the benefit be?"	**Uncertainty** Effectiveness
"There are too many recommendations for the amount of money that is available. For me, the recommendations were not practical."	**Financial** Cost of renovations

Table 3: Renovation Priorities Not Included on Evaluation Report on Initial Survey (n=11)

Question A7: *Does your household have any other renovation priorities that were not included on your evaluation report? Please specify.*

Additional Renovation Priorities	
"Drain for water softener system; Water leakage into basement."	"Kitchen and washroom upgrade; Basement finishing."
"Longer term, we hope to renovate the kitchen and redo the house flooring. These are not imminent, though, so were not covered by the report."	"None that are related to household energy efficiency, but we are planning a microFIT solar roof installation in 2016."
"Pipes."	"Pool heater - currently an older natural gas unit. Would like to supplement with solar."
"Probably redo my floor at some point, but it's not really related to energy efficiency. Eventually redo my roof. Heavily sloped attic I want to make more liveable. I'll be replacing some posts on the porch."	"Review and fix any electrical issues."
"Replacing roof/ceiling insulation, getting solar panels."	"Shed and deck."
"The brick chimney on the exterior wall of our house needs major repairs."	

Table 4: Additional Factors Important to Signing Up for the Program (n=6)

Comment	Importance
"Complete review and discussion of the Evaluation Report, and noting which items could be done without hiring a contractor, as well as practical ideas and visuals on how to do the indicated renos. Sourcing foam insulation that could be owner installed when the weather is warmer."	Had not thought of this before
"Getting help understanding trade-offs between our options for our plan (ie. HRV vs. ERV, type of insulation to use); Getting help planning a renovation to finish our basement in an energy efficient manner; Seeking a third party's opinion about options presented by potential contractors; Getting help understanding what energy savings make sense to do before considering energy generation (e.g. solar panels)."	Very important
"Help with materials to achieve energy efficiency."	Very important
"Looking in to green gardening."	Somewhat important
"Prioritizing of the projects, creating a plan."	No rating
"Solving specific problems encountered in relation of my implementation of the construction plan."	Not at all important

Table 5: Comments on Program in Relation to Program Expectations on Initial Survey (n=6)

Question D7: *If the Home Energy Coach Service was above or below your expectations, please let us know how we can make improvements.*

Respondents' Comments	Theme
"I really enjoyed asking questions I had about my house and our energy use and learning about energy usage."	**Information Provision** (+) (Not specified)
"I would have liked more specifics when it comes to potential contractors for retrofit work."	**Information Provision** (-) Lack of specificity
"Really amazing program in theory. I was excited, but he needs to bring it down to our level. He talked about extra stuff we didn't need to know and couldn't translate. We were sitting there thinking 'Are you understanding this?'. Too much technical info. It was frustrating."*	**Communication** (-) Lack of translation skills
"[The coach] was knowledgeable and had insulation display to explain the options."	**Information Provision** (+) Visual aids
"[The] coach was very interested in our questions and eager to discuss different ways of solving the situations our home presented. [T]he energy coach was not only talking theory, but had experience in his own home renos. [The] coach was interested in us."	**Communication** (+) Engaged, interested **Information Provision** (+) Personal experience
"We've only had one meeting so far, and it seemed like the coach didn't quite know how to get the conversation going. We haven't done this before, and he didn't offer any strong lead on the discussion. I understand he wants to answer our questions, but I don't yet know what questions to ask. Also, I believe the system would be greatly improved by having the Energy Coach conduct the first meeting in our home, so he can see what we're talking about. The conversation got stymied at times, because it took a while for him to fully understand certain aspects of our house."	**Communication** (-) Lack of direction **Home Visits***

*This quotation was captured over the phone and recorded as accurately as possible by the researcher.

