Exploring Householders' Interest in Home Energy Goal-Setting

by

Eric Mallia

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

Waterloo, Ontario, Canada, 2011

© Eric Mallia 2011

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

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

Eric Mallia

Abstract

The deployment of advanced metering infrastructure, most notably in the residential electricity sector, and the development of energy monitoring technology, has enabled and justified the exploration of more sophisticated systems to energy management in the home. Previously, energy usage feedback has been shown to help householders to learn and to adapt usage behaviour. However, these systems are still in their infancy and exploration of householder interest in them, and their designs, is needed to assist in the diffusion of this innovation.

The effectiveness of feedback has been found to be enhanced when it is shown relative to a conservation goal. Additionally, disaggregated feedback has been found desirable to householders and has helped them to learn. However, little is understood about how disaggregated home energy feedback *relative to a goal* can be designed to help householders to conserve. This study explored interest in home energy goal-setting through a web-based survey of Ontario householders.

Inferential statistics showed, with 95% confidence, that 35% to 37% of urban Ontario homeowners with post-secondary education would be strongly interested in setting home energy goals – and 29% to 31% would be willing-to-pay at least $6 per month for home energy goal-setting technology. Both financial and environmental reasons were often cited by respondents for their interest. Interest in home energy goal-setting did not relate to experience or interest in setting 'non-energy' goals but was significantly and positively associated with: (1) awareness in the environmental impact of energy usage, (2) pro-sustainability attitudes and behaviours, (3) desire to reduce usage, (4) desire to learn, and (5) motivations to help society. Householders preferred web-based feedback to other mediums such as in-home displays or bills. They also identified goal-based appliance-specific feedback as desirable but found the graphical presentation of multiple appliances on one page confusing, and instead preferred numerical presentations. Both extrinsic and intrinsic benefits to home energy goal-setting were supported by respondents and the most cited barrier to goal-setting was that it takes a lot of time. However, it is expected that a home energy monitoring system would help mitigate this potential barrier since progress would be tracked and reported automatically.

Acknowledgements

Studying the development and implications of a sustainable society is something that I have cherished during my two years as a graduate student in the Department of Environment and Resource Studies (ERS) at the University of Waterloo. As part of this experience, I have had the opportunity to work with, and learn from, many wonderful people and to whom I would like to acknowledge first.

To begin, I would like to acknowledge the outstanding support and mentorship of my thesis advisor, Dr. Ian Rowlands. Conversations with Ian during this process have been both enlightening and enjoyable and I am very appreciative of his sincerity, humility, professionalism and humour. I would also like to thank Dr. Paul Parker for sitting on my thesis committee and for so willingly opening his office door to chat about this research and other projects I had on the go. Paul has been a constant and reliable 'energy coach' for me as a graduate student. Ian and Paul have also provided me with opportunities to share my work more broadly and for this I am also grateful.

I have also had the pleasure of being inspired and educated by several other professors in the Faculty of Environment including Dr. Bob Gibson, Dr. Paul Kay, Dr. Jennifer Clapp, Dr. Jennifer Lynes, Dr. Steven Young, Dr. Len Tsuji, Dr. Geoff Lewis and Dr. Goretty Dias. I thank them for adding their own expertise and contributions to my personal and intellectual development through course work and other projects. And, in the Faculty of Engineering, I was fortunate to work closely with Dr. Roydon Fraser, Dr. Michael Fowler, and Dr. Leonardo Simon on several projects relating to the transportation sector. These experiences also contributed to my understanding of novel and critical approaches to developing a more sustainable society and these have greatly influenced my pathway forward beyond graduate school. I would be remised if I did not acknowledge the ongoing administrative support of Jennifer Nicholson and Maureen Grant who were always happy to answer my questions throughout this process.

To my classmates and friends in ERS, thank you for helping to make learning fun and for developing a great support network for one another throughout the process. And, thank you to Chrisa Hoicka for our productive discussions and exchanges of ideas on these energy issues and research methods.

I would like to thank the Energy Hub Management System project team members and partners including the Ontario Centres of Excellence (OCE), Hydro One Networks Inc. (Toronto), the Ontario Power Authority (OPA), Energent Incorporated (Waterloo), and Milton Hydro Distribution Incorporated (Milton) for their support of this research.

I am very grateful for the support of my family and loved ones. My two brothers, Ryan and Stephen, have allowed me to 'test' my energy management ideas with them before they ever appeared in a formal research proposal and I thank them for supporting me through all my endeavours and adventures in life. To my parents, a huge thanks for their unconditional support and for being incredible role models of hard work and humility. And, finally, to Charlotte, thank you for listening to my seemingly endless ideas from graduate school and, most of all, thank you for helping me love every day of this journey.

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

1.1 Introduction of the Issues

Continual and rapidly increasing demand for energy has resulted in an increase in the world's total primary energy supply by more than 100% in the last three decades (IEA, 2010). While energy is a resource that helps sustain and develop social systems, the extraordinary increase in the amount of emissions created by the production and consumption of energy has presented several environmental problems. The methods used to generate electricity, for example, continue to require large amounts of resource extraction and, in many regions, the burning of fossil fuels in thermal power plants are contributing to climate change and other issues of reduced air quality. In addition to the environmental issues, social and economic concerns exist regarding the cost of energy and the security of energy supply systems. Although 'cleaner' and renewable sources of electricity generation are being developed, they are not being deployed quickly enough to sufficiently address all of these concerns (Dietz et al, 2009).

Conservation and demand-side management (CDM) offers solutions to help address, at least in part, concerns about how to supply a sufficient amount of energy that helps to meet our social and developmental needs, while mitigating environmental harm. The emerging development of advanced metering infrastructure (AMI) in electricity systems, for example, is expected to help facilitate CDM initiatives and it is anticipated that these will expand at a rapid pace. As explained in a recent article in the mainstream media, "while much of this technology is still in its infancy, North America-wide AMI deployments will rapidly accelerate" (Relich, 2010).

The use of 'smart' meters will provide electricity utilities and governments with the capacity to enhance their CDM initiatives since these meters can collect electricity consumption data in time intervals (i.e. consumption levels are 'time stamped'). Access to this level of detail in residential electricity consumption data permits CDM initiatives such as time-of-use pricing that could help incentivise consumers to conserve and reduce on-peak demand. Smart metering data also has its advantages for consumers of electricity. By augmenting smart meters with in-home electricity usage feedback technology, it has been shown, in several cases, to lead to increased pro-conservation behaviours in the residential sector (Darby, 2006; Faruqui et al, 2009). Feedback has developed as a "learning tool, allowing energy users to teach themselves

through experimentation" (Darby, 2006, p.3). However, the extent to which feedback has been effective at stimulating energy conservation behaviours has varied. In the studies reviewed for this thesis, the conservation savings were in the range of 0% to 22%. The large variation in results highlights the complexity of multiple variables affecting the success of in-home energy feedback strategies.

In several residential energy feedback studies, for example, it has been shown that employing a strategy which incorporates a conservation goal was more effective than providing feedback alone (Becker, 1978; Van Houwelingen & Van Raaij, 1989; McCalley & Midden, 2002). In addition, householders have identified that more granularity in the feedback (e.g. consumption data presented by room or appliance, rather than for the whole household) would help them to target and reduce wasteful energy consumption behaviours (Fischer, 2008).

The purpose of this study was to investigate householder interest in disaggregated home energy goal-setting and performance-based feedback. To operationalise goal-setting in the context of home energy management, an examination of the home energy feedback literature was conducted. Three types of comparison standards were identified as a form of fostering pro-conservation behaviours in the home: (1) historic comparisons, (2) normative comparisons and (3) goal-based comparisons. In the literature review, goal setting theory in relation to home energy conservation and in broader applications was examined to identify the current state of knowledge regarding the use of goal-setting to motivate behavioural change. This review of the literature helped identify the social and academic needs to explore householders' interest in home energy goal-setting and various strategies to performance-based feedback. To help fill this gap in knowledge, householders in Ontario were surveyed and presented with various feedback design options. Their responses helped to identify: (1) the extent of their interest and existing experiences, (2) the type of households that would likely be most interested, (3) the design elements that are most preferred and (4) the potential benefits and barriers to home energy goal-setting. The rest of this chapter will introduce the geographical, political and social context in which this study took place.

1.2 Energy and Sustainability in a Canadian Context

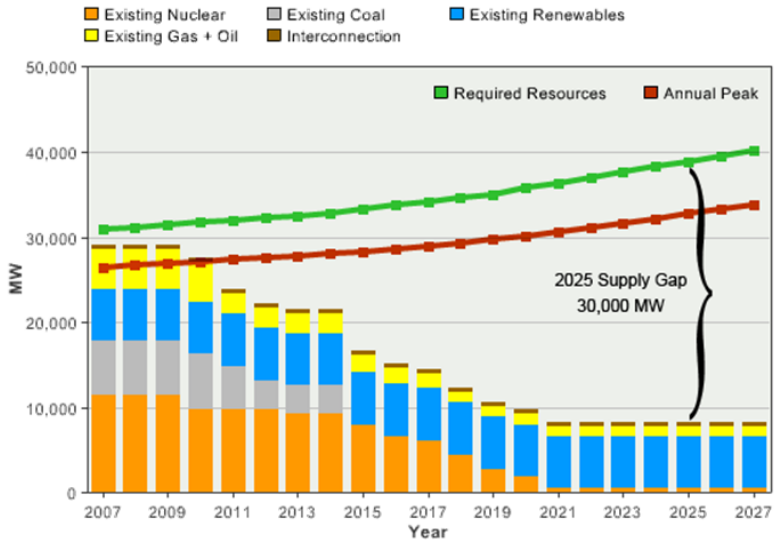
In 2002, Canada ratified the Kyoto Protocol and set a goal to reduce its greenhouse gas (GHG) emissions to 6% below 1990 levels by the year 2012 (UNFCCC, n.d.). Some groups have suggested that Canada's energy resource-based economy, cold climate and large geography have made it challenging for the country to meet its GHG emissions reduction targets (CE, 2010). The challenge is further intensified in the residential sector by population growth and increasing consumer demand for larger homes and more 'small' electric appliances (e.g., home entertainment systems, cell phones, kettles, microwaves, personal computers, etc.). From 1990 to 2007, energy use in Canadian homes grew by 12% and energy use required for small electric appliances grew by 123% (NRCan, 2010a). During the same period, Canada's population grew by 19% and the average living space per home in Canada grew by 10% (NRCan, 2010b). Meanwhile, GHG emissions from electricity generating facilities have increased by 37% from 94 mega tonnes of CO_2 equivalent (Mt CO_2e) to 129 Mt CO_2e (NRCan, 2010c). From 2005 to 2020, it is projected that the Canadian population will grow by 11% and the number of households in Canada will grow by 20% to a national housing stock of 15 million (NRCan, 2010b).

These growth rates in relation to the residential sector highlight that there are more Canadians, in bigger homes, using more energy consuming devices than ever before. In order for Canada to make significant improvements in reducing its GHG emissions associated with the residential sector, innovation is required in the technology used to generate, distribute and manage energy while also addressing the way consumers perceive and manage their energy consumption. In May 2009, the province of Ontario, one of Canada's top electricity consuming regions (second only to Quebec), passed a Green Energy and Economy Act (GEA) with an objective to rebuild the energy system in the province and to initiate growth in cleaner and renewable sources of energy supply. Additionally, the GEA aims to "create the potential for savings and better managed household energy expenditures through a series of conservation measures" and to set electricity conservation targets for local utilities to help them deliver effective programmes to households and businesses (OMEI, 2010a). The GEA in Ontario also builds on plans to phase-out the Province's coal-fired power plants by 2014 (OMEI, 2010a). In the next section of this chapter, the Ontario energy context is provided in greater detail.

1.3 Electricity Generation in the Province of Ontario

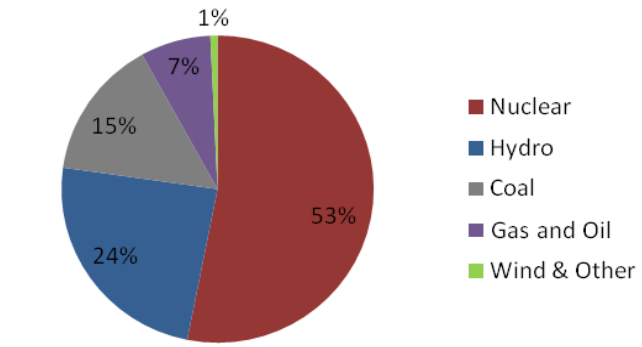
According to the Ontario Ministry of Energy and Infrastructure (OMEI), the installed electricity generation capacity in the province of Ontario is approximately 31,000 megawatts (OMEI, 2010b). In addition, existing nuclear facilities are nearing their end of life and, without refurbishment of their reactors, would be almost entirely phased-out of the generation mix by 2020 (OMEI, 2010b). The Ontario government is faced with the challenge of a generation capacity gap of 30,000 MW by the year 2025 if no further investments are made in electricity supply and demand-side management strategies (OMEI, 2010b). This supply gap is shown in Figure 1.

Figure 1 - The Anticipated Electricity Supply Gap in Ontario (OMEI, 2010b)



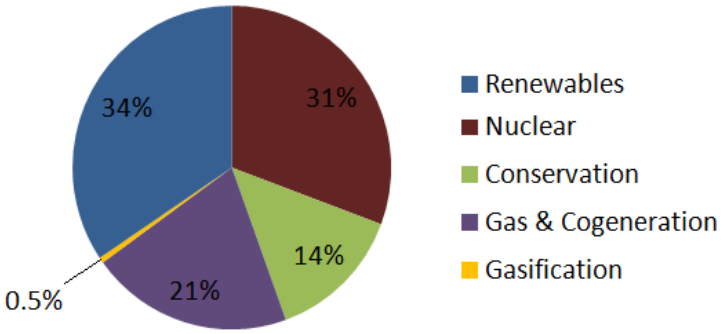
Since most of the non-renewable sources of electricity generation in Ontario will be coming to the end of their life in the next 10 to 15 years, the Ontario government needs to decide how it will meet the anticipated electricity supply gap. Four options that are often mentioned in the political discourse are: (1) investing in conservation and demand-side management; (2) importing electricity from neighbouring jurisdictions; (3) investing in new electricity generation technology; and (4) expanding and refurbishing existing facilities. Figure 2 shows Ontario's electricity generation supply mix in the year 2008.

Figure 2 - Ontario Electricity Generation Supplied in 2008 (IESO, 2010)



The Ontario Power Authority (OPA) is the governing body in the province "responsible for reliable, cost-effective and sustainable supply of electricity for Ontario. Its main activities are focused on strategic co-ordination conservation efforts across the province, planning the power system for the long term and ensuring the development of needed generation resources" (OPA, 2010a). The OPA has developed an *Integrated Power System Plan (IPSP)* as "a road map of generation, conservation and transmission decisions and opportunities to ensure Ontario has the power it needs into the future" (OMEI, 2010b). Figure 3 shows the planned electricity generation capacity mix for 2025.

Figure 3 - Ontario's Targeted Electricity Generation Capacity Mix in 2025 (OMEI, 2010b)



In Figure 3, 'Renewables' include hydroelectric, wind, solar, geothermal, biomass and biogas sources of electricity generation and make up the largest proportion of the targeted capacity mix for 2025. It is anticipated that the 'Feed-in-Tariff' (FIT) programme, launched in 2009, will help stimulate growth in the renewable sector. As part of this plan, nuclear capacity will be maintained at current levels with the refurbishment of existing facilities and/or the

construction of new facilities. Natural gas facilities, primarily used as a 'peaking' source of electricity generation right now, are known to be a cleaner source of electricity generation relative to coal and the expansion of natural gas generation (including cogeneration) is planned (OMEI, 2010b). The remaining supply gap anticipated by 2025 (14%) is planned to be met by conservation and demand-side management (CDM) strategies for the Ontario electricity system. Some CDM initiatives have already begun including investments in advanced metering technology (e.g., smart metering of Ontario households), time-of-use pricing policies for some jurisdictions, conservation awareness and education and various rebate and financial incentive programmes (for a complete list of these programmes, see OPA, 2010c). This thesis will explore the extent to which Ontario householders' could be engaged in CDM strategies to help meet the province's conservation goals. The OPA also created a 'Technology Development Fund' which "assists innovative energy technologies that will improve the supply and conservation of electricity – are in the pre-commercial stage – and require funding for development, demonstration or verification" (OPA, 2010b). The next section of this chapter will discuss one such technology which is being developed through a project led by researchers at the University of Waterloo.

1.4 The Energy Hub Management System Project

The purpose of the Energy Hub Management System Project is "to develop and to implement an Energy Hub Management System that will allow static energy users to manage effectively their energy requirements. More specifically, this project will empower energy hubs – that is, individual locations that require energy (e.g., manufacturing facilities, farms, retail stores, detached houses) – so that they can contribute to the development of a sustainable society through the real time management of their energy demand, production, storage and resulting import or export of energy" (UW, n.d.). The investigation carried out for the purpose of this thesis on householders' interest in home energy goal-setting was nested within the broader Energy Hub Management System Project at the University of Waterloo. Part of the objectives of this home energy goal-setting investigation has been to assist in the development and deployment of a residential energy hub management system in pilot homes in the city of Milton, Ontario. In addition, this investigation sought to provide reliable information for the benefit of

the project, society and the academic literature, regarding residential energy users and their interest in this innovation.

One of the key elements of the residential energy hub management system is to provide householders with a web-based portal to serve as an interface between them and the system installed in their homes. Indeed, the aim of this research, at least in part, was to help inform the design of the system's interface so that it is user-friendly and helps motivate pro-conservation behaviours in the home. More information regarding the development of the interface for testing in this investigation is discussed in the 'Methodology' section of this thesis. The Energy Hub Management System Project has been co-funded by the Ontario Centres of Excellence (OCE), Hydro One Networks Inc. (Toronto), the Ontario Power Authority (OPA), Energent Incorporated (Waterloo), and Milton Hydro Distribution Incorporated (Milton). The collaboration of government, industry and academia is a fitting one for this research in light of the GEA objective of "setting electricity conservation targets for local utilities and help them to deliver effective programs to households and businesses" (OMEI, 2010a).

1.5 Structure of the Thesis

After this introduction chapter, the thesis includes five more chapters. Chapter 2 presents a review of the literature studied for this thesis – including previous residential energy conservation initiatives, home energy feedback studies and goal-setting theory. In Chapter 3, relevant explanations for, and justifications of, the qualitative and quantitative methods used for this investigation are presented. In addition, limitations to the investigation are stated. In Chapter 4, the results from a web-based survey are shown and they are later statistically analysed and discussed in Chapter 5. The thesis concludes in Chapter 6 with recommendations and suggestions for future work.

Chapter 2: Literature Review

2.1 Introduction and Chapter Outline

In this chapter, the findings from the literature review undertaken for this thesis are presented. This review has included articles relating to household resource management, energy usage feedback and goal-setting. The purpose of the literature review was three-fold:

1. To identify the current state of knowledge and critical issues with regards to home energy management;
2. To inform the design and development of a user interface as part of the Energy Hub Management System project; and
3. To help determine the appropriate methodology for this investigation.

The literature reviewed for this chapter included articles from both the academic and grey literatures through searches in the Web of Science and Scopus databases and with Google Scholar. A variety of academic articles, private reports, websites and books were examined in order to sufficiently meet the purposes of the literature review presented in this chapter.

This chapter contains several sub-sections following this introduction. First, the unique challenges of household energy management will be presented, followed by a section summarising the key findings regarding research on residential energy conservation strategies. These key findings lead to a more specific look at the use of comparison standards and goal-setting as 'tools' to help motivate householders to conserve energy in their homes. In addition, a review of goal-setting theory and its relevant concepts and the key findings from goal-setting studies more generally are presented. The chapter will conclude by synthesising the reviewed literature into critical issues needing further examination and the identification of the research objectives for this thesis.

2.2 Challenges Relating to Home Energy Management

Several articles in the literature helped to identify the challenges for householders to conserve energy in their home. For example, Darby explained that residential energy usage is largely invisible and "this invisibility comes about in a number of ways: through connection to huge hidden distribution networks; through lack of thought about energy unless it becomes

expensive or suddenly scarce; through design for convenience or utility rather than for visibility and learning; and through obscure metering and billing systems" (Darby, 2000, p.2). Fischer argued that electricity consumption "involves activities as diverse as listening to music, cooking meals, working with the computer, or making a phone call... in each of these activities, conservation means a different set of behavioural modifications. It is difficult for the consumer to link all these various activities and develop a coherent, comprehensible, and concise cognitive frame of what 'electricity conservation' could mean in everyday life" (Fischer, 2008, p.80). Since energy consumption is not easily seen and not well understood, the environmental impacts of energy consumption are largely disconnected from the individual consumer decisions made in their home (Darby, 2000). Energy information regarding the impact of energy usage behaviours is required to allow householders to make informed decisions about how best to manage their home's energy usage – taking into consideration all, or at least some, of the factors that would influence such a decision for them.

2.3 Consequence and Antecedent Strategies to Home Energy Management

Consequence interventions provide information to householders *after* they have performed a behaviour (or series of behaviours) in their homes. In the context of home energy management, there are several types of consequence interventions including:

(1) Feedback – providing consumers with information relating to their own energy consumption behaviours;
(2) Rewards – providing incentives to householders to perform energy conservation behaviours which could be in the form of monetary or non-monetary rewards; and
(3) Recognition and Criticism – praising or criticising householders for their behaviour in relation to a comparison standard (Abrahamse et al, 2005).

The effectiveness of feedback has varied, however it is believed that home energy feedback is more effective at reducing energy consumption when provided continuously rather than periodically (Van Houwelingen and Van Raaij, 1989). Monetary rewards can provide extrinsic motivation to householders to perform pro-conservation behaviours (Wood and Newborough, 2007) although several studies found that the change in behaviour due to incentives and monetary rewards was not sustained over time, particularly after the reward is no longer

provided (McClelland and Cook, 1980; Slavin et al, 1981). Providing non-monetary rewards, such as achievement and recognition is another type of consequence intervention strategy that has been argued as an effective approach to invoking pro-conservation behaviours (McKenzie-Mohr and Smith, 1999). However, unlike monetary rewards, achievement and recognition provides intrinsic, rather than extrinsic, motivation to perform pro-conservation behaviours – and the recognition could be positive or negative. For example, in one study, Shultz et al (2007) provided households with positive and negative recognition in the form of 'happy faces' (for conserving more energy than a neighbourhood average) and 'sad faces' (for conserving less energy than a neighbourhood average). The study found that households that received these 'emoticons' saved more energy than householders that only received descriptive information about their consumption.

Antecedent interventions provide information to householders *before* performing behaviours in their homes. There are several types of antecedent interventions that relate to home energy management, including:

(1) Commitment – a promise or pledge to change one's behaviour in the future;
(2) Goal-setting – a specific goal to attain, either self-set or assigned, such as reducing electricity usage by 10%;
(3) Information – the promotion of energy conservation behaviours that could be provided in several ways including general workshops, brochures, mass media campaigns and home energy audits; and
(4) Modelling – providing examples of preferred or suggested behaviour (Abrahamse et al, 2005).

All of these strategies for behavioural change have been found effective in various studies in the literature, however, each of them have their limitations. Commitment, for example, has been effective at motivating household energy conservation; however, in some studies the effectiveness of commitment on energy conservation was found to be short-lived (Katzev and Johnson, 1984). Goal-setting has been shown to be effective at stimulating reductions in household energy consumption when combined with other interventions such as performance-based feedback (Becker, 1978; McCalley & Midden, 2002; Van Houwelingen & Van Raaij, 1989), although conservation results are generally related to goal difficulty (Becker, 1978). Information alone has often been found to be more effective at increasing awareness and

knowledge levels, rather than at changing behaviours – except in some cases where tailored information was provided in the form of home energy audits (Winett et al, 1982-1983; Gonzales et al, 1988; Hirst et al, 1981). And, according to one study, modelling conservation behaviours through a TV programme was an effective way to temporarily reduce energy consumption in households that were exposed to the intervention, but the energy savings were not maintained in the long-term (Winett et al, 1985). In these studies and other articles found in the literature, this problem is commonly known as the 'fallback effect' – that is, "the phenomenon in which newness of a change causes people to react, but then that reaction diminishes as the newness wears off" (Wilhite and Ling, 1995, p.147) – and is often cited as a challenge with antecedent strategies to home energy conservation.

All of the consequence and antecedent strategies have been found to be effective, to some degree, at invoking pro-conservation behaviours; however, it is well established in the literature that continuous feedback based on energy conservation results is generally more effective than information alone (Van Houwelingen & Van Raaij, 1989). Perhaps more importantly, however, is the enhanced conservation effect achieved by interventions that combine multiple strategies (e.g., Hirst et al, 1981; Van Houwelingen & Van Raaij, 1989). As Wood and Newborough describe, "the most effective energy information is that which captures the attention of the audience, gains involvement and is credible and useful in the user's situation. It is not simply the informational content given, but the way in which the information motivates the consumer into action that is important" (Wood and Newborough, 2007, p.496).

As discussed, studies have suggested that feedback – that is, information about the results of past behaviours – is necessary to enable individuals to learn about, and from, their behaviours. Indeed, several studies have found that providing householders with energy usage feedback has led to conservation results (Darby, 2006; Fischer, 2008; Faruqui et al, 2009). In the case of home energy conservation, it is reasonable to suggest that feedback would, therefore, serve as a motivation tool for householders to conserve energy in their homes. Insights from cognitive dissonance theory could help to explain why. The theory explains that when an individual realises that his behaviours are inconsistent with his values, he is likely to be motivated to make whatever adjustments possible to reduce such dissonance (either adjusting behaviour or values to bring them in line with one another) (Festinger, 1957). As an example, some householders may believe that they should be as efficient as possible at using energy in their homes, but they cannot

act upon those desires without understanding if and where wasteful behaviours may be occurring. If householders learn, through energy usage feedback, where their values are inconsistent with their behaviours, it can motivate them to change.

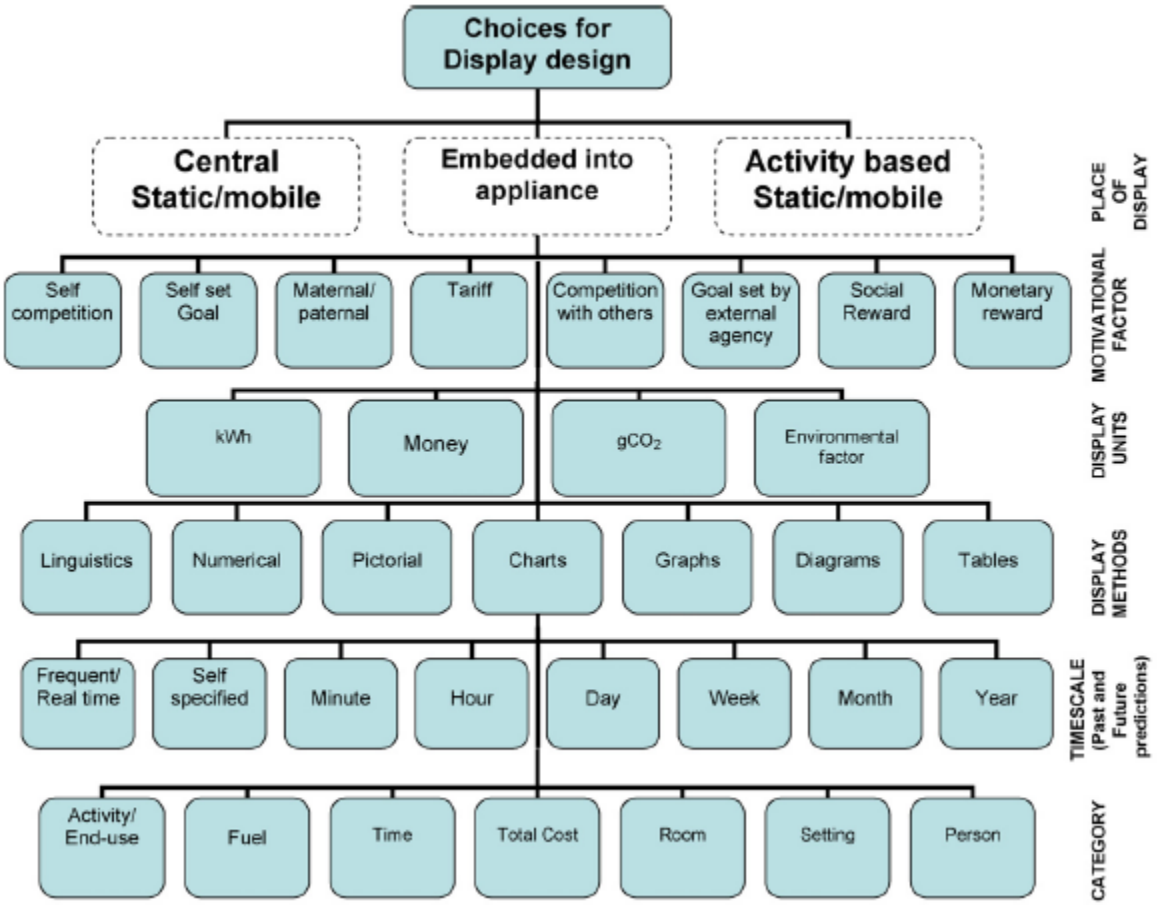
Taking into consideration the cognitive dissonance theory, computerised real-time feedback can help address the other energy management challenges presented earlier in this chapter. It does this by making consumption levels more visible; by incorporating ecological indicators (e.g., CO_2 emissions associated with consumption levels); and by simplifying a complex set of behaviours into manageable 'end-use categories' that help identify target behaviours for conservation (or at the least for better management). Moreover, by providing householders with clear 'performance indicators' in relation to their values (or expected behaviour), they can understand better whether or not their actions are consistent with their personal values regarding energy consumption in their homes.

2.4 Designing Home Energy Usage Feedback

Designing information to be presented to householders about their energy usage behaviours involves many data visualisation considerations and choices. This means that there are many possibilities in the realm of feedback and the task of this section is to present them and suggest what warrants further development and examination. Figure 4, from Wood and Newborough (2007), provides a good summary of the factors influencing the design of home energy usage feedback. These factors include: (1) placement of the feedback, (2) behaviour change motivational factors, (3) units of measurement, (4) visualisation methods (e.g., numbers, graphs, tables, etc.), (5) frequency of feedback, and (6) level and type of data granularity.

Figure 4 – Factors Influencing the Design of Home Energy Feedback

(Wood and Newborough, 2007, p.496)



In addition to the six considerations identified in right hand column of Figure 4, other authors have identified more factors including the type of behavioural change sought (McKenzie-Mohr and Smith, 1999; Froehlich et al, 2010), and the use of generalised or tailored energy conservation tips (Fischer, 2008).

Researchers of home energy behaviour that consider the design of energy usage feedback, have suggested that two types of conservation behaviours in the home should be evaluated: (1) purchase-specific energy efficiency behaviours – which are one-time actions that provide a long-term conservation outcome; and (2) reoccurring curtailment behaviours – which refer to the creation of new routines to reduce environmental impact and/or energy costs.

In a review article of eco-feedback technology studies, Froehlich et al. (2010) found that a large majority of eco-feedback technologies focused on curtailment behaviours, rather than

one-time efficiency behaviours in the home. The advantages of focusing on curtailment behaviours included the ability to target discretionary usage, often with simple and inexpensive changes in usage patterns (e.g. remembering to turn-off the light or adjusting the thermostat). However, as presented earlier, ensuring that behaviour change is prolonged and does not suffer from the 'fallback effect' has been a challenge. Some have argued, instead, that efficiency behaviours provide greater opportunity for conservation because they are one-time changes that *are* prolonged (Gardner and Stern, 2009), while others contend that in some cases the 'rebound effect' – the loss of efficiency gains due to added consumption elsewhere – often counteracts the conservation benefits of one-time energy efficiency behaviours (Greening et al, 2000). Despite the arguments for and against targeting either type of conservation behaviour, it is important that designers of energy conservation interventions understand which behaviours they are trying to motivate, and under what household conditions they are working, in order to incorporate the appropriate behaviour change strategies into their intervention (Froehlich et al, 2010; McKenzie-Mohr and Smith, 1999).

In some cases, interventions have provided either energy efficiency or curtailment tips to try to foster pro-conservation behaviours in the home. However, *generic* energy conservation tips have been found to be of little interest to householders (Fischer, 2008). Therefore, when incorporating energy conservation tips to stimulate pro-conservation behaviours, it may be more effective to offer tips that are *tailored* to specific inefficiencies found in each respective household receiving feedback.

In terms of placement of the feedback, it is established that feedback is more effective when provided more frequently and is readily-accessible (Van Houwelingen & Van Raaij, 1989). However, one article explains that for some end-use categories, certain design elements are likely more suited to central displays than appliance-specific displays. For example, Wood and Newborough provide examples of previous studies that led to the conclusion that graphical formats are more relevant to central displays than displays embedded on an appliance (Wood and Newborough, 2007). And, according to the same article, there is conflicting information regarding the effectiveness of bar charts versus line graphs – although the authors acknowledge that line graphs are likely more appropriate to demonstrate changes over time (Wood and Newborough, 2007). Numerical, graphical, tabular, pictorial and symbolic techniques are some of the ways to present energy usage feedback and the appropriate strategy is likely determined by

context – as described above. Therefore, various designs strategies and elements should be tested with potential future users.

Behaviour change motivational strategies in terms of energy usage feedback, like other design considerations, are diverse, but they all generally rely on householders wanting to meet some sort of 'performance' standard. For example, comparisons to one's previous consumption or the consumption of one's neighbour have been used to motivate behaviour change with varying results. Additionally, a specific and challenging self-set or assigned goal as the main comparison standard has been studied and shown as an effective motivational factor. Comparative feedback examples like these, and more broadly defined as providing results-based information to householders relative to a meaningful reference point, will be presented next.

2.5 Motivating Behaviour Change and Household Resource Management

Relative to descriptive information alone, energy consumption feedback in homes can inform householders of more than just 'what they are doing', it also has the added benefit of explaining 'how they are doing' relative to a comparison standard. In order to ensure that the information provided to householders is meaningful, it needs to be compared to a relevant point of reference. The use of comparison standards has been shown, in some studies, to motivate participants of a treatment group (who received the comparative feedback) to conserve more energy than participants of a control group (Siero et al, 1996; Darby, 2006; Fischer, 2008). Typically, two types of comparison standards have been considered for residential energy usage feedback:

(1) *The historic standard* – comparisons of current energy consumption relative to one's own energy consumption from an earlier time period; and
(2) *The normative standard* – comparisons of current energy consumption relative to energy consumption of another home in the same time period (either of similar profile or within the same neighbourhood).

Several articles in the literature have explained that both of these comparisons have been successful at impacting the behavioural decisions of householders (Darby, 2006; Fischer, 2008), although several drawbacks have been identified for each of them.

2.5.1 Historic Standards

In several studies, using energy consumption from a previous billing period has been an effective standard of comparison (Darby, 2006). Indeed, these studies have shown that some householders are motivated to conserve less energy than they did for a comparable time period. And, for most intents and purposes, past (or historic) energy consumption is a reasonable source of data to use when trying to understand the typical behavioural patterns in one's home. For example, if householders are curious to understand how much energy is required to heat their homes in the winter time, they may very well look at how much energy they needed in the preceding winter season. However, multiple factors influencing the level of energy consumption will usually change over time. For example, accounting for changes in the number and types of energy consuming devices and household occupants provides a challenge when comparing consumption of two or more periods of time. Moreover, fluctuation in weather patterns will likely have an influence on the amount of energy demanded for space heating and space cooling in a household. In some studies, energy consumption data has been 'weather-corrected' by using a method referred to as 'degree days' to account for fluctuations in weather (see, for example, Van Houwelingen & Van Raaij, 1989). A degree-day is typically set as the "deviation of the outside average day temperature by one degree below 15 degrees Celsius, this being the temperature below which home heating" was normally used (Van Houwelingen & Van Raaij, 1989, p.99). One challenge for designers of home energy feedback is the fact that weather-adjusted data – for example, with degree days – is likely not well understood by many householders. Furthermore, it could be difficult to choose accurately the outside temperature at which home heating will be used – indeed this threshold will be different for every household.