Table 6: Full Dataset for Household Structure

Question E2: *Please indicate below the number of household members in each age range.*

Household Member 0-18	Household Members 19-64	Household Members 65+
0	0	2
3	2	0
0	2	0
2	2	0
2	2	0
1	2	0
0	0	2

0	2	0
0	2	0
1	2	0
1	2	0
2	2	0
3	2	0
0	2	0
0	2	0
0	3	0
0	1	0
0	1	0
3	2	1
3	2	0
0	2	0

Section 2: Monthly Surveys

Table 7: Coach Helpfulness/Unhelpfulness on Monthly Survey #1 (n=10)

Question 3/4: *For those activities you rated the coaching service "helpful", how did the coaching service help? For those activities you rated the coaching service "unhelpful", what could the service do better?*

Respondents' Comments	***What*** **the Energy helped with**	***How*** **the Energy Coach helped**
"Give an overview on the report and discussion of concerns we had with our house and ways to correct the problems (e.g. high humidity, condensation on windows)."	▪ Audit report ▪ Renovation plan	**Building skills/capacity** Procedural information **Information provision** Clarification Options
"He was helpful in getting me to get off my behind and put everything together to get the project started."	▪ Renovation plan (getting started)	**Other support** Motivation
"Helped clarify the priorities of specific tasks, understand trade-offs between various options."	▪ Renovation plan	**Information Provision** Clarification Option evaluation
"Helped me to understand the options for insulating and helped me to communicate more effectively with the contractor."	▪ Renovation plan ▪ Contractor relationship	**Building skills/capacity** Communication with contractor **Information provision** Options
"Helped understand the nuances of our energy audit, and create a better workplan. It also helped us work out what questions to ask while getting quotes from	▪ Audit report ▪ Renovation plan ▪ Contractor relationship	**Building skills/capacity** Communication with contractor **Information provision**

contractors."		Clarification
"Identified what we could do ourselves. We are still in progress with that part and weather will prevent completion of DIY until spring thaw and warmth increase outdoors."	▪ Renovation plan	**Building skills/capacity** Procedural information (DIY)
"The coach gave me an idea of the budget that I would need in the future as well as the planning that I would need to complete when I decided to renovate."	▪ Renovation plan (future) ▪ Budget	**Information provision** Planning
"The coach helped to determine what items we could change that would save the most amount of energy based on the budget we have to work with."	▪ Renovation plan	**Information provision** Option evaluation
"We appreciated being able to review and evaluate our plans for retrofitting our home. Coach shared helpful information with us. Coach also helped us apply for an 'extension' to our renovation schedule."	▪ Renovation plan ▪ 'Extension' application	**Information provision** Option evaluation
"We were able to get ideas of what we could do. Because there are no big incentives we are in no rush."	▪ Renovation plan	**Information provision** Options

Section 3: Exit Survey

Table 8: Factors Influencing Renovation Plan (Other than Energy Coach) (n=10)

Question A4: *Did factors other than the Home Energy Coach play a role in the renovations that you decided to proceed with?*

Respondent Comments	Theme and Sub-Theme
"Aesthetics of the house was an additional issue."	**Other** Aesthetics
"Cost and contractor availability."	**Professional network** Contractor availability **Financial** Cost of renovations
"Explanation of direct vent hot water heater, how to insulate a crawl space and cold cellar."	**Skills/capacity** Procedural information
"I also received info from REEP staff prior to this to clarify R24 cutoff for increased rebate for basement reno."	**Professional network** REEP staff information
"Our house was rated as about average for efficiency. After doing the math, it seemed that only draftproofing was worthwhile given our current budget."	**Financial** Return on investment

"Money."	**Financial** Cost of renovations
"More the $$ incentive from Union gas."	**Financial** Access to rebates
"Radon testing. Architect design ideas."	**Professional network** Architect design ideas
"The Energy Audit that indicated the rate of full air exchanges made us determined to have a lower carbon footprint in our home's energy use. We wanted to see if we could improve our Energuide (tm) rating."	**Environmental concern** Reduce carbon footprint
"The right thing to do, cost, putting on new roof."	**Environmental concern** "Right thing to do" **Financial** Cost of renovations **Other** Concurrent with other renos

Table 9: Additional Challenges Faced in Renovations (n=8)

Question A7: *In addition to the factors mentioned above, were there factors that you considered to be challenges that you faced in your renovations?*