In addition to weather changes, other factors influencing household resource consumption could also change over time. For example, consumption may *decrease* when householders are out of their home for extended periods of time (e.g., on vacation) or if energy efficiency retrofits have been recently implemented. In these examples, energy conservation could very well be a matter of circumstance, rather than a change of habitual, reoccurring behaviours – thus making historical consumption less appropriate as a comparative measure than say, adjusted historical data that helps account for these other factors. Similarly, home energy consumption could *increase* for numerous reasons such as an increase in the number of household occupants or less time spent away on vacation. These constantly changing variables

can make historic comparisons less relevant to current realities and make energy usage feedback less meaningful.

2.5.2 Normative Standards

Social norms have been used in many cases to foster pro-conservation behaviours in households (McKenzie-Mohr & Smith, 1999), although their effectiveness as a strategy to motivate home energy conservation has shown mixed results (Fischer, 2008; Froehlich et al, 2010; Wood and Newborough, 2007). Normative comparisons have generally been more effective when behaviours are made visible among peer-groups because social pressure would exist to conform to the norm (McKenzie-Mohr & Smith, 1999). However, in some cases, social norms have actually led to *increases* in consumption where householders learned that they are consuming less than their peers (Shultz et al, 2007).

Darby (2006) contends that normative comparisons are typically challenging motivators for behavioural change for several reasons. First, she explains that householders have been found to be interested in the comparison for the sake of knowing how they compare, but not always for the sake of behavioural change. Second, Darby and others have cited studies where householders were sceptical about the choice of their comparison group (Darby, 2006; Wood and Newborough, 2007). In another study, it was found that some participants "responded quickly and positively to the fact that [a] graph showed that they were using less than their neighbours, but they rejected the concept as generating false comparisons" (Simon et al., 2004, p.15). Similarly, in a UK survey with 136 respondents, "self–other comparisons were considered the least useful way to gauge whether consumers had been using unnecessary amounts of energy" (Wood and Newborough, 2005 as cited in Wood and Newborough, 2007). Finally, the literature also suggests that comparisons between households present a logistical challenge since they rely on adequate databases that need to be built up over time (Fischer, 2008).

In general, studies have found that even when comparative feedback is effective at fostering pro-conservation behaviours, eventually a 'performance plateau' is reached, after which the effects of historic and normative comparison standards are no longer effective motivators (Froehlich et al, 2010). Using 'injunctive' norms, which describe how one ought to behave, rather than 'descriptive' norms which describe how others have behaved, has been effective in some cases at prolonging the effect of comparative feedback (Shultz et al, 2007; McKenzie-

Mohr & Smith, 1999). Determining desirable planned behaviour and the impact of performance-based feedback relative to one's energy usage goal has been studied as well (Becker, 1978; Van Houwelingen & Van Raaij, 1989; McCalley & Midden, 2002). One study examining the effectiveness of various motivational strategies with regards to energy-saving behaviours recommended that "goal setting is a generally successful motivational method, [therefore] this factor should be part of the design philosophy for both local (i.e., located at or on the appliance) and central energy consumption displays" (Wood and Newborough, 2007, p.502). The concept of a new comparison standard based on goal-setting theory and the theory of planned behaviour is explored further in the following sections of this chapter.

2.5.3 Goal-Setting and Performance-Based Feedback

Recent research has suggested that there is a need to better understand the effectiveness of a third comparison standard which compares householders' current energy consumption relative to planned (or desirable) levels of future energy consumption. Providing feedback in the context of desirable levels of consumption requires a method of establishing what is in fact desirable. This method could be established by consumers or suggested to them. The theory of planned behaviour (Ajzen, 1991) would suggest that motivating householders to conserve energy depends, at least in part, on establishing an intention to conserve and the individual's perceived level of control (in this case to conserve energy). In this way, the theory of planned behaviour is linked to feedback theory. Feedback is a mechanism that can be used to inform householders about their previous (and even current) energy usage behaviours – which is required information to know how and where one might begin to conserve energy in the home. In addition, feedback can help householders establish desirable levels of consumption, by understanding historic and current behavioural patterns. Feedback, coupled with an assessment of one's current and future household attributes, can help householders establish conservation goals that are meaningful to them. In so doing, householders can begin to make personal commitments regarding planned energy usage, have better perceived control of outcomes, and could become more actively engaged in the exercise of home energy management. As discussed earlier, one of the commonly cited problems with providing householders with energy usage information is the 'fallback effect' which occurs when consumption returns to previous levels after the novelty of

the information wears off. However, if householders remain active at reviewing consumption patterns and planning desirable levels of future consumption, it is possible to imagine that householders would be less likely to experience a fallback effect and act accordingly to achieve their goals.

Anderson and White (2009, p.44) explain that "we know that some people lose interest in a real-time display quite rapidly but little, so far, about how interest may be maintained and developed. Little is known as yet about the uses of displays for predictive and feed-forward feedback, and how they could help people to budget." This finding suggests that the ongoing exercise of managing a household's energy budget might help maintain and perhaps develop interest in energy usage feedback over time. Although home energy budgeting is not a concept that has been investigated (or even defined) previously, some interesting studies have been conducted to learn more about the role of goal-setting and performance-based energy feedback in the home. This may suggest that the term 'goal-setting' is preferred to 'budgeting', although further research could help determine if this is the case. One suggestion is that perhaps 'budgeting' is less preferred of a term to feedback designers and householders alike because it could be interpreted to mean 'living with limitations' whereas 'goal-setting' could be perceived as a more positive strategy to resource management since it involves the implicit satisfaction of goal achievement.

Three goal-setting studies in the literature were particularly important for this thesis because they have identified how goal-setting and performance-based feedback have already been studied in a home energy context. These three studies, along with some earlier work on goal-setting more broadly, will be presented in the following section. These studies have helped identify the current state of knowledge regarding home energy goal-setting and what additional research would serve to advance the literature going forward.

2.6 Goal-Setting

2.6.1 Goal-Setting and Task Performance

Some of the most influential contributions to the study of goal-setting and performance feedback have come from the oft-cited social psychologist, Edwin Locke. Locke explains that information on its own is effectively neutral and has no effect; however, "a goal provides a

standard by which the person can judge if the feedback represents good or poor performance. To explain the effects of feedback it is necessary to know what, if any, goals or standards the person uses to appraise it'' (Locke, 1991, p.16). In a comprehensive review of goal-setting and task performance, Locke examined several social psychology studies that investigated how goals affect human behaviour and found that the following factors are important in regards to goal setting: (1) goal acceptance, (2) goal commitment, (3) expectations of goal attainment, (4) pre-existing values, and (5) whether or not the goal was assigned or self-set (Locke et al, 1981). Goal acceptance and goal commitment are similar, but the former suggests that the goal is assigned whereas the latter could apply to assigned or self-set goals. Expectations of goal attainment (also referred to as 'goal achievement') have been found to have an effect on the choice of goal difficulty for those of which are self-selected (Locke et al, 1981). In addition, past performance of relating to goal attainment was also found to impact goal acceptance and the expectations of goal attainment going forward (Locke et al, 1981).

In relation to setting home energy goals, the two previously discussed comparison standards – historic and normative comparisons – may influence both the choice of goal difficulty and the expectations for goal attainment. However, Locke et al (1981) also found that one's self-confidence may influence the individual's goal choice and expectations of goal attainment. The perceived value of attaining the goal can serve as a motivating (or discouraging) factor to try to achieve the goal as well (Locke et al, 1981). Therefore, home energy goals that are associated with meaningful motivating factors for achievement will likely be more effective than goals without such benefits. One concern with providing extrinsic incentives and rewards as a motivating factor, however, is the 'fallback effect' that has occurred, in some cases, when conservation gains achieved through incentivising behaviour are eventually negated when the incentives are removed (McKenzie-Mohr & Smith, 1999). Alternatively, it is also recognised that the perceived benefit from goal attainment may include intrinsic rewards, such as the satisfaction of achievement (Locke et al, 1981). This is an important finding in the context of residential energy conservation because, in many cases, the financial incentives from conservation (e.g. energy cost reductions on a monthly bill) will be only a small proportion of the household's disposable income (McCalley & Midden, 2002). In fact, intrinsic motivations, such as the satisfaction gained from goal achievement for residential energy consumers that set their own goals, might be a way of fostering pro-conservation attitudes and could reinforce goal

commitment and support stronger expectations of goal attainment. This does not suggest that there are no extrinsic (or monetary) benefits from household energy conservation; rather that these benefits might be too small to significantly motivate behavioural change and that creating intrinsic rewards through goal achievement might be a more resilient strategy.

There is a small, but important set of studies, which provides evidence to support the enhanced value of incorporating goal-setting and performance-based feedback into home energy management strategies. The following section of this chapter reviews three important studies in the area of home energy goal-setting and serves to identify the research gaps for this investigation.

2.6.2 Goal-Setting for Residential Energy Usage

An interesting goal-setting study by Lawrence Becker (1978) analysed the joint effect of goal-setting and residential electricity feedback. In this study, it was found that householders conserved more electricity if they were assigned a difficult goal (20% savings) than if they were assigned an easy goal (2% savings). It was also found that householders that received performance-related feedback in relation to their goal saved significantly more electricity, on average, than householders that had the same goal assigned but did not receive feedback. The average savings for the 20%-goal group that received feedback was 15.1%, while the average savings for the 20%-goal group that did not receive feedback was only 4.5%. Even though in both cases the 20% goal was not attained, the study showed that the group that received both a 20% 'challenging' goal and goal-based feedback was the only group to consume significantly less electricity than the control group that did not receive either. The group with a 2% conservation goal did not consume significantly less than the control group.

In a study of natural gas consumption, similar results were found with regards to goal-setting and feedback for householders (Van Houwelingen & Van Raaij, 1989). In this study, four treatment groups were given information about how to conserve natural gas in their homes, but only one was assigned a conservation goal (of 10%). The other three groups received a mix of feedback coupled with conservation tips, information alone or were asked to self-monitor consumption at their gas meter. These four groups were later compared to two control groups that did not have goals assigned, did receive feedback or conservation tips, and were not asked to

self-monitor consumption levels. The only treatment group that had statistically significant ($p<0.01$) conservation success (12.3% savings) relative to the control groups was the group that had the conservation goal (10% savings) and daily performance feedback. With a higher p-value ($p<0.05$), one other treatment group, which received monthly usage feedback and conservation tips but did not have a goal, had statistically significant conservation performance (7.7%) relative to the control groups – however, this result was still considerably lower than the group that had a goal assigned. Therefore, this study found that householders that had a goal and frequent performance feedback conserved more energy than householders that did not have a goal. However, it is hard to know whether the difference between the comparison groups was because of the assignment of a goal or because of the more frequent feedback, which suggests a further examination that better controls for these confounding variables would be valuable.

In a more recent study, McCalley and Midden (2002) explored the effects of goal-setting and feedback at the appliance level through a technologically advanced washing machine control panel. As a part of this laboratory study, 100 participants were asked to do 10 trail loads of laundry in order to establish a baseline of electricity consumption per subject. From the initial 100 participants, four comparison groups of 25 participants each were created – three treatment groups and one control group. The first treatment group was provided with feedback about their electricity consumption, but these participants did not have a conservation goal. The other two treatment groups also received feedback regarding their consumption, but one group of participants was assigned a conservation goal of 20% and the participants in the other groups were asked to choose their own goal from a range of options (0%, 5%, 10%, 15%, or 20%). The majority of participants setting their own conservation goal chose 20%, while the average goal for this self-set goal group was 15%. The control group did not receive feedback and did not have a goal. The results showed the average conservation savings were high in both the assigned goal group and the self-set goal group – 19.5% and 21.9% savings respectively. In addition, "the results also confirm that the success of goal-setting is not dependent on whether the user is anticipating large monetary savings as the amounts of possible energy, and thus also monetary, savings per wash are very small" (McCalley and Midden, 2002, p.599). This finding is important when contextualising the significance of goal-setting in residential energy conservation. These findings reinforce the suggestion that intrinsic motivators for goal attainment might be strong drivers for behavioural change, which is important since monetary

savings from energy conservation might be relatively small in proportion to a household's total financial budget. One limitation to this study was that the test subjects participated in a laboratory setting rather than in their homes. In their homes, it is possible that multiple variables, not included in the laboratory setting, could influence their behaviours (for example, the actual need to pay a 'real' utility bill). However, this study is one of the rare cases where energy conservation in relation to goal-setting and task performance feedback has been tested at the appliance level; yet, little is known about how appliance-specific goals can help consumers more effectively set and manage conservation goals for their entire household. Further work in this regard is needed. As explained by McCalley and Midden (2002, p.590), "the use of appliance-specific product-integrated energy feedback is a relatively unexplored path to a potentially large, untapped, conservation resource." This finding has helped clarify the research need that will be explored in this thesis. The following section provides an introduction to the potential advantages and disadvantages of home energy goal-setting with disaggregated (i.e. appliance-specific) performance-based feedback before proceeding to the research objectives for the thesis.

2.6.3 Goal-Setting Residential Energy Usage at the Appliance Level

Enabling residential energy consumers with the ability to set and manage appliance-specific energy goals could be beneficial for several reasons.

First, it allows consumers to break down total household energy usage into more manageable end-use categories and tasks. Breaking down large goals into smaller end-use specific goals might help householders systematically construct goals for the household as a whole. It could also provide continual learning as various appliances and devices would often impact the household goal differently at different times of the day, month or year.

Second, appliance-specific feedback helps identify areas of inefficient usage (either from inefficient devices or wasteful behaviours). This feedback is important in order to target specific behaviours that could be altered in an effort to attain one's conservation goal. In addition, providing householders with 'personalised' conservation tips based on the appliance-specific performance-based feedback could be more impactful than providing 'generic' tips alone. In general, a personalised approach to energy conservation tips in the home has been found to be

more desirable than generic ones (Fischer, 2008). However, little is known on how personalised tips might interact with disaggregated performance-based feedback and in turn strengthen householders' expectations of goal attainment and perceived behavioural control. It is hypothesised that such a relationship would exist, and as explained in a recent review of electricity feedback studies, "one unanimous finding is that households in all countries approve [of] feedback that is more detailed and more closely linked to consumption actions. It gives them a sense of control" (Fischer, 2008, p.100). Despite the desire to have end-use or appliance-specific feedback, "most previous studies have considered displays of total household consumption, rather than the consumption of individual appliances or activities" (Wood and Newborough, 2007, p.496).

Third, providing residential consumers with appliance-specific feedback is a customer service opportunity for utilities since householders have identified that appliance-specific feedback is something which they desire (Fischer, 2008).

Although the opportunities for appliance-specific goal-setting are compelling, one concern with setting appliance-specific goals is that it might lead to 'home energy management fatigue', since it involves more effort than previous studies and displays have incorporated (Wood and Newborough, 2007). Therefore, a challenge exists in providing detailed disaggregated feedback that is simple to understand and to act upon. In the context of goal-setting, 'self-set' goals at the household level with 'suggested' goals at the appliance-level (e.g., calculated based on a series of assumptions and parameters) may help to simplify appliance-specific goal-setting – or at the least, help to relieve the potential anxiety of setting too many goals at once.

2.7 Summary, Recommendations and Research Needs

The reviewed literature showed that further investigation is required to examine the opportunities for home energy goal-setting with disaggregated performance based feedback. For example, several studies in the literature showed that householders typically conserve more energy when they are working towards realistic, yet challenging goals and receive ongoing frequent feedback about how they are tracking relative to their goals. In addition, goal-setting theory suggests that goal achievement (and arguably, progress towards goal achievement) is an

intrinsic motivator for behavioural change – and possibly attitudinal change as well. Yet, this is not well understood in the context of home energy goal-setting.

As identified, energy usage feedback relative to a goal can help reinforce (or clarify) expectations regarding goal achievement and give householders a greater sense of control. The knowledge that personal satisfaction from goal achievement is an effective intrinsic motivator is an important finding from the literature because extrinsic benefits such as financial savings from home energy conservation, on their own, are believed to be weak motivators. As explained by Wood and Newborough, displaying 'performance' in terms of actual monetary savings was suggested as ineffective "due to the small financial savings associated with individual energy-saving behaviours" (Wood and Newborough, 2007, p.502). Providing performance feedback as savings in energy units, for example in kilowatt-hours, has not been recommended as a good motivator neither since "consumer understanding of scientific units is limited. For example, the majority of us do not understand energy units and experience difficulty in estimating how much energy will be needed for different end-use events" (Wood and Newborough, 2007, p.499). Similar arguments have been presented for performance feedback based on one's reduced environmental impact, for example grams of CO_2 emissions, since these units are at times abstract and sometimes questioned by householders (Anderson and White, 2009; Wood and Newborough, 2007). Instead, using personal satisfaction from goal achievement as a motivator for home energy conservation is an interesting alternative requiring further examination. This research will seek to compare the relevance of intrinsic versus extrinsic motivations in relation to the achievement of home energy goals.

In addition, the problematic occurrences of the fallback and rebound effects on energy conservation gains raise the question: can actively setting and managing home energy goals increase householders' 'engagement and interest' in home energy management activities (for example, reviewing usage patterns, thinking about how behavioural changes might impact performance towards goal achievement, discussing energy usage behaviours with others in the home, etc.) and thus lead to more resilient pro-conservation attitudes and behaviours in the long-term?

Behaviour change literature (e.g., McKenzie-Mohr and Smith, 1999) would also suggest that self-set goals would lead to 'stronger' goal commitment than goals that are assigned by an external agent (e.g., a utility or government ... or researcher!), although more research is needed

to understand how this distinction impacts energy consuming behaviours in the home. And, "if an energy consumption display is to facilitate goal setting, the target level has to be considered carefully. If a goal is too easily achieved its effectiveness may be limited, while unrealistic goals can cause distress" (Wood and Newborough, 2007, p.497).

Providing disaggregated usage information, by appliance for example, has been identified as a desirable feedback feature to householders (Fischer, 2008), although only a few studies tested appliance-specific 'comparative feedback', and these were limited to feedback provided at or near one appliance (for McCalley and Midden, 2002, it was a 'clothes washer' in a laboratory study and for Wood and Newborough, 2003, it was a 'cooker' in 44 homes). More research is needed to understand how a centralised feedback mechanism (e.g., an in-home display, web-based portal, etc.) with appliance-specific goal-setting might help householders to budget and target wasteful energy consuming behaviours. Furthermore, little is known about how best to display this information to householders. Wood and Newborough (2007) contend that numerical data have been used in field studies with appliance-specific feedback, but no studies have examined numerical versus graphical data on appliance-specific displays – and certainly not with the enhanced feature of appliance-specific goals. Therefore, a research need here is identified that asks the questions: (a) how would appliance-specific goal-based feedback be best designed and (b) how will householders become engaged in the act of setting and managing home energy goals?

Not to be forgotten here is the reality that each household is unique, with various attributes, demographics, experiences, awareness levels and attitudes, and as such, home energy goal-setting may be more or less desirable to each individual household. Therefore, it would also be useful to know who would be interested in home energy goal-setting and what motivates them to participate. In other words, who are likely to be the early adopters of home energy goal-setting and what characteristics would be used to describe them? Rogers (1995) describes early adopters as members of society that recognise the intrinsic and/or convenience value offered by an innovation. Therefore this research will seek to understand which householders in Ontario are motivated to set and achieve home energy goals and for what reasons. And, finally, designers and marketers of home energy goal-setting technology and tools would benefit from a clearer understanding of the potential benefits and barriers perceived by householders to home energy goal-setting. As described by McKenzie-Mohr and Smith (1999), marketers of pro-sustainability

behaviours should emphasise the benefits of such behaviours while mitigating potential the barriers to adoption.

2.8 Research Objectives

The purpose of this thesis, then, is laid out in this section with the following objectives:

Objective #1 – Determine the extent to which Ontario householders are interested in home energy goal-setting and why.

Objective #2 – Determine which Ontario householders are most likely to be the early adopters of home energy goal-setting.

Objective # 3 – Collect householders' opinions and reactions to goal-based feedback design options.

Objective # 4 – Determine some of the relevant perceived benefits of, and barriers to, home energy goal-setting.

The following chapter in the thesis will present the methods used to meet these research objectives.

Chapter 3: Methodology

3.1 Introduction

This study seeks to explore householders' interest in home energy goal-setting, and to describe how this understanding of householders can help to advance the design of home energy management systems that provide tailored energy feedback relative to a goal. This exploratory study also aims to help develop a better understanding of home energy feedback that is meaningful and motivational to householders and that could lead to enhanced pro-sustainability behaviours. Babbie explains that "exploratory studies are most typically done for three purposes: (1) to satisfy the researcher's curiosity and desire for better understanding, (2) to test the feasibility of undertaking a more extensive study, and (3) to develop the methods to be employed in any subsequent study" (Babbie, 1999, p.72). Indeed, all three of these purposes are applicable to this exploratory study. The literature review presented in the preceding chapter revealed that home energy conservation efforts could be enhanced by incorporating goal-setting into home energy feedback; it also noted that most householders want to receive disaggregated feedback (for example, by household appliance). What was not clear from the literature review was whether the two features combined – goal-setting and appliance-specific feedback – provided new opportunities for householders to engage in home energy management more effectively.

The literature review also revealed that disaggregated 'feed-forward' information that allows householders to establish and manage ongoing home energy goals has yet to be explored. These findings in the literature, combined with the deployment of advanced metering technology in Ontario, particularly in the electricity sector, helped to establish the need to investigate this phenomenon further. This study also seeks to describe the ways in which goal-setting experience in other areas of the householder's personal life relates to their interest in home *energy* goal-setting – this includes the way in which home energy goals might be set and preferences towards the way in which the energy feedback is presented. And, finally, this exploratory study also aims to identify householders' perceived barriers and benefits to home energy goal-setting so that future research, including more extensive field experiments that might measure the impact of disaggregated home energy goal-setting on conversation behaviours, can be informed by such knowledge to help develop their study interventions.

In this thesis, inductive reasoning, rather than deductive reasoning, is pursued by measuring householders' interests, experiences, attitudes, opinions and household attributes to discover themes and relationships that seek to inform the design of home energy goal-setting tools and home energy feedback more broadly. Babbie explains that "inductive reasoning moves from the particular to the general, from a set of specific observations to the discovery of a pattern that represents some degree of order among all the given events [whereas] ... deductive reasoning moves from the general to the specific. It moves from (1) a pattern that might be logically or theoretically expected to (2) observations that test whether the expected pattern actually occurs" (Babbie, 1999, pp.22-23). The objectives here are to explore householders' existing experiences, opinions, attitudes and behaviours and relate them to their interest in home energy goal-setting. It is believed that this knowledge would serve to inform future experiments in order to construct hypotheses, interventions and the appropriate research methods to measure this phenomenon. As Palys explains "the inductive approach seems ideally suited to the fieldworker who is interested in 'getting inside the heads' of research participants ... and then building theory on the basis of themes that emerge from that interchange" (Palys, 1997, p.47).

The unit of analysis in this study was the Ontario householder. The study did not limit participation to homeowners, although participants were asked to identify whether they owned their home or were renting it as a tenant. In addition, data regarding household attributes were collected through the study's research instrument – a web-based survey – including the number of occupants in the home, home size and type, geographical location (i.e. city), number and types of appliances present in the home, primary source of heating fuel and other demographic data such as level of education, age, gender and household income. Including demographic information as part of the research helped in two ways. First, these data were used to help describe the respondents that chose to participate in the study and the degree to which they represented the 'Ontario householder' (the results are shown in Chapter 4). Second, these data were also used to discover and describe who would be most likely interested in home energy goal-setting and what in particular interested them. In order to collect these data and other data regarding householders' interests, attitudes, experiences and opinions, three research methods were considered: (1) questionnaire surveys, (2) face-to-face interviews, and (3) in-person focus groups. Several advantages and disadvantages exist for each.

Surveys ask participants to respond to preset written questions and the goal of doing survey work, as described by McLafferty, "is to acquire information about the characteristics, behaviours and attitudes of a population by administering a standardized questionnaire, or survey, to a sample of individuals" (McLafferty, 2003, p.87). Part of the challenge with surveys is that they generally experience low response rates and non-response bias since it is often found that people with low levels of education or busy lives are less likely to participate (McLafferty, 2003). In addition, surveys are limited in the sense that the researcher is not able to ask follow-up questions to seek clarification on responses. And, in most cases, it is challenging to know who has completed the survey and whether they are the participants that are sought. On the contrary, the primary advantages to conducting surveys in social science research are the ability to recruit more study participants and the reliability (or consistent replication) of the technique across all participants surveyed (Babbie, 1999).

Interviews and focus groups, conversely, can be semi-structured to allow the researcher to probe for clarification with follow-up questions, administer longer questionnaires, ask questions in more complex sequences, and build rapport with the participants to generate more meaningful answers (Babbie, 1999; Palys, 1997). However, these approaches conducted in-person are often more expensive and time-consuming to administer and there is potential for inconsistency in question delivery from one participant to another (Shipman, 1972; Babbie, 1999). Shipman describes that "the choice between questionnaires and interviews is usually determined by the high cost of the latter, but it is, once again, also a choice between reliability and insight. Adjustments can be made in interviews and answers can be probed. The cost is in reliability ... there is always the effect of non-verbal clues intervening" (Shipman, 1972, p.77). And, in the case of focus groups, another challenge occurs when more vocal members of the group may 'overpower' the opinions of participants who are more timid (McKenzie-Mohr and Smith, 1999). Since the purpose of this thesis was, in part, to identify the relationship between a range of independent variables and the study's key dependent variable, namely, householders' interest in home energy goal-setting, it was decided that a survey questionnaire would likely provide a larger sample size and greater statistical reliability than the other two approaches.

Surveys have been justified for exploratory research in the methodology literature, as Palys describes "if you're new to an area of research, an *experience survey* may suggest research ideas... When doing this sort of exploratory research, talk to as many people and observe as

many situations as possible" (Palys, 1997, p.51 ... emphasis in original). Similarly, Babbie makes the cases that "survey research is probably the best method available to the social scientist interested in collecting original data for describing a population too large to observe directly... Surveys are also excellent vehicles for measuring attitudes and orientations in a large population." (Babbie, 1999, p.234). It was believed that conducting an online questionnaire, rather than a paper-based postal survey, would provide greater opportunity to survey a larger and more diverse sample of the Ontario population for this study – and as such, an online version of the questionnaire was created as the instrument for data collection.

The use of a web-based survey, as opposed to a paper-based survey, also helped save resources (both materials and costs) in administering the survey since a paper-based questionnaire would have resulted in approximately 25-30 pages per questionnaire delivery. Moreover, the web-based survey did not require participants to mail back a multi-page survey, thus saving on postage costs. A web-based survey also enhanced the ability and ease in which colour images and screenshots of home energy goal-setting prototypes could be shared with participants, again reducing the printing costs. Finally, it was recognised in advance that an web-based survey would likely exclude members of the population that do not have access to, or choose not to use, the internet; however, this was not seen as a major limitation since it was assumed that such participants would not be interested in web-based home energy management technology either. However, during the recruitment process, potential participants were told that they could have the opportunity to complete a paper-based survey if they preferred. Recruitment strategies are further discussed in section 3.3 of this chapter and in the next section the instrument for data collection – the web-based survey – is described in greater detail.

3.2 The Instrument – A Web-Based Survey

After selecting the instrument that would be used to collect data for this study – a web-based survey – the next step was to develop and test survey questions that would serve to address the research objectives. This stage in the research process aimed to develop "questions and create a survey instrument that both achieves the goals of research and is clear and easy to understand for respondents" (McLafferty, 2005, p.88), while also seeking to ensure the reliability and validity of the chosen methodology (Babbie, 1999; Silverman, 2000; Palys, 1997). Each of

these, reliability and validity, will be defined and applied to the instrument throughout this section of the thesis. Next, a description of how the questions were ordered and categorised for the participants will be presented.

3.2.1 Description of the Survey Sections

The questions in the survey were presented in five 'parts' to the study participants and a complete copy of the survey may be found in Appendix A of this thesis. The first section, 'Part A,' focused on questions about the participants' experiences with, and opinions towards, goal-setting more broadly (i.e., goal-setting in areas other than home energy management). Early in this section (Question A.2), the respondents were asked to explain what types of goals they set in their personal lives and had the option to select from the following options: (a) personal financial goals, (b) nutritional/dieting goals, (c) fitness goals, (d) educational/career goals, and/or (e) other goals – of which they were asked to describe. They could have also selected 'not applicable' if they did not set goals at all or select several goals if more than one applied to them. The next four questions in 'Part A' (Questions A.3 to A.6) of the web-based survey were then programmed to either appear or not appear depending on their responses in Question A.2. For example, if a respondent acknowledged that she sets fitness goals, for example, but not any other type of goal provided in the list, then she only received questions relating to fitness goals for the next four questions (and not for the other types of goals since they did not apply to her). By programming the web-based survey to 'filter out' questions that no longer applied to particular participants, it made it easier to shorten the length of the survey – which was seen as advantageous to keep participants interested in completing it. Throughout 'Part A' of the survey, participants were asked to share their experiences and opinions regarding their personal goals including:

- The rewards and incentives that they may receive for goal attainment;
- The negative consequences and disincentives that they may experience for not attaining their goal;
- The timeline(s) in which they manage their goals;
- The factors which motivate or dissuade goal attainment;
- The tools they use to help manage their goals;

- If, and how, they share their goal-setting experiences with others in their lives and whom these people might be;
- The extent to which they 'breakdown' goals into smaller tasks and categories; and
- Their perceived benefits and barriers to goal-setting in general.

These characteristics of goal-setting were collected to explore the dynamics of goal-setting more broadly and to help explore their relationship to home energy goal-setting more specifically. In the next section of the survey, 'Part B,' participants were asked to share:

- Their level of awareness relating to the amount, costs and environmental impact of energy consumption in their homes;
- Their attitudes towards conserving energy in their homes; and
- The extent to which they practice pro-sustainability energy management behaviours (e.g., purchasing efficient appliances, conserving energy, load shifting where possible, etc.).

For this study, these data also served as independent variables and helped establish the level to which householders felt that they were already doing as much as they could to conserve (for example, without a home energy goal-setting technology).

In 'Part C' of the survey, interest in home energy goal-setting, the study's key dependent variable was measured. In addition, many questions were posed that were similar to those asked in 'Part A' about goal-setting in other areas of one's personal life, but instead in 'Part C', each question related more specifically to home energy goal-setting. For numerous multiple choice questions in 'Part C', participants were asked to elaborate on or describe why they chose certain responses from the list of options provided. These open-ended written questions (seeking elaboration and clarification) were used to allow participants to respond more openly and with greater detail. Meanwhile the structured (or fixed-response) questions allowed for greater statistical reliability when analysing the results. More description and rationale of the various types of questions will be discussed in the following section of this thesis. Questions in this part of the survey sought to collect data about:

- Interest in setting home energy goals;
- Unit of preference for home energy goal-setting;
- Interest in 'breaking down' home energy goals into appliance-specific goals;
- Interest in receiving tailored conservation tips relating to goal performance;

- The choice of goal difficulty and goal type (e.g., conservation vs. load shifting);
- The timeline(s) in which they would expect to manage home energy goals;
- The rewards and incentives that they may expect to receive for goal attainment;
- The negative consequences and disincentives that they may expect to experience for not attaining their energy goals;
- The factors which may motivate or dissuade goal attainment;
- The tools they would prefer to use for managing home energy goals;
- If they would expect to share their home energy goal-setting experiences with others in their lives and whom these people might be;

As mentioned these variables are in many ways similar to those presented in 'Part A' of the survey, with the intention to explore the similarities and difference between home energy goal-setting and goal-setting in other areas of one's life.

In 'Part D' of the survey, participants were shown four screenshots. Each screenshot shown was accompanied by a brief explanation so that participants could sufficiently understand the context in which to interpret them. The screenshots were taken from a prototype web-based interface to a home energy management system being developed by a University of Waterloo-led project (as described in Chapter 1). The participants were asked to describe what they liked or disliked about each screenshot and what they found clear or confusing. In addition, they were asked to comment on the extent to which they felt this aspect of the interface would be helpful for them to manage better the energy usage in their home. Subsequently, each screenshot was presented, in turn, with its explanation and the same questions about likes, dislikes, clarity, confusion and perceived usefulness for managing energy usage.

The final section of the survey contained questions that collected data regarding demographic and household attributes. In addition to the conventional demographic questions about age, income, education, gender, etc., participants were also asked to describe their home's appliances and heating fuel, as well as their seasonal levels of electricity consumption. And, before completing the survey, participants were also asked to indicate how they had learned about the study, so that the success of various recruitment strategies could be evaluated. Recruitment strategies for this study will be discussed in greater detail in section 3.2.3 of the thesis. Next, the types of questions used and the rationale for asking them will be presented.

3.2.2 Evaluating the Reliability, Validity and Rationale of the Survey Questions

Several questions throughout the survey were unstructured (or open-ended), which gave the respondents the ability to provide details and comprehensive opinions and accounts of their experiences with goal-setting and home energy usage. Meanwhile, other questions were much more structured (with fixed-responses), including numerous questions that asked the respondents to select the level to which they agreed with a statement on a seven-point Likert scale. When self-evaluating the validity of this study, the following definition provided by Babbie was considered: "in conventional usage, the term *validity* refers to the extent to which an empirical measure adequately reflects the *real meaning* of the concept under consideration" (Babbie, 1999, p.112 ... emphasis in original). Open-ended questions were seen as advantageous to ensure content validity – that is the degree to which "a measure covers the range of meanings included within the concept" (Babbie, 1999, p.114), since with open-ended questions "respondents are not constrained in answering questions [and] ... can express in their own words the fullest possible range of attitudes, preferences and emotions. Respondents' 'true' viewpoints may be better represented" (McLafferty, 2005, p.89). Moreover, construct validity was measured on "the *logical* relationship among variables" (Babbie, 1999, p.113... emphasis added). For example, interest in home energy goal-setting, it was believed, would be positively associated with interest in learning about one's home energy usage and willingness to conserve. Furthermore, perceived benefits of home energy goal-setting were linked to motivations to achieve home energy goals, while the perceived barriers were connected to the indifference to conserve and the potential inconveniences of the exercise.

Including fixed-response questions enhanced the statistical reliability of the findings. When evaluating reliability of the methods, the following definition from Babbie was considered: "reliability is a matter of whether a particular technique, applied repeatedly to the same object, would yield the same result each time" (Babbie, 1999, p.110). Using the fixed-response questions, including those with a seven-point Likert scale, helped ensure consistency and comparability during data collection and data analysis. In addition, fixed-response questions were seen as advantageous in some cases to provide a frame of relevance for the survey participants and they made "it easier to analyse and interpret because [the responses] fall into a limited set of categories" (McLafferty, 2003, p.90). As another measure to increase question reliability, care was take "to ask only about things the respondents [were] likely to know the

answer to" (Babbie, 1999, p.111). For example, participants were briefed at the start of the online survey that having their electricity bills nearby would help them in answering some questions about monthly electricity consumption near the end of the survey. And, efforts were made to be as clear as possible when presenting the context and explanation of screenshots. Furthermore, critical terms of reference, such as 'home energy management system' were defined for the survey participants to provide clarity about the subject matter.