Respondent Comment	Theme and Sub-Theme
"Cost- expensive! Haven't tried to access incentives, but doesn't look so easy…"	**Financial** Access to rebates, Cost of renovations
"Ensuring consistent aesthetic during a multi-stage renovation."	**Aesthetics** Maintaining consistency
"I felt like it might have been helpful for the energy coach to talk directly to my contractor since my attempts to communicate were sometimes ineffective because of my lack of understanding of the process."	**Contractors** Communication **Skills/Capacity** Communication
"I'm going to be a senior labourer."	**Skills/Capacity** Age
"It's overwhelming and confusing."	**Skills/Capacity** Uncertainty
"Managing the timing of contractor contributions to the project, i.e. my ability to work was held up at one point related to delay in contractor being able to do the work."	**Contractors** Availability
"Planning this before Christmas was a bad idea. There was a month where nothing could be done, due to contractor unavailability."	**Contractors** Availability
"Second time for me mudding drywall - I am getting better, but not perfect. Glad it was basement and Garage walls where shelving is to be attached! Inaccessible header addressed by insulating Garage wall. Header insulating and caulking was difficult to access."	**Skills/Capacity** Complex DIY renovations

Table 10: Enablers that Helped Respondents Overcome Challenges (n=14)

Question A6: *From the question above, you noted that some activities were* ***somewhat*** *or* ***very difficult*** *during your renovation process. How do you think you were able to overcome these challenges? (eg. Help from family/friends, internet searches, community programs etc.)*

Respondent Comments	Theme
"Change priorities so they can be done."	**Other/Unspecified** Time
"Finding the money for everything to be done, not an expert on these changes- so hopefully they are correct."	**Other/Unspecified** Money
"Hoping REEP will still let me know of any government incentives that might be retroactive."	**Support networks** REEP
"Internet help, I am my own labourer and general contractor."	**Self-directed research** Internet
"Internet searches provided confirmation of our Roxul (tm) decision. Time to do the renos was based on our work/vacation schedule - and some things did not go as fast as anticipated. Local supplies of materials made it easier."	**Self-directed research** Internet **Support networks** Local suppliers **Other/Unspecified** Time (Vacation)
"Lack of time: Setting a realistic/lengthy timeframe seems like the best approach (given that I work full time and have 3 children)."	**Other/Unspecified** Time
"Money and time are restrictions within renovations. I had family help when it came to both."	**Social networks** Family, friends
"More time when holidays arrive and to recruit friends and family."	**Social networks** Family, friends
"Multiple conversations with family and friends in the construction business as well as REEP staff suggestions."	**Social networks** Family, friends **Support networks** REEP
"Research on Internet."	**Self-directed research** Internet
"The rebate program should be helpful."	**Support networks** Rebate
"While adding attic insulation is straightforward. Determining a good solution for window replacement is still daunting. There are a very large number of suppliers and contractors to sift through. For windows replacement I am going to have to spend more time doing internet searches and talking to contractors."	**Self-directed research** Internet Contractors
"It is still extremely difficult and so we have not taken any real action."	n/a
"Timing seems to be an insurmountable issue with contractors: both finding them, and then locking down a work schedule. We also had some difficulty in ensuring the work was done to our standards, given we are at work during the time the renovations are being done."	n/a

Table 11: Helpfulness of Energy Coach in Overcoming Challenges (n=15)

Question A8/9: *Was the Energy Coach* ***helpful*** *in overcoming any of these challenges? If so, how was the Energy Coach helpful? (eg. directing you to resources, helping to create a workplan etc). If the Energy*

*Coach was **not helpful** in overcoming some of these challenges, how could the Coach have been more helpful to you? Please be as specific as possible.*