The use of categorical responses to questions, resulting in ordinal data, was carefully considered as well. For some questions that might have been more sensitive (e.g., inquiring about household income levels), categories were used where possible to make these questions feel less intrusive for the respondents (McLafferty, 2003). Moreover, the 'size' of the Likert scale was strategically selected as well. As already mentioned, a seven-point scale was used as it was believed to offer an adequate range of responses for statistical analysis and since seven is an 'odd number' it permitted responses of indifference (i.e., the center point in the scale represented a neutral view on the topic) (Babbie, 1999; McLafferty, 2003). It was believed that providing more than seven points on the Likert scales would have decreased respondents' ability to discriminate among categories, leading to loss of meaning (McLafferty, 2003). For all questions with fixed-responses an option to respond with either 'I don't know' or 'not applicable' was also provided. And, where applicable, respondents had the opportunity to select an 'other' option "to allow for the fullest range of responses" (McLafferty, 2003, p.90).

'Double-barrelled questions' were avoided wherever possible since they could have provided two possible responses to a question requiring only one (Babbie, 1999). For example, rather than asking participants whether they set AND manage goals all in one question, they were simply asked if they set goals and in separate questions how they managed goals, if applicable. And, as described by McLafferty (2003), "writing good questions requires not only thinking about what information we are trying to obtain but also anticipating how the study population will interpret particular questions" (McLafferty, 2003, p.89). As such, the survey was piloted with four people to test respondents' interpretation to its wording and question order.

Each pilot participant completed the survey next to the researcher and paused to seek clarification if the wording of a question was too confusing. Additionally, pilot participants were asked questions along the way to ensure that they interpreted survey questions as intended. After each pilot participant completed the survey, various nuances in wording were adjusted to

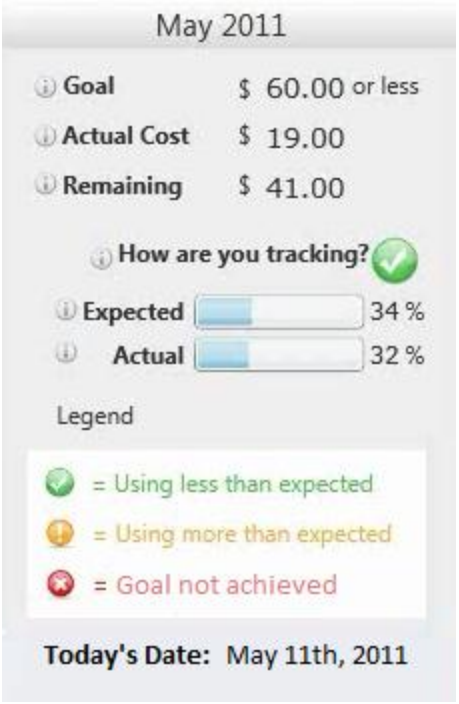
enhance the question's clarity before testing with the next pilot participant. And, as a result of the survey pilot, several questions were removed – including an entire section on very specific self-reported energy conservation behaviours and one of the screenshots in Part D (reducing the number of screenshots from five to four). Reducing the length of the survey was done because all four pilot participants commented that the survey was too long (originally) and they felt that it was too much work to complete. In addition, several questions and sections were reordered so that some independent variables relating to energy awareness, attitudes and behaviours appeared before the key dependent variables in the survey. This was done to ensure that the questions about home energy goal-setting did not suggest a 'preferred' response to energy awareness or attitudes, for example.

3.2.3 The Design of the Goal-Setting Tool Screenshots

Many design elements of the goal-setting tool shown in 'Part D' of the web-based survey were derived from suggestions in the literature. Indeed some finer details about the design have been informed by several studies, specifically. In this section, some of those design elements are presented and explained.

In the first iteration of designs for the goal-setting interface, happy faces and sad faces were used to indicate good performance and poor performance relative to a home energy goal. This idea was inspired by the work of Shultz et al. (2007) who successfully used these 'emoticons' in their own home energy feedback studies to help stimulate pro-conservation behaviours. An initial design was presented to friends and colleagues to test their reactions and it became clear that more than two distinct feedback symbols would be needed for a home energy goal performance indicator. Instead, a three-symbol system was required to indicate when householders were: (1) using less energy than expected at any point in the goal-setting timeframe, (2) using more energy than expected at any point in the goal-setting timeframe, and (3) when they had already used too much energy and would not meet their goal in the given timeframe. Instead of the two-symbol system of happy faces and sad faces, the three-colour system resembling a traffic light (green=good; yellow=caution; and red=bad) was developed. The image shown in Figure 5 provides an illustration of the final design that was tested with the study participants in Part D of the survey.

Figure 5 – Indicator Reflecting Performance with Three-Colour System

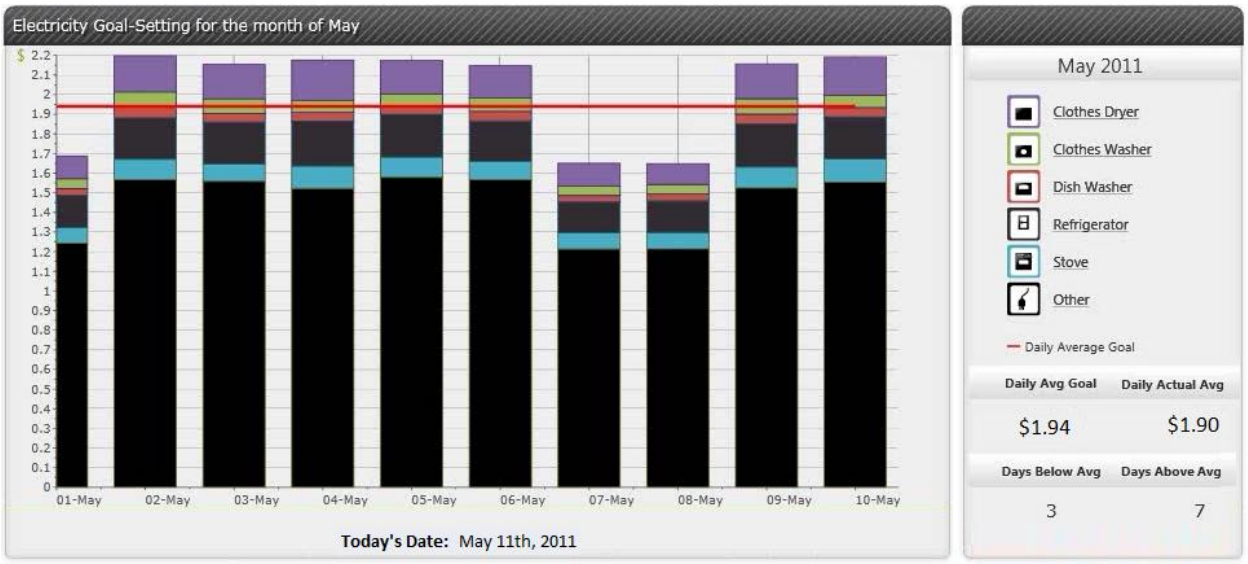


Two more screenshots were developed with the future intention of using them to give householders disaggregated feedback relative to their home energy goals. The first of these two is a matrix detailing appliance-specific goals and how the household is tracking for each of them. This concept, in part, was inspired by, and adapted from, work by Wood and Newborough who explained that a "score shown alongside the current energy-use value to imply a good or bad score [may] be applied by end-use activity where more than one appliance is usually required to complete the task (e.g. home laundry, refrigeration, lighting, cooking, etc.)" (Wood and Newborough, 2007, p.497). The screen providing a performance score (or in this case a symbol labelled 'Tracking') for each end-use category was developed with these suggestions in mind and is shown in Figure 6.

Figure 6 – Appliance-Specific Goal-Setting Feedback Display

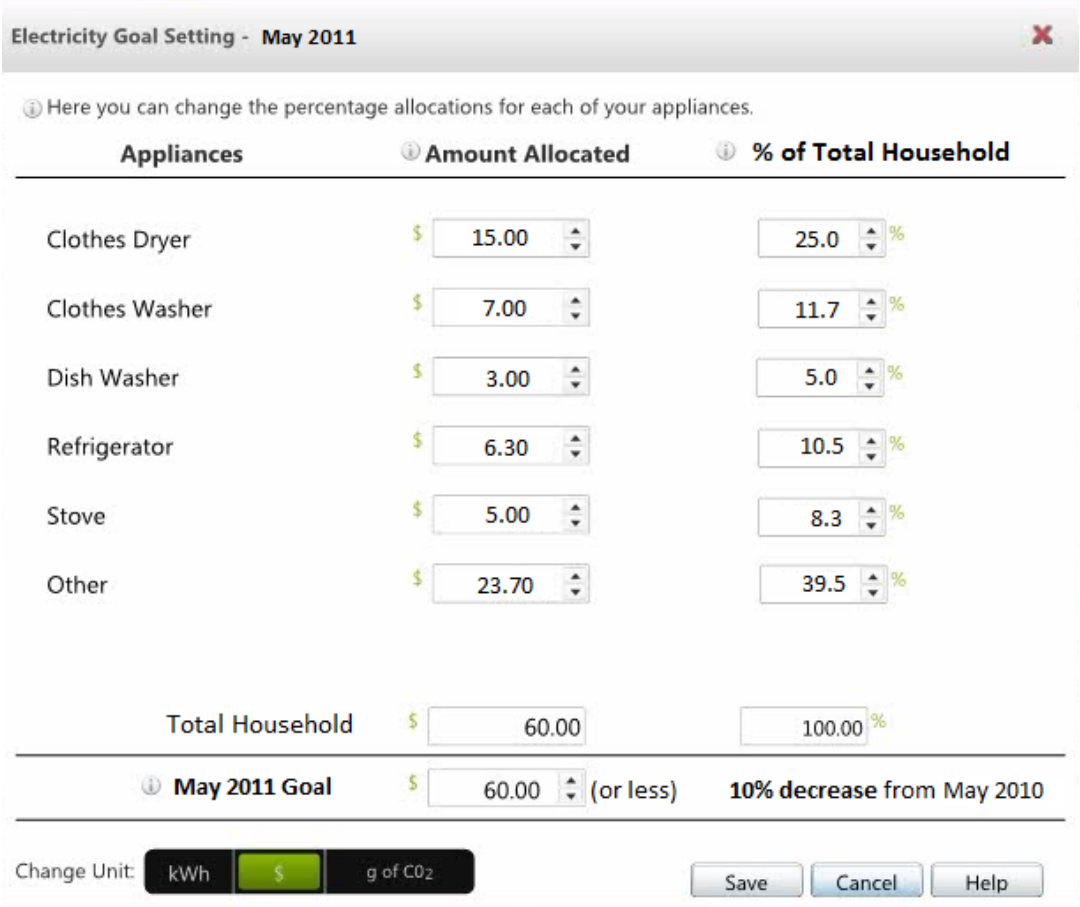
The other screenshot providing feedback relative to a goal was developed to present information to the householder in graphical form. As explained by Wood and Newborough "consideration of graphical formats is most relevant to the design of a central energy consumption display to help the user make choices and form objectives. Energy use could be highlighted by moving bars" (Wood and Newborough, 2007, p.500). Figure 7 presents the vertical bar graph that was developed to share daily energy usage feedback relative to a 'daily average goal'. The daily average goal would be calculated by the system based on the long-term goal (e.g., monthly goal) selected by the householder. The comparison of actual usage to an average over a certain time period is another display recommendation from the literature (Wood and Newborough, 2007).

Figure 7 – Daily Consumption Graph with Average Daily Goal



The fourth screenshot developed for the online survey was largely created out of intuition as the literature did not provide recommendations relating to it. This screenshot shows study participants how they would go about selecting, and inputting, a home energy goal into their home energy management system through an online portal. It was decided that householders using this screen would input monthly goals (rather than other time periods), because monthly goals would most likely align with regular billing cycles. This screenshot is shown in Figure 8.

Figure 8 – Screen Used to Select and Input a Home Energy Goal

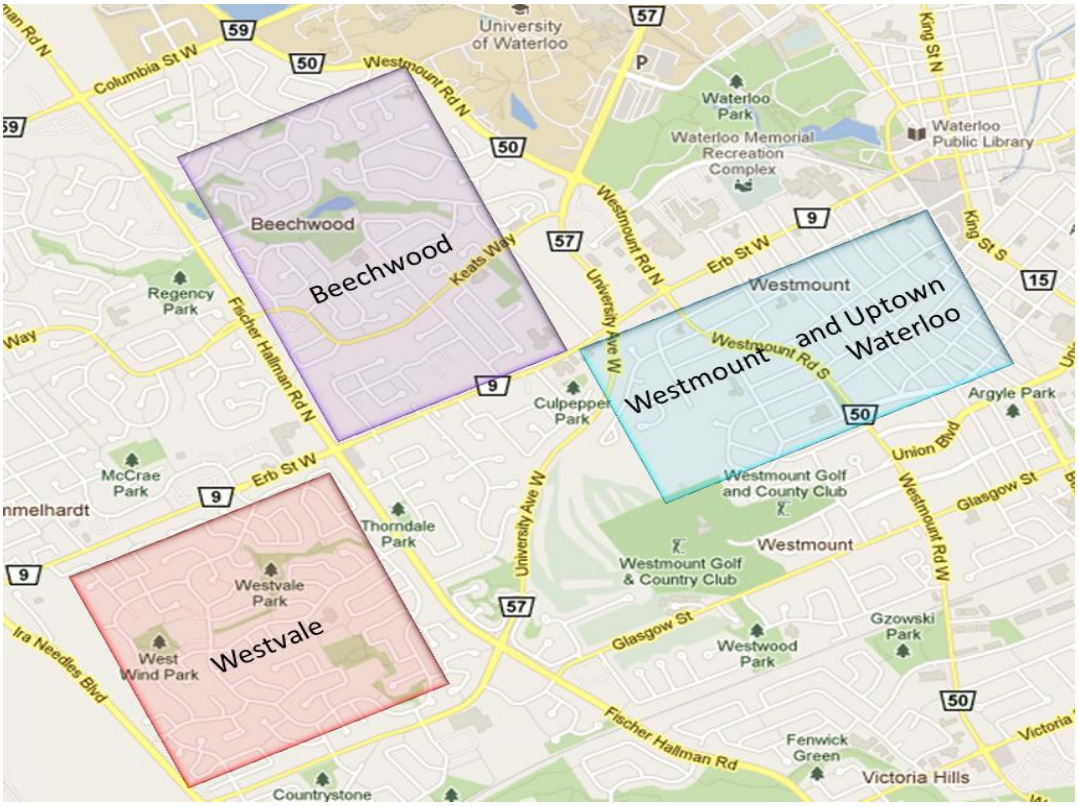


3.3 Recruitment of Participants

While recruiting participants for this study, three recruitment techniques were employed. One of the techniques involved the distribution of 2,000 one-page information letters about the online survey to households by placing the letter (folded in three, without an envelope) in the mailboxes of homes in three neighbourhoods in the city of Waterloo. The three neighbourhoods (Westvale, Beechwood and Westmount/Uptown Waterloo) are shown in the map in Figure 9 and were chosen for several reasons. First, it was believed that the close proximity of these three neighbourhoods to the University of Waterloo helped provide legitimacy to the study and gave residents the opportunity to contribute to local research. Despite their proximity to the university, however, the neighbourhoods were not believed to be largely tenant-based communities (i.e., student rentals), although a small minority of study participants were, in the

end, renters (8%). Homeowners were preferred participants to renters, since it was believed that many tenants might not manage the energy bills for the home (i.e., the bills may be managed by the landlords instead), but home ownership was not a requirement for study participation. The only required criterion for participation was that the respondents of the survey had to be at least 18 years of age. Second, nearly all homes in these three neighbourhoods had mail boxes at their front doors which permitted door-to-door delivery of the letters, whereas other neighbourhoods in Waterloo used centralised mailbox systems which required a key to open the mail slot (and only the homeowner and postal service have the key!). Third, these three communities offered a diverse set of home types, including row housing, semi-detached houses, one-storey bungalows and two-storey larger homes. And, finally, all homes that received a letter had a smart meter already installed at their homes, and it was understood that they would soon begin to be billed using time-of-use pricing (Waterloo North Hydro, 2011). This final characteristic helped justify the current need for home energy management research to potential study participants.

Figure 9 – Targeted Communities for Recruitment of Study Participants in Waterloo (Google, 2011)



In the one-page information letter, residents were informed about the nature and purpose of the study, were provided with a URL address to a University of Waterloo webpage to access the web-based survey, and were informed about the study's clearance from the university's Office of Research Ethics. From this university webpage, potential participants were able to click on a link to fluidsurveys.com to complete the web-based survey. A copy of the information letter is provided in Appendix B of this thesis and a copy of the information on the university webpage is provided in Appendix E. The letters were distributed from Monday, 17 July 2011 to Wednesday, 27 July 2011. During these ten days of letter distribution, approximately one third of the two thousand letters were distributed to each of the three neighbourhoods. On occasion, some householders were outside of their residence (e.g., doing gardening work, walking their dog, etc.) and received the letter in-person. For these householders, attempts were made to explain the contents and purpose of the letter without greatly influencing their potential responses if they chose to participate in the survey.

In addition to the distribution of information letters, an advertisement was placed on the fifth page of the *Waterloo Chronicle*, the city's local newspaper. The $1/8^{th}$ of a page advertisement appeared on the top left corner of the page in the newspaper the same week in which the letters were distributed (on Wednesday, 20 July 2011). A copy of the advertisement is provided in Appendix C of the thesis. Finally, free online classified advertisements were posted in the 'Volunteers' section of craigslist.com and kijiji.com for the city of Waterloo and surrounding municipalities (which were Kitchener, Cambridge, Guelph, Brantford, Mississauga, Toronto, London and Hamilton) from Friday, 15 July 2011 to Friday, 5 August 2011 (see Appendix D for text used in the online ad). The online survey 'opened' on Friday, 15 July 2011 and was 'closed' (i.e. no longer accessible to the public) by the end of day Friday, 5 August 2011.

In addition to the opportunity to contribute to this research, study participants also had the opportunity to participate in a draw to win one of two $100 gift cards redeemable at a selection of major retailers of their choice. It was believed that giving the participants the ability to choose where they could redeem the gift card would appeal to a broader set of participants (rather than providing a gift card to one retail location of the researcher's choice). The results from the recruitment process are presented in Chapter 4 of this thesis.

3.4 Review of Study Limitations

Throughout the review of this study's methodology, various limitations and assumptions have been presented; however, there are three overall limitations to the study that are worth summarising before the presentation of the survey results in Chapter 4.

Self-Selection Bias

Those who participated in this study learned about it in one of three ways: (1) a letter from the university, (2) an advertisement in the local newspaper, or (3) an advertisement in an online classifieds website. However, regardless of the way in which participants learned about the study, they all volunteered themselves to participate. This method of recruitment and 'self-selection' surely created a degree of sampling bias since it is likely that the participants of the study were individuals more interested in the subject matter (Shipman, 1972; Babbie, 1999).

Low Response Rate to Letter Campaign

As described earlier in this chapter, study information letters were delivered to 2,000 homes in the city of Waterloo over a two week period. After nearly three weeks from the day the letters began to be distributed, the online survey was closed and 46 households that fully completed the survey learned about it through the letter campaign. Therefore the response rate to the letters was approximately 2.3%. There could be a number of reasons why the response rate was low for this particular study (e.g., residents are experiencing survey fatigue, many might have been away on summer vacations, etc.), but regardless of the cause, caution should be taken when interpreting the results to represent 'all' householders. Indeed, measures were taken to mitigate the low response rate, including supplementing the letter campaign with other recruitment methods, but as Shipman explains "postal questionnaires usually get very low response... [and] there is always suspicion that the non-responders may have been the most interesting and certainly the most non-conformist group" (Shipman, 1972, p.59).

The Hawthorne Effect

One challenge with asking householders to report their attitudes towards energy conservation and other pro-sustainability behaviours is that they may choose to respond in a manner that they believe is preferred by the researcher or socially-desirable. Although this concept known as, the Hawthorne Effect, was first made relevant to field experiments (as explained by Babbie, 1999), it also has relevance here with survey research and thus should be considered when interpreting the results of the study. Next, the results of from the study's survey will be presented in Chapter 4 and the degree to which the participants represented the broader Ontario population will be analysed in Chapter 5.

Chapter 4: Results

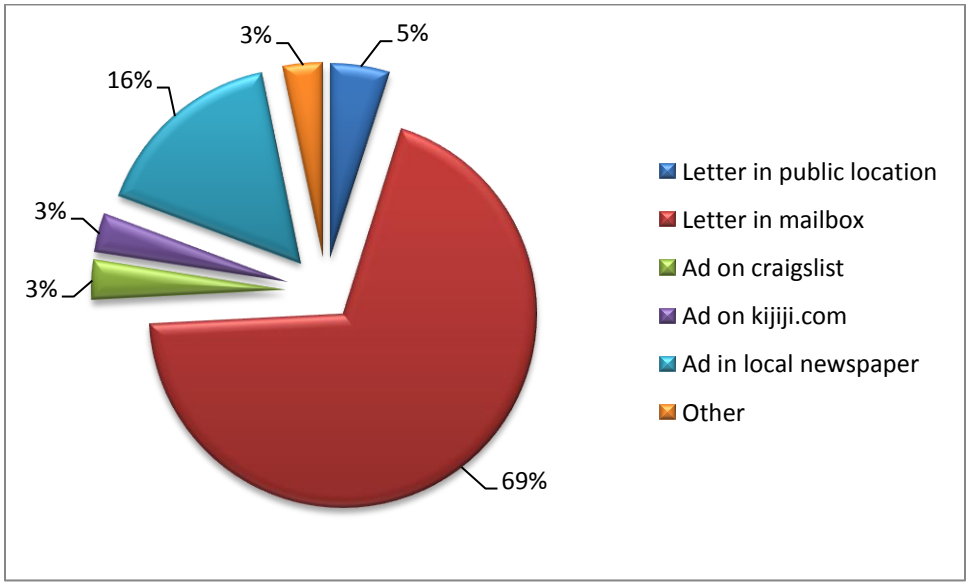
4.1 Introduction and Chapter Outline

The purpose of this chapter is to present the results of the survey conducted during the data collection period of this study. First, the results from the recruitment campaign are presented in Section 4.2. Second, the characteristics of the sample are described in relation to the population data for the city of Waterloo and the province of Ontario. Third, the qualitative and quantitative findings from the surveys are summarised. The qualitative responses to open-ended questions have been summarised by categories and presented in tables, while the quantitative responses to fixed-response questions are presented visually using bar graphs and pie charts. The categorisation of 'raw responses' to open-ended questions is further explained in Appendix F.

4.2 Results from the Recruitment Campaign

As explained in Chapter 3, the final question of the online survey asked respondents to identify how they learned about this study. Seventy-four individuals accessed the online survey and 62 of them completed the survey. Fifty-five respondents chose to participate in the draw for one of two $100 gift cards. 'Completing the survey' meant that the participant went through all 21 pages and clicked the 'Submit' button on the last page (but it did not necessarily mean that they responded to all the questions in the survey, as some questions may have been left blank). Of the 62 respondents who completed the survey, a large majority of them (46 respondents or approximately 74%) learned about the study from a letter they received in their mailbox (43 respondents or approximately 69%) or a letter they received in a public location (three respondents or approximately 5%). It is assumed that respondents who indicated that they received the letter in a public location were the relatively few individuals that received letters (handed to them by the researcher) while they were walking around the neighbourhood – as letters were not distributed at public locations such as retail stores. Figure 10 summarises how study participants were recruited and which recruitment methods attracted the most respondents. The percentages in the pie chart do not add up to 100% because of rounding.

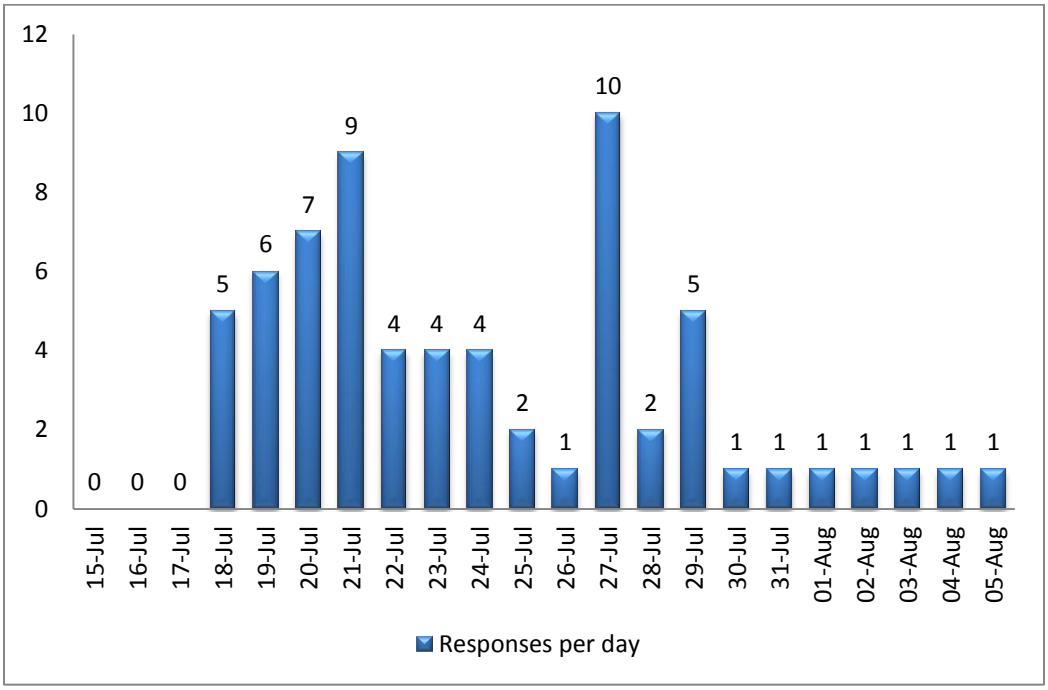
Figure 10 – Summary of How Participants Learned About the Study (n=62)



Since 46 of the 62 respondents that completed the survey learned about it from the information letters, the response rate to the letter campaign was approximately 2.3% (46 respondent divided by 2000 letters). However, 12 of the 74 individuals that began the survey did not complete it and thus it is not known how these householders learned about the study. The 2.3% response rate could be considered fairly low (Babbie, 1999) and since it was not possible to identify the characteristics of householders that did not choose to respond or complete the survey, caution will be taken when drawing conclusions for Ontario householders more broadly.

A few days after the distribution of the letters stopped (Wednesday, 27 July 2011), the rate of daily responses to the survey also began to decline. After approximately one week of very minimal daily responses, the survey was closed on Friday, 5 August 2011. The timing of survey responses during the recruitment campaign is summarised in Figure 11.

Figure 11 – Daily Response Rates during the Recruitment Campaign



4.3 Description of Participants' Demographic Information and Household Characteristics

In the last section of the online survey, study participants were asked to provide responses to 18 questions about their household and demographic profile. Some of the key findings from some of these questions are presented in Table 1 and compared to similar statistics from the 2001 Canadian Census Survey (Statistics Canada, 2007) and other sources (OMEI, 2010c; OEB, 2011).

Table 1 - Characteristics of the Study Participants Relative to the General Population

Characteristic	Survey Participants	City of Waterloo [1]	Ontario [1]
Population size	62	86,543	11,410,046
Male to female split	38% to 62% (n=61)	49% to 51%	49% to 51%
Median age	44 (n=59)	35.0	37.2
% over age of 15 years	100% (n=62)	80.4%	80.4%
Lived at the same residence one year ago	87% (53 of n=61)	82.7% (71,580)	84.2% (9,610,125)
Median household income (after tax)	$58,756 (n=52) (2010 $)	$62,747 (2000 $)	$53,626 (2000 $)
% with college or university education	93% (57 of n=61)	52% (53,895)	43% (6,898,455)
% of population employed	61% (38 of n=62)	68.4%	63.2%
% of owner-occupied dwellings	90% (56 of n=62)	69.6%	66.7%
Average number of home occupants	3.3 (n=62) (family type not distinguished)	3.2 (married-couple families)	3.2 (married-couple families)
Average house size (sq. ft)	1500 to 1999 sq ft (n=61)	Not available	1200 sq ft [2]
Average monthly electricity usage (kWh)	600 to 899 kWh (n=60) (non-winter months)	Not available	800 kWh [3]

1 – Statistics Canada, 2007, unless otherwise indicated
2 – OMEI, 2010c
3 – OEB, 2011

Fifty-six (or 90%) of the respondents that completed the survey were homeowners, which was more than the typical share of homeowners in Waterloo (70%) and Ontario (67%). However, this was reasonable to expect since homeowners were likely those managing the energy bills and thus were likely more interested in research involving home energy management technology. Thirty-eight respondents (or 61%) indicated that they were currently working, while 11% were in school, 19% were retired, 6% identified themselves as 'homemakers', and 2% were unemployed.

Fifty-four of 61 respondents (or 89%) indicated that they had been living in the same residence for more than one year, which was also slightly higher, as a percentage of the population, than the Waterloo and Ontario averages, 83% and 84% respectively. Only four participants in the study indicated that they would be moving to a new home within one year. The average number of household occupants in the study was 3.3, which is nearly identical to the

average for Waterloo (3.2) and Ontario (3.2). Approximately 16% of respondents indicated that they had one child, 20% indicating two children and 8% indicating three or more children in their home. The most common housing type was a detached two (or more) storey household (53% of respondents) and the most common house size was between 1500 to 1999 square feet (33% of respondents' homes). Figures 12 and 13 summarise the data for household types and size of the participants in this study.

Figure 12 – Household Types in the Study Sample (n=62)

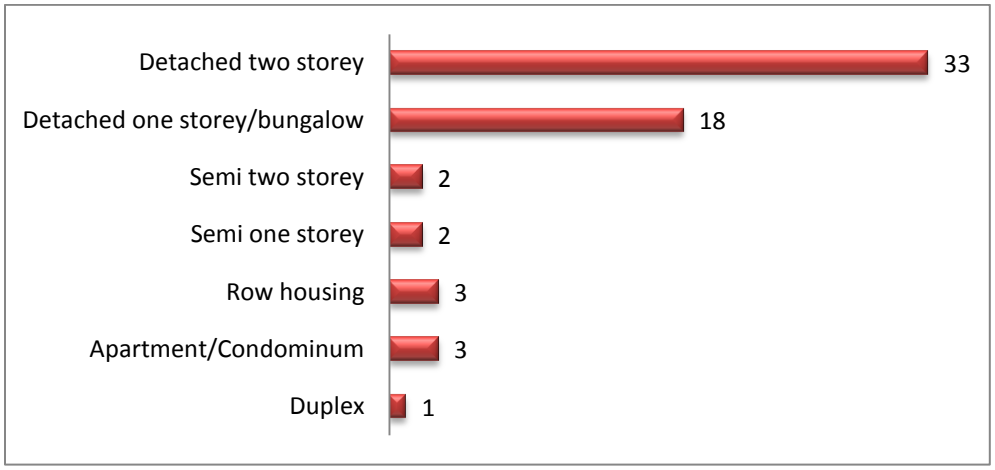
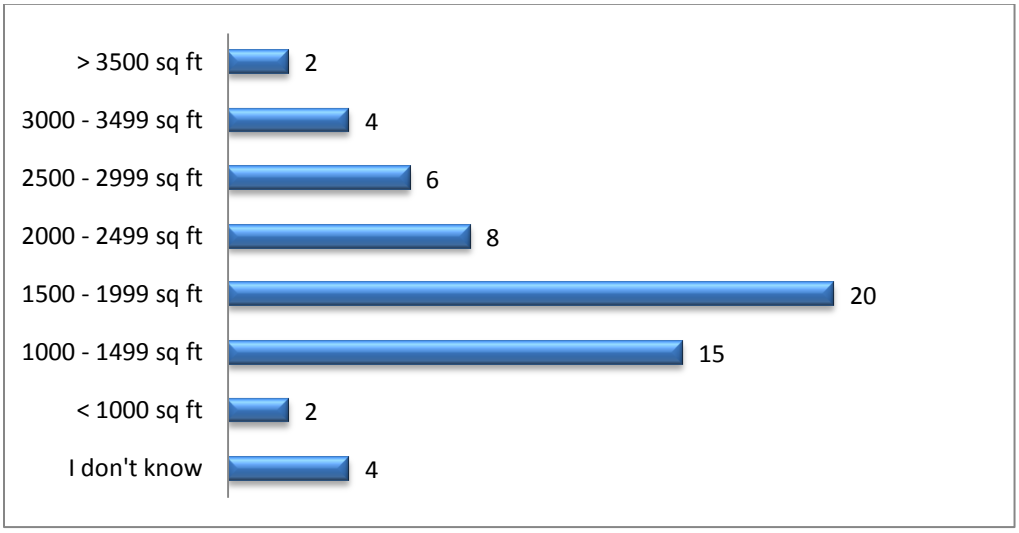


Figure 13 – House Size by Square Footage in the Study Sample (n=61)



All participants indicated that they were at least 18 years of age (it was a requirement for participation) with the average age of participants being 46.1 years. This was slightly older than the Waterloo average (35 years) and the Ontario average (37.2 years), which was expected since the broader population averages included members of society younger than the age of 18. The broader population male to female split in Ontario (and Waterloo) was reported as 49% to 51%, but in this study fewer males participated than females (38% males and 62% females). All participants lived in the province of Ontario, but since some recruiting was done through online classified ads and the local newspaper, not all participants lived in the city of Waterloo. Twelve of 60 participants (20%) indicated that they were living in cities other than Waterloo, including Kitchener (6), Cambridge (2), Burlington (1), Mississauga (1), Toronto (1) and Mount Forest (1).

In general, study participants held higher levels of education than the general population with 93% of participants earning a college or university diploma or degree. The figures for Waterloo and Ontario were 52% and 43%, respectively (Statistics Canada, 2007). Figure 14 summarises the various degrees and diplomas held by the study participants.