Was the Energy Coach helpful in overcoming any of these challenges? If so, how?	**Interpretation of Coach Helpfulness**	If the Energy Coach was not helpful in overcoming some of these challenges, how could the coach have been more helpful to you?"
"Coach helped us find resources that helped with some of the issues - especially doing the garage wall once he made a house visit - and the one outside wall - which we would not have done had it not been for the energy coach. Coach also confirmed our need to wait for weather before we did overhang insulation for foam to be applied."	Helpful	"One of the challenges was pot light draft-proofing. Energy Coach recommendation was not possible for our retro-fit pot lights, but manufacturer had a product which we were able to install. We did not provide energy coach with the brand info of our 22 pot-lights."
"He was very helpful."	Helpful	"He was very helpful."
"It was helpful that I could go back to the energy coach multiple times to clarify information."	Helpful	"Would have liked to have met in person rather than just on the phone so that he could see exactly what my house needed."
"The Energy Coach made it much easier to understand the best actions to take based on the Home Energy Evaluation Report."	Helpful	n/a
"Yes."	Helpful	
"Yes, deciding which renos to do, the order, and getting specific advice about technical aspects of several of the renovations."	Helpful	It would have been helpful to have the energy coach come onsite at least one time.
"Yes, it was based on costs."	Helpful	
"Yes with the options for insulating the basement".	Helpful	Not applicable
"He was of some help indicating which windows he had used in his own renovation, but not so much that I feel like I can proceed without doing significant research."	Somewhat helpful	"Again, because the variety of window supplier and models is huge, some narrowing down of that field would have been helpful. Outlining a handful of window lines, contractors to install them, and the pros and cons of the different models would have been the most helpful."
"Provided some helpful information."	Somewhat helpful	
"Somewhat limited help."	Somewhat	"Provide onsite feedback of specific

	helpful	issues the need to be addressed. This would help prioritize the renovation."
"Sort of. Would like someone to look at what I did, and walk me through the rebate process."	Somewhat helpful	"See above."
"No".	Not helpful	"The coach was helpful."
"Not good at translating the knowledge and making it accessible to us."	Not helpful	"Being better at communicating information in ways someone outside the field can understand. Breaking down concrete and realistic steps to take."
"Not really. The list of contractors was the same as the companies we had short-listed in our own search, so that was comforting."	Not helpful	"A home visit earlier in the process would have been very helpful. Then we could have asked more specific questions before moving ahead. It all seemed a bit rushed."

Table 12: Changes to Renovation Plans on the Exit Survey (n=12)

Question A2: *Did you complete/do you plan to complete different renovations than you had intended once you received your Home Energy Evaluation Report? If so, in what way? (eg. Did/do your renovations differ in type, extent or sequence?)*

Type of Change to Renovation	Details on Changes to Renovations	Energy Coach Influence?	Details on the Influence of the Energy Coach
Type	"Adding to the attic insulation was not something I had intended on doing and was the first recommendation from the Home energy report. It will be the first renovation I do."	No	"The energy coach did not influence my decision to do it. He made it seem more reasonable to do it myself, which reduces the cost of the retrofit."
Extent	"Decided to insulate entire bedroom as well as bathroom, and found holes in basement that we now will insulate."	Yes	n/a
Sequence	"Doing basement sooner than planned."	No	"More the $$ incentive from Union gas."
n/a	"Hoping to still replace some doors and windows and add further insulation to the attic at some future time."	Yes	"The coach influenced the priority to which I gave the renovations as money was limited and I wanted to do what was most important."

Extent, Type	"I insulated the cold room and sealed it. Also, I modified the basement wall insulation to be a wet wall, and increased the insulation value to R28 using 2 layers of Roxul batt insulation. I also capped the unused fireplace chimney."	Yes	"Yes, during our face to face to meeting in ?Nov/Dec."
Extent, Type	"New tasks: draftproofing, plan to add an HRV/ERV. Extent: amount of insulation to add to basement."	Yes	"Helped me evaluate amount and type of insulation to add to the basement walls. Helped me evaluate type of HRV/ERV."
n/a	"No difference, the plan is to stay within the parameters of union gas [coperate] plan."	Yes	"Coach advised that an insulated door to the cold room would be a second stage that was required."
n/a	"Not at this point - everything that I have done so far has been something that my contractor was intending on completing."	Yes	"Renovations in the future, however, will likely be slightly modified to complete things like replacing windows and wall insulation in addition to aesthetic improvements."
Sequence/ Priority	"The evaluation helped us prioritize, and do our basement and attic insulation earlier. It also showed the wall insulation was less important than attic/basement."	Yes	"The evaluation was very helpful, and then Philip's visit to our house helped define final plans, and next steps."
Type	"Type differed - used Roxul Board (tm) rather than Styrofoam board due to Roxul's higher fire rating, and similar moisture barrier rating. Chose to use Roxul Batts in studded walls for their higher fire rating."	Yes	"Coach influenced decision in first meeting by pointing our DIY possibilities and potential materials to consider."
Extent	"Upgraded attic insulation from r-20 to r-50 to take advantage of rebate program."	Yes	"Yes, he said it would be the best thing we could do to make our home more efficient."
Sequence, Type	"We are not doing renovations we thought we would immediately (new furnace)."	Yes	"Said it was fine."

Table 13: Comments on Program in Relation to Program Expectations on Exit Survey (n=8)

Question D4: *If the Home Energy Coach Service was above or below your expectations, please elaborate in the space provided. What are your expectations, and how did the service perform above or below these?*

Respondents' Comments	Theme/Sub-Theme
"DIY openness of the coach encouraged us in our renovation plans and scope."	**Building Capacity/Skills (+)** Encouraged DIY
"I hoped for more assistance clarifying the report and helping us translate that into constructive action."	**Information Provision (-)** Lack of translation into action
"I was hoping for more direct advice in selecting products and suggesting reliable contractors."	**Information Provision (-)** Lack of specificity
"It wasn't as intensive or personalized as I expected."	**Personalization (-)** 'Standard' rather than personal
"Only thing, I would like it for them to sit with me to apply for rebates…"	**Information Provision (-)** Unclear rebate process
"Since we didn't proceed with any renovations based on our report it's tough to elaborate. The coach was great in explaining and answering our questions and giving us a feeling on how much value we would get out of doing any specific changes to our home in terms of energy savings."	**Information Provision (+)** Options evaluation
"The inspection was done right away, the types of insulation were on display at the office."	**Information Provision (+)** Visual aids
"The service itself was interesting, but I received a standard report and fairly standard advice about my home without being able to access any monetary incentives."	**Personalization (-)** 'Standard' rather than personal

Table 14: Program Improvement Suggestions on Exit Survey (n=10)

Question D5: *If you could change any aspects of the program, what would they be?*

Respondent Comments	Theme
"Earlier home visits. More communication (we didn't quite know how much we could get in touch with the coach. I realize now we could have asked a lot more than we did -- but we were so busy with organizing the reno that we didn't really have time to be checking in.)"	Communication Home Visits
"Expand Union Gases directive."	Rebates
"Extend it"	Extension
"Going through an intermediary to set up calls with the coach."	Communication
"Home visits"	Home Visits
"It would have been more helpful for me if the Home Energy Coach was offered a little longer. His availability was primarily over the winter which is when renovations are less likely to be carried out. If he was available through to the fall I would have more likely engaged his services after the initial consult."	Extension
"It's a good program."	n/a

"More specific information about the renovation as opposed to general information."	Specificity
"Only thing I would like it for them to sit with me to apply for rebates…"	Rebates
"The person who came to do my home evaluation was more helpful than the coach. He explained to me some of the factors in the house that make it energy efficient/inefficient. He also pointed out specific small actions that could improve things. I think he would be an excellent Home Energy Coach."	n/a

Table 15: Key Attributes of a Successful Energy Coach (n=5)

Theme/Key Characteristic	Interviewee Quotation
Aware of homeowner goals and capacity Knowledgeable Objective Personable	"I want someone who doesn't try to take one solution and cram it into every different situation, someone who is able to assess different situations objectively. The ability to listen and apply suggestions that are relevant to me would be a key characteristic. Another one would be knowledgeability, knowing what the options are."
Aware of homeowner goals and capacity Knowledgeable Personable	"I would say super knowledgeable, really good listening skills in terms of figuring out what the homeowner wants and can afford to do. And since I said, even though a lot of people want to do the right thing, it's nice if there's a rebate. So a successful one might walk me through the paperwork process of completing those rebates."
Aware of homeowner goals and capacity Knowledgeable Personable	"I'm looking for someone who can give good rationale for solutions. I'm also looking for someone who has the practical ability to translate the rationale or the science into something in the marketplace that exists. … Sometimes, I'm looking for environmentally-friendly materials, so I want someone with knowledge of those, because those are specialized and harder to find on the internet. And then practicality in terms of affordable and for me as a do-it-yourselfer, practical solutions that I might be able to manage. And then the last thing, which I would rank fourth on the list, is personability, and the ability to listen and work with a person in terms of communication and that sort of stuff."
Aware of homeowner goals and capacity Knowledgeable	"Knowledgeability and the ability to help craft a plan are really essential. And being understanding of different priorities … Having good knowledge of all the different options that are out there, and how they can impact a specific space is really valuable."
Knowledgeable	"One that can talk you through everything that's a possibility. [Regarding Union Gas Rebate Program] A coach that follows parameters I think."