Figure 14 – Study Participants' Education Levels (n=61)

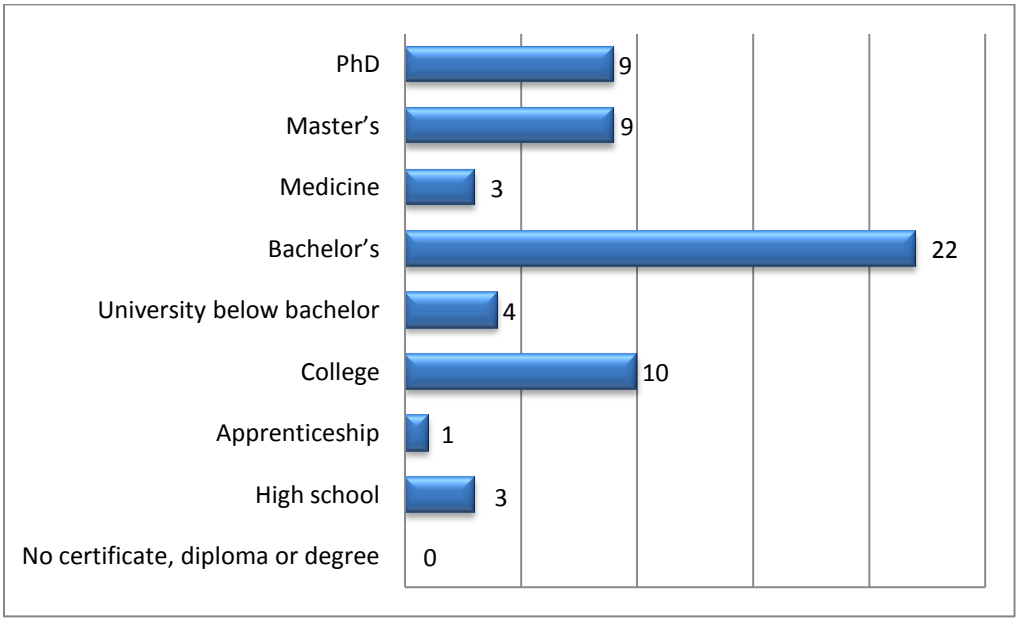
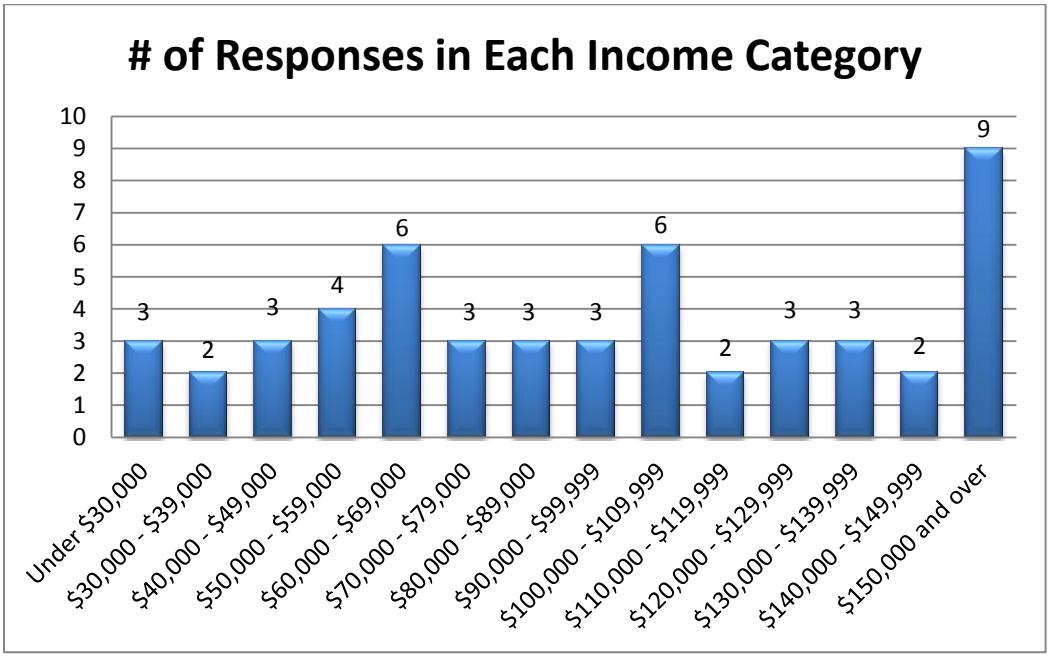


Figure 15 summarises the responses to the question inquiring about household income levels. The median pre-tax household income was $80,000 to $89,999. Assuming an average tax rate of 30% (calculated from tax rates provided by CRA, 2011) of the pre-tax median

category, then the median after-tax household income of participants would be approximately $55,614 to $61,898. The median after-tax household incomes for Waterloo and Ontario were $62,747 and $53,626 respectively (Statistics Canada, 2007).

Figure 15 – Pre-Tax Annual Household Income Levels (n=52)



The most common type of energy used for space heating in the homes of the study participants (n=61) was natural gas (85%), while some participants indicated that their main source of space heating was electricity (13%) and one participant (2%) was using oil as the main source of heating fuel. For more details, Table 2 shows the appliance profile of households participating in the survey.

Table 2 – Number of Energy Consuming Devices/Appliances in the Households by Type (n=61)

Type of Energy Consuming Device/Appliance	Number of devices/appliances (number of households)
Furnace	1 (58) 2 (1)
Air Conditioning Unit (central, room, or window)	1 (48)
Clothes Washer	1 (61)
Clothes Dryer	1 (59)
Refrigerators	1 (44) 2 (16) 2.5 (1)
Stoves	1 (59) 2 (2)
Dishwashers	1 (48)
Microwaves	1 (53) 2 (2)
Stand Alone Freezers	1 (35)
Televisions	1 (23) 2 (14) 3 (15) 4 (2) 5 (3)
Personal Computers	1 (23) 2 (17) 3 (12) 4 (3) 5 (4) 6 (2)
Hot Tubs	1 (8) 2 (1)
Pool Pump	1 (7)
Pool Heater	1 (3)
Heat Recovery Ventilator	1 (5)
Space Heater	1 (9) 2 (1)
Dehumidifier	1 (30)
Humidifier	1 (13)

Respondents were also asked to report the amount of electricity they typically consumed during the summer, winter and spring/fall seasons. The most common range of electricity consumption in the summer and spring/fall months was 600 to 899 kilowatt-hours (kWh) per month, whereas in the winter months, the most common range was higher at 900 to 1199 kWh per month. Summer months were defined as June, July and August and winter months as

December, January and February. The most common monthly electricity consumption category for all seasons combined was 600 to 899 kWh which was calculated by summing the number of responses for each electricity consumption category in each of the three questions. And, the 800 kWh per month reported for a typical Ontario household (OEB, 2011) is within this range. However, it is worth noting that approximately 30% of respondents admitted that they did not know how much electricity they consumed each month even though they were instructed to get their bills at the beginning of the survey. Figures 16, 17, and 18 summarise the typical amount of monthly electricity consumption reported by the study participants.

Figure 16 – Self-Reported Electricity Consumption in the Summer (n=61)

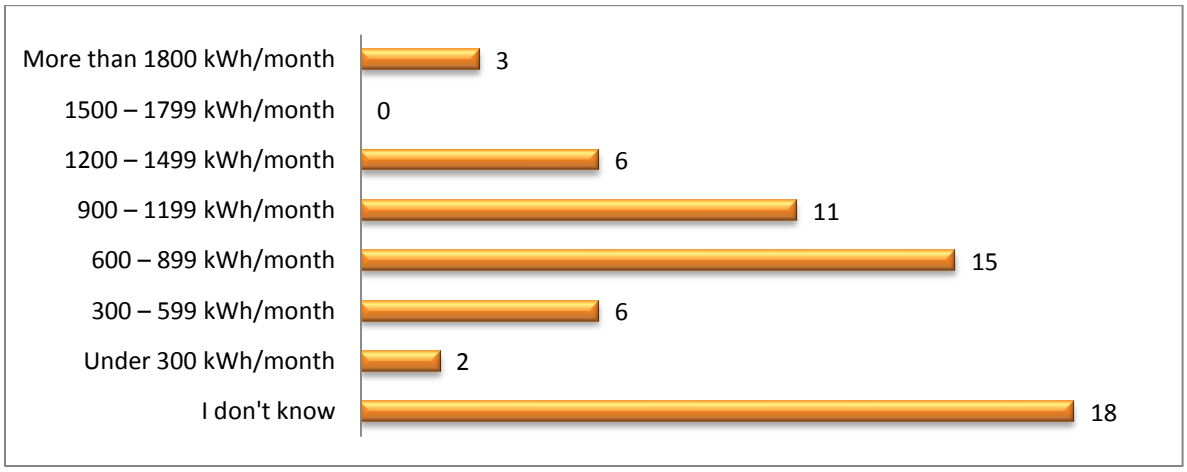


Figure 17 – Self-Reported Electricity Consumption in the Winter (n=60)

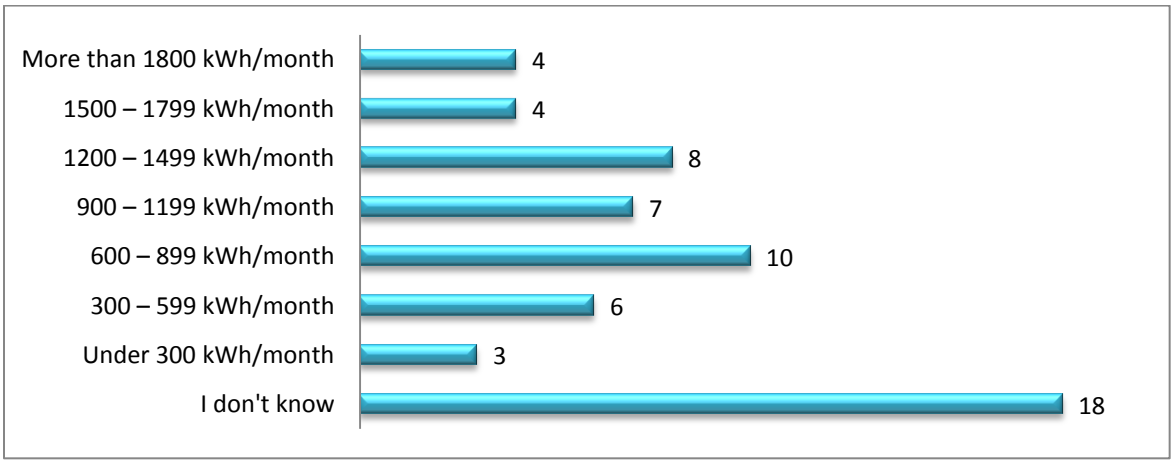
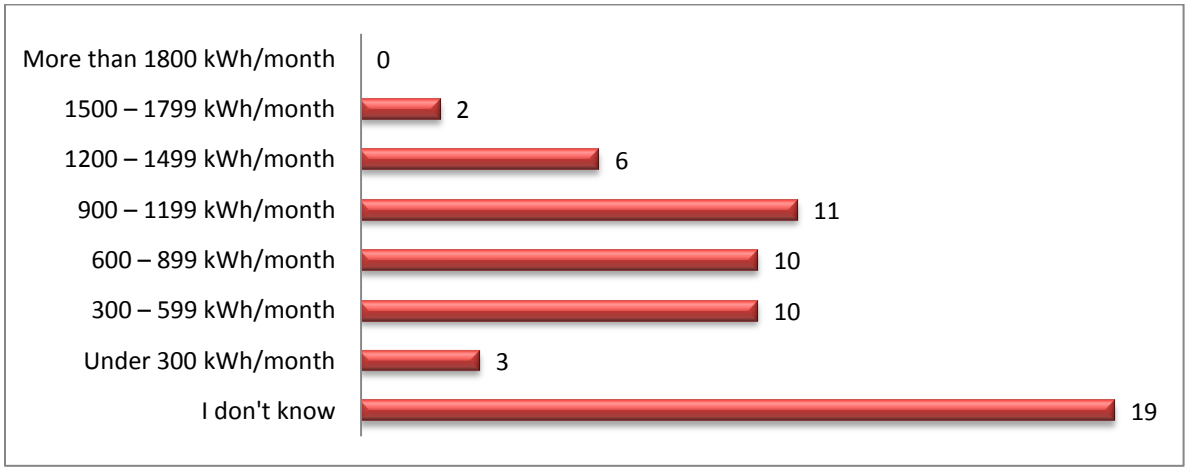


Figure 18 – Self-Reported Electricity Consumption in the Spring and Fall (n=60)



4.4 Results from Parts A to D of the Survey

In this section of the thesis, the results from the first four parts of the survey will be presented. As a reminder, 'Part A' contained the questions relating to the householders' experiences and opinions of goal-setting more broadly. 'Part B' contained the questions about energy awareness and pro-sustainability attitudes and behaviours. 'Part C' asked about the study's key dependent variable – householders' interest in home energy goal-setting – and in 'Part D' the participants were asked to comment on screenshots of a web-based home energy goal-setting interface.

4.4.1 General Goal-Setting Interests and Experiences

Question A1 – Do you set goals in any area of your life? For example, do you set personal financial goals, nutritional/dieting goals, fitness goals, educational/career goals, etc.?

Responses:

Of the 74 responses to this question, 62 of them (84%) responded 'Yes' and 12 responded 'No' (16%).

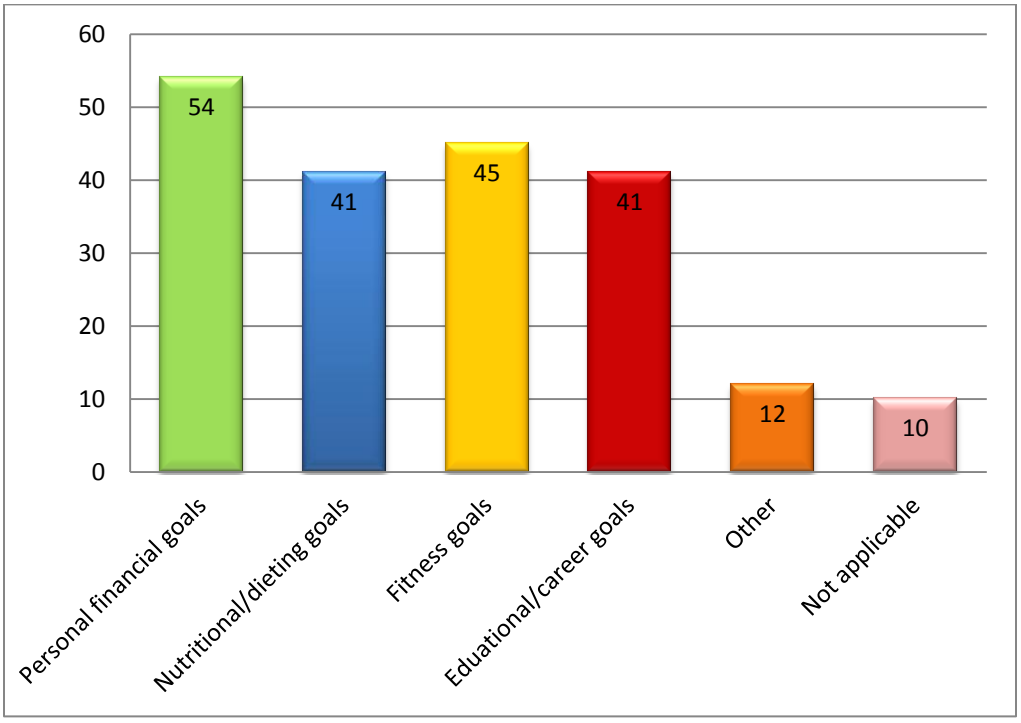
Question A2 – If you selected 'Yes', please select the types of goals you set. (Please select all that apply to you). If there is another type of goal that is not included in the list below, please identify it in the 'Other' option.

Responses:

Of the 74 responses to this question, 54 noted that they set personal financial goals (73%), 41 nutritional/dieting goals (55%), 45 fitness goals (61%), 41 educational/career goals (55%), and 12 set of 'other' types of goals. Ten individuals indicated that this question was 'not applicable' to them (14%). Of the 12 'other' types of goals, the responses were interpreted and placed into the following categories (number of responses):

i. Housework/home improvements goals (4)
ii. Musical goal (2)
iii. Personal improvement goals (2)
iv. Sports goals (1)
v. Travel goals (1)
vi. Retirement goals (1)
vii. Energy goals (1)

Figure 19 – Types of Goals Set by Participants (n=74)



Question A3 – What types of rewards or incentives do you get for achieving your goals? If you receive rewards or incentives for achieving your goal, please describe them next to the goal that you typically set. If you do not receive rewards for achieving your goal, please write 'none' in the space provided. (Note that rewards and incentives could be monetary and/or non-monetary.)

Responses:

Table 3 provides a summary of the types of rewards and incentives that participants received for goals that they set in their personal lives. Since these were written responses, respondents had the ability to describe more than one reward or incentive for each goal – and indeed, several did so. For presentation here, the responses have been categorised as extrinsic benefits – that is, benefits that are tangible and measureable, such as more purchasing power or weight loss – and intrinsic benefits – that is, benefits that are not tangible and felt by the individual such as personal satisfaction or 'feeling good'. The raw responses and categorisation rationale is available in Appendix F.

Table 3 – Types of Rewards or Incentives for Achieving One's Goal

Type of Goals:	Type of Motivation:
Personal financial goals: n=55 **Number of respondents indicating both extrinsic and intrinsic benefits: n=5**	**Extrinsic: (30)** • Increase spending power (16) • Increased savings (11) • Reduce debt and interest payments (2) • Government incentives (1) **Intrinsic: (24)** • Financial freedom/security/less stress (15) • Personal satisfaction (8) • Meet or exceeding targets (1) **Indicated 'none' or left blank (11)**
Nutritional/dieting goals: n=40 **Number of respondents indicating both extrinsic and intrinsic benefits: n=4**	**Extrinsic: (31)** • Better health (15) • Desirable body figure/features (9) • Reduce risk of illness (1) • New clothing (1) • Massage (1) • Participating in more activities (1) • Indulge after goal achievement (1) • Better annual check up at the doctor (1) • Less medication (1) **Intrinsic: (16)** • Feel healthier/good/satisfied (16) **Indicated 'none' or left blank (5)**

Fitness goals: n=41 **Number of respondents indicating both extrinsic and intrinsic benefits: n=7**	**Extrinsic: (32)** • Better health (17) • Desirable body figure/features (8) • Less risk of illness/mobility issues (3) • Clothes fit better (1) • More social connections (1) • Indulge after goal achievement (1) • Better sex life (1) **Intrinsic: (19)** • Feel healthier/good/satisfied (14) • Increase confidence/self-esteem (3) • Less stress (2) **Indicated 'none' or left blank (8)**
Educational/career goals: n=39 **Number of respondents indicating both extrinsic and intrinsic benefits: n=3**	**Extrinsic: (15)** • Increased salary/income (8) • Career advancement (7) **Intrinsic: (22)** • Personal satisfaction/sense of achievement (12) • More wisdom/knowledge/skills (4) • Less stress/good work life balance (2) • Thought stimulation (1) • Self respect (1) • Sense of control (1) • Recognition from colleagues/employer (1) **Indicated 'none' or left blank (7)**
Housework/Home improvement goals: n=4	**Intrinsic: (3)** • Personal satisfaction (2) • Less stress (1) **Indicated 'none' or left blank (1)**
Musical goals: n=2	**Intrinsic: (1)** • Feeds my spirit **Indicated 'none' or left blank (1)**
Personal improvement goals: n=2	**Intrinsic: (2)** • Personal satisfaction (2)
Sports goals: n=1	**Extrinsic: (1)** • Better health
Travel goals: n=1	**Intrinsic: (1)** • Enjoy outdoor activities
Retirement goals: n=1	**Intrinsic: (1)** • Security
Energy goals: n=1	**Extrinsic: (1)** • Government incentives

Question A4 – What types of negative consequences or disincentives are there if you do not achieve your goals? If there are no negative consequences for not achieving your goal, please

write ‘none’. Please explain the negative consequences for each applicable type of goal. (Note that negative consequences and disincentives could be monetary and/or non-monetary.)