Appendix M: Survey Questions Not Included in Thesis

Some questions were included on the survey instruments for the program partners and were not directly related to the objectives of this thesis. However, for the sake of completeness the responses are included in this appendix.

Section 1: Initial Survey

Question A2. Please complete your household's planned home energy retrofit timeline by filling in the month and year for each activity.

Respondents were asked to estimate their renovation timeline for initial retrofits and all retrofits. Two participants did not provide a clear month and year estimate (eg. early 2016). Eighteen out of 21 respondents suggested the initial phase of their retrofits would occur in the near term – here, interpreted as completed by the end of 2016. Three respondents did not provide an estimated timeline for their initial retrofits. In terms of completing all retrofits, the responses were quite mixed. Eleven out of 21 respondents suggested that all of the household's renovations would be completed at some period in 2016, while several others indicated renovations would occur by 2017, and others suggested ongoing renovations or did not provide a timeline for the completion of all renovations.

Question E6. What decision-making role do you usually play in the following activities?

	Controlling thermostat temperature	Purchasing new appliances	Running appliances at particular times	Total
Primary decider	11	8	6	25
Collaborator	9	13	14	36
Not engaged in the decision	0	0	1	1
Total	20	21	21	62

Section 2: Exit Survey

Question A10: If you could begin your renovations again, is there anything that you would find helpful to know from the beginning to make the process easier for your household?

Respondent's Comments
"How long it would take, and how hard it would be to live with the mess and disorganization. How long it takes to find contractors, and for them to find time in their schedules. That spray foam insulation isn't enough in the header space. (We only were told this during the home visit, after the work was done.

Had we known earlier, we would have asked for additional spray foam or some additional work by the contractor to ensure the insulation of those spaces.)"
"I can't think of anything."
"Renovations usually take longer than all parties are expecting them to."
"More information."
"No."
"No."
"No."
"No."
"N/A."
"Not at this time."
"Takes for time than planned."
"That the manufacturer of pot lights should be consulted up-front. Material, time and effort was wasted in trying to make dry-wall coverings for a potlight design that required draftproofing from the inside rather than outside."
"The energy coach was not available during the planning and early decision making phase of this project. This would likely have saved me a lot of time around the planning of the project, especially if he could have come onsite to advise re: various decisions I was unsure about."
"What is most useful to do, and how to do in in a cost effective manner."

Question C1: Did the Energy Coach provide you with any behavioural advice to help you save energy in your home (eg. unplugging appliances when not in use, doing laundry during off-peak hours)?

Respondent's Comments
Yes.
Yes.
Yes - direct vent hot water heater.
Yes - multi-plug timed extension and lighting suggestions.
Yes - reducing electricity usage of hot tub.
Yes - the above, as well as adding a home office to reduce the commute.
Yes - there was some discussion.
Yes - though I knew those.
Yes - to a degree.
Yes - use of power bars, LED light fixture, programmable thermostat.
No.
No.
No.
No.
No.
No – never discussed as recalled.

Question C3: Are there any household behaviours that you have changed as a result of your meetings with the Energy Coach (eg. unplugging appliances when not in use, doing laundry during off-peak hours)?

Respondent's Comments
No.
No.
No.
No.
No.
No.
No.
No.
No – we did those things previously.
No – we were already doing a most of what was suggested.
No – we were doing it before.
None.
Not really, no.
Yes - laundry and dishwasher during off-peak hours.
Yes - turning off lights when leaving and at night and getting kids to do it.
Yes - using appliances in off-peak hours.
Yes - try to be mindful of time of day when I do dishes or wash.

Question B3: Would you have preferred another method of interacting with the coach? If yes, please elaborate in the space provided.

On the exit survey, respondents were then asked if they would have preferred another form of consultation, for which five respondents indicated they would have. Two respondents indicated they would have preferred an 'at-home' visit – for one participant, this option had not yet been offered. The other three respondents indicated that they would have preferred to utilize the in-person consultation option rather than consulting over the phone. As an aside, one respondent suggested that they be able to set up consultations with the coach directly, rather than through an intermediary (ie. the REEP Green Solutions office).

Appendix N: Sample Residential Detail Level 2 Report from Municipal Property Assessment Corporation

mpac

Residential Detail Level 2 Report

Property Address: 123 ONTARIO ST

Municipality: ANYTOWN

Roll Number: 1234111222333000000

Assessed Value*: $927,000

Property Code & Description 301 - Single-family detached (not on water)

Legal Description: CON B PT LOT99 RP 99RP9999

Last Valid Sale Date (yyyy/mm/dd) 2010-06-28
Last Valid Sale Amount $830,000

Services:

Hydro	Water	Sanitary	Heating	Air Conditioning
Y - Hydro available	M - Municipal	M - Municipal	FA - Forced Air (gas/oil) Heat Pump / Solar	No

Lot Details:

Frontage (ft)	Depth (ft)	Site Area
69.13	144.03	9,956.79 F

Building Permit Information:

Number	Issue Date (yyyy/mm/dd)	Expiry Date (yyyy/mm/dd)	MPAC Work Description	MPAC Status
05-1038	2005/11/17	2006/10/06	New Building	Complete

Primary Structures:

Structure Code & Description	301 - SINGLE FAMILY DETACHED
Year Built	2006
Total Floor Area(Above Grade)(sq ft)	3,585
First Floor Area (sq ft)	1,660
Second Floor Area (sq ft)	1,925
Third Floor Area (sq ft)	-
Basement Total Area(sq ft)	1,795
Basement Finished Area(sq ft)	60
Full Storeys	2
Partial Storeys	-
Bedrooms	4

Full Bathrooms	3
Half Bathrooms	1
Renovation Year	-
Addition Year	-

Garage Structures:

Structure Code & Description	116 - ATTACHED GARAGE
Year Built	2006
Total Area (sq ft)	760
Garage Spaces	3

NOTE: Under Assessment Act a number of changes have been made to the property assessment system, which became effective in the 2009 property tax year. These changes include the introduction of a four-year assessment update and a phase-in of assessment increases. For more information regarding Assessment Updates visit www.mpac.ca

*Assessed Value is based on a January 1, 2012 Valuation Date.

**Phased-In Assessment reflects the phased-in portion of the Assessed Value returned to the municipality/local taxing authority on the 2014 Assessment Roll for the 2015 taxation year.

Appendix O: Additional Data Collected from Municipal Property Assessment Corporation Reports

Table M-1: House Structural Characteristics (taken from MPAC, 2016)

	Count	Average	Median	Minimum	Maximum	Standard Deviation
Total Floor Area (Above Grade) (sq ft)	21	1,821.14	1,751	991	2,943	625
Full Storeys	10 - 1 11 - 2					
Partial Storeys	2 - 0.25 2 - 0.5 2 - 0.75					
First Floor Area (sq ft)	21	1,187.62	1,162	733	1,800	305
Second Floor Area (sq ft)	16	814	756	214	1,457	
Third Floor Area (sq ft)	1	280	280	280	280	
Basement Total Area (sq ft)	21	1,159	1,043	634	1,833	
Basement Finished Area (sq ft)	13	580	513	181	1,466	
Bedrooms	21	3.33	3	2	6	
Full Bathrooms	21	1.81	2	1	3	
Half Bathrooms	21	1.07	1	1	2	

Table M-2: Additional House Characteristics

			Number of Households in Sample	Number of Households in Sample (%)
Property Description	Row house		1	5
	Semi-detached		1	5
	Single family detached		19	90
Services	Air conditioning	Yes	16	76
		No	5	24
	Heating*	Electric baseboard	1	5
		Forced air	19	90
		Hot water (boiler)	1	5
	Hydro	Hydro available	1	5
	Sanitary	Municipal	12	57
		Septic bed	1	5
		Unspecified	8	38
	Water	Municipal	12	57
		Private well	1	5
		Unspecified	8	38