Responses:

Table 4 provides a summary of the types of negative consequences and disincentives that participants received for not achieving goals that they set in their personal lives. Again, these were written responses and some respondents described more than one consequence or disincentive for each goal. The response types were categorised and summed as extrinsic consequences – that is, consequences that are tangible and measureable, such as more lost income – and intrinsic consequences – that is, consequences that are not tangible and felt by the individual such as personal guilt.

Table 4 – Types of Negative Consequences or Disincentives for Not Achieving One’s Goal

Type of Goals:	Type of Motivation:
Personal financial goals: n=55 **Number of respondents indicating both extrinsic and intrinsic consequences: n=1**	**Extrinsic: (19)** • Decreased spending power (11) • Higher interest payments on debt (4) • Need to pay attention to finances more closely (2) • Can’t travel as much or as well (2) **Intrinsic: (22)** • Increased stress (11) • Loss of financial freedom/independence/control (6) • Negative feelings (e.g., guilt, disappointment) (5) **Indicated 'none’ or left blank (16)**
Nutritional/dieting goals: n=37 **Number of respondents indicating both extrinsic and intrinsic consequences: n=6**	**Extrinsic: (20)** • Decreased health (4) • Pay more for food/medication (3) • Risk of illness/loss of mobility (4) • Less desirable body shape/appearance (5) • Need new clothes (3) • Negative annual check up (1) **Intrinsic: (21)** • Feeling sluggish/less healthy (11) • Negative feelings (e.g., guilt, disappointment) (5) • Decreased self-esteem (5) **Indicated 'none’ or left blank (10)**
Fitness goals: n=39 **Number of respondents indicating both extrinsic and intrinsic consequences:**	**Extrinsic: (17)** • Decreased health (7) • Less desirable body shape/appearance (4) • Risk of illness/loss of mobility (3) • Need new clothes (3) **Intrinsic: (28)**

n=9	• Feeling sluggish/lazy/less healthy (15) • Negative feelings (e.g., guilt, disappointment) (8) • Decreased motivation (3) • Increased stress (1) • Decreased sex drive (1) **Indicated 'none' or left blank (12)**
Educational/career goals: n=37 **Number of respondents indicating both extrinsic and intrinsic consequences: n=1**	**Extrinsic: (9)** • Lack of career advancement (4) • Loss of income (4) • Poor work performance (1) **Intrinsic: (20)** • Negative feelings (e.g., guilt, disappointment) (12) • Increases stress (4) • Become disinterested in life/depressed (3) • Loss sense of control (1) **Indicated 'none' or left blank (14)**
Housework/Home improvement goals: n=4	**Extrinsic: (1)** • Loss of produce in the garden **Intrinsic: (3)** • Sense of guilt • Increased stress • Less aesthetic **Indicated 'none' or left blank (1)**
Musical goals: n=2	**Intrinsic: (1)** • Loss of inspiration **Indicated 'none' or left blank (1)**
Personal improvement goals: n=2	**Intrinsic: (2)** • Decreased self-esteem • Increased stress
Sports goals: n=1	**Extrinsic: (1)** • Injuries
Travel goals: n=1	**Extrinsic: (1)** • Financial consequences of spending too much (1)
Retirement goals: n=1	**Indicated 'none' or left blank (1)**
Energy goals: n=1	**Extrinsic: (1)** • Poor application of capital

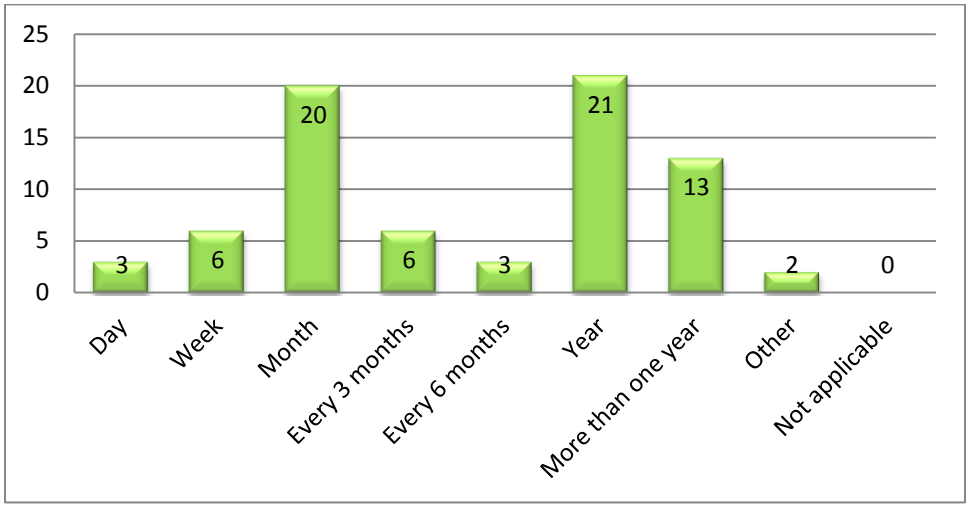
Question A5 – For each of the types of goals that you selected, please specify the timeframe you use to manage your goals? (For the options that do not apply to you, please select 'not applicable'.)

Responses:

The most commonly used timelines for managing personal financial goals were 'one year' (42% of respondents) and 'one month' (40% of respondents), although nine respondents to this question (18%) indicated that they manage their financial goals weekly and/or daily and 14

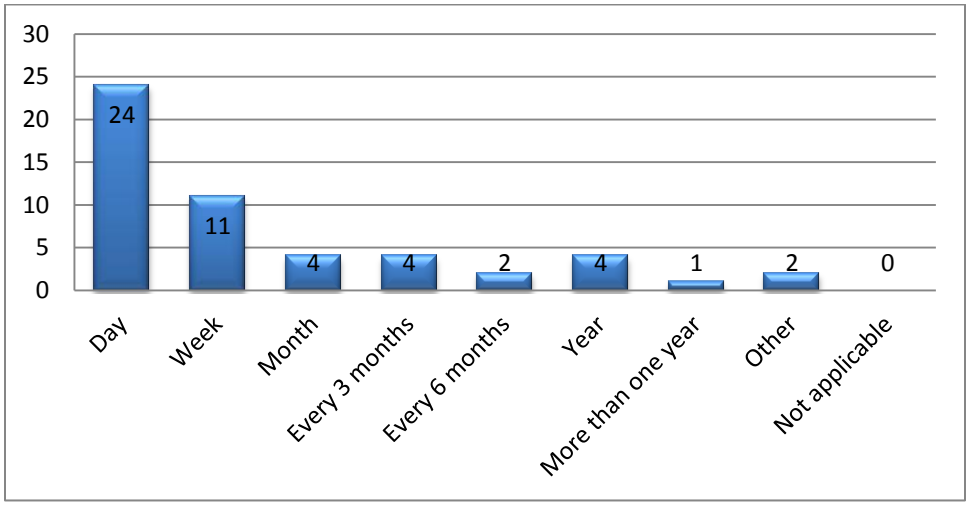
respondents (28%) indicated that they set long-term goals of greater than one year. Thirteen respondents (26%) used multiple timelines simultaneously to manage their personal financial goals. Figure 20 provides a graphical representation of the timelines used to manage personal financial goals.

Figure 20 – Timeframes Used to Track Progress Towards Personal Financial Goals (n=50)



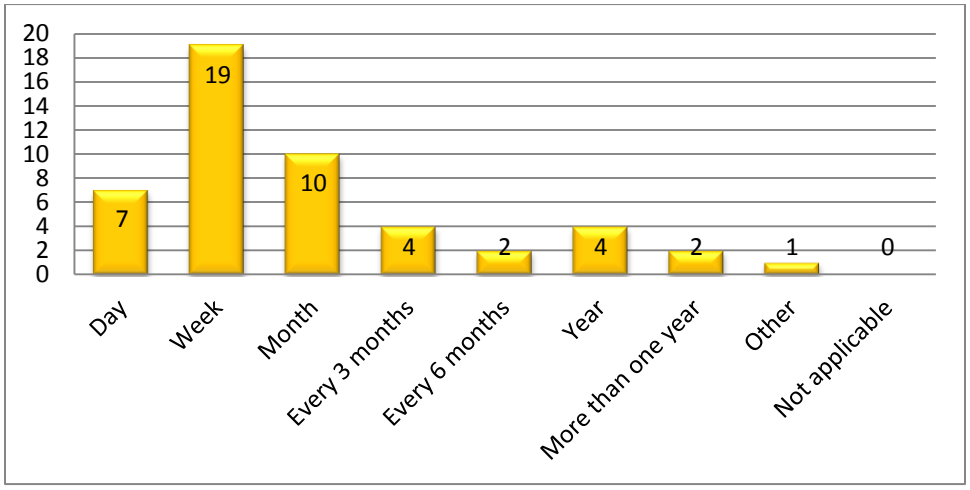
In contrast to personal financial goals, the most commonly used timelines for managing nutritional and dieting goals were in the immediate term of every day (63% of respondents) and every week (29% of respondents). One respondent even managed nutritional goals meal by meal. Eight respondents (21%) used multiple timelines simultaneously to manage their nutritional and dieting goals. Figure 21 provides a graphical representation of the preferred timelines used to manage these goals.

Figure 21 – Timeframes Used to Track Progress Towards Nutritional/Dieting Goals (n=38)



Similar to nutritional and dieting goals, the individuals in this study used more immediate timelines for managing fitness goals. The most common timeline for managing fitness goals was 'every week' (48% of respondents). Sixty percent of individuals manage fitness goals either weekly or daily and about 28% of individuals set fitness goals for greater than one month. Only four respondents (10%) used multiple timelines simultaneously to manage their fitness goals. Figure 22 provides a graphical representation of the preferred timelines used to manage these goals.

Figure 22 – Timeframes Used to Track Progress Towards Fitness Goals (n=40)



By far the most common timeframe used for managing educational and career goals was 'once a year' (59%). Only 18% of individuals setting educational or career goals managed them in timeframes of one month or less. Five respondents (13%) used multiple timelines simultaneously to manage their educational and/or career goals. Figure 23 provides a graphical representation of the preferred timelines used to manage these goals.

Figure 23 – Timeframes Used to Track Progress Towards Educational/Career Goals (n=39)

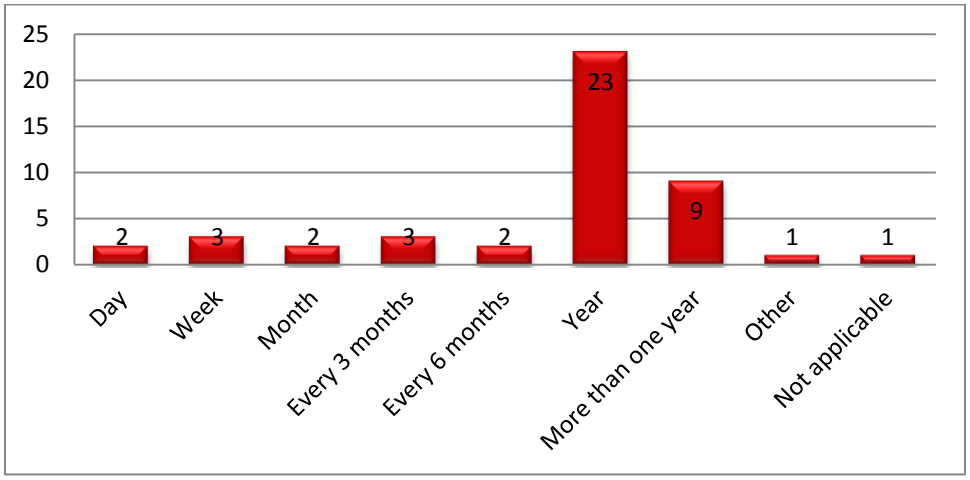


Table 5 summarises the timelines used for the 'other' goals identified by the survey respondents, although since the sample size for each of these types of goals is so small, no trends or relevant findings can be distinguished.

Table 5 – Timeframes Used to Track Progress Towards 'Other' Goals

Goal Type	Day	Week	Month	Every 3 months	Every 6 month	Year	More than 1 year	N/A
Housework (n=4)	2		1			1		
Music (n=2)		1						
Personal improvement (n=2)	2	1	1		1	1	1	
Sports (n=1)	1							
Travel (n=1)					1			
Retirement (n=1)							1	
Energy (n=1)	1						1	

Question A6 – What factors motivate you to achieve your goal? Please describe your level of agreement with the following statements regarding the <u>factors that motivate</u> you to achieve your goals.

"I am motivated to achieve this type of goal because...

i. It is the responsible thing to do;
ii. I get personal satisfaction from achieving these goals;
iii. I want the reward associated with achieving these goals;
iv. It benefits me, and/or my family, to achieve these goals;
v. It benefits others in society for me to achieve these goals;
vi. I want to avoid the negative consequences associated with not achieving these goals."

Responses:

The following four tables summarise the responses to Question A6 and each table represents a goal type that was provided. For personal financial goals, individuals seem to most strongly agree with the statement that they are motivated to achieve these goals because it will benefit them or their family (69% strongly agreed). In addition, 100% of respondents at least somewhat agreed that the personal satisfaction was a motivational factor for the achievement of their financial goals. Less than half of the respondents at least somewhat agreed that 'benefits to others in society' were motivational factors to achieve their personal financial goals.

Table 6 – Factors that Motivate Achievement of Personal Financial Goals

Motivational Factor	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Responsible thing to do	47	18 (38%)	20 (43%)	6 (13%)	3 (6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Personal satisfaction from goal achievement	48	23 (48%)	17 (35%)	8 (17%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Want reward for goal achievement	48	23 (48%)	14 (29%)	7 (15%)	2 (4%)	0 (0%)	2 (4%)	0 (0%)	0 (0%)
It benefits me/my family	48	33 (69%)	13 (27%)	2 (4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
It benefits society	48	1 (2%)	7 (15%)	15 (31%)	13 (27%)	2 (4%)	4 (8%)	4 (8%)	2 (4%)
Want to avoid negative consequences	47	15 (32%)	18 (38%)	7 (15%)	3 (6%)	1 (2%)	0 (0%)	2 (4%)	1 (2%)

Relative to most of other goal types, fewer individuals were strongly motivated to achieve nutritional and dieting goals because they felt that it is the responsible thing to do or because it benefitted others in society. Instead, individuals setting these types of goals strongly agreed with statements about motivation from personal satisfaction (54%), rewards (54%), and other benefits to themselves or their family (61%).

Table 7 – Factors that Motivate Achievement of Nutritional/Dieting Goals

Motivational Factor	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Responsible thing to do	37	7 (19%)	15 (41%)	8 (22%)	4 (11%)	1 (3%)	2 (5%)	0 (0%)	0 (0%)
Personal satisfaction from goal achievement	37	20 (54%)	14 (38%)	2 (5%)	0 (0%)	1 (3%)	0 (0%)	0 (0%)	0 (0%)
Want reward for goal achievement	37	20 (54%)	10 (27%)	4 (11%)	3 (8%)	0 (0%)	2 (4%)	0 (0%)	0 (0%)
It benefits me/my family	36	22 (61%)	11 (31%)	2 (6%)	0 (0%)	0 (0%)	1 (3%)	0 (0%)	0 (0%)
It benefits society	37	2 (5%)	7 (19%)	9 (24%)	13 (35%)	0 (0%)	5 (14%)	1 (3%)	0 (0%)
Want to avoid negative consequences	37	17 (46%)	12 (32%)	5 (14%)	1 (3%)	0 (0%)	2 (5%)	0 (0%)	0 (0%)

Individuals setting fitness goals also seemed to be most highly motivated by the same three factors that motivate achievement of nutritional and dieting goals: 61% strongly agreeing that personal satisfaction was a fitness goal motivator, and 55% and 57% for rewards and personal benefits, respectively. Fifty-four percent also strongly agreed that they wanted to avoid the negative consequences of not attaining their fitness goals.

Table 8 – Factors that Motivate Achievement of Fitness Goals

Motivational Factor	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Responsible thing to do	38	13 (34%)	16 (42%)	3 (8%)	4 (11%)	0 (0%)	2 (5%)	0 (0%)	0 (0%)
Personal satisfaction from goal achievement	38	23 (61%)	15 (39%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Want reward for goal achievement	38	21 (55%)	11 (29%)	4 (11%)	2 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
It benefits me/my family	37	21 (57%)	13 (35%)	2 (4%)	0 (0%)	0 (0%)	1 (3%)	0 (0%)	0 (0%)
It benefits society	38	4 (11%)	8 (21%)	8 (21%)	11 (29%)	0 (0%)	6 (16%)	1 (3%)	0 (0%)
Want to avoid negative consequences	37	20 (54%)	7 (19%)	7 (19%)	1 (3%)	0 (0%)	2 (5%)	0 (0%)	0 (0%)

Similar to the three goals already discussed, educational and career goal achievement appears to be largely motivated by personal satisfaction from goal achievement (66% strongly agree), wanting a reward for goal achievement (53% strongly agree) and the personal benefits to oneself and one's family (66% strongly agree). Relative few strongly agreed that they were motivated to achieve educational and career goals for the benefits to society.

Table 9 – Factors that Motivate Achievement of Educational/Career Goals

Motivational Factor	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Responsible thing to do	47	9 (24%)	12 (32%)	8 (21%)	6 (16%)	0 (0%)	2 (5%)	0 (0%)	1 (3%)
Personal satisfaction from goal achievement	48	25 (66%)	11 (29%)	1 (3%)	1 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Want reward for goal achievement	48	20 (53%)	8 (21%)	5 (13%)	4 (11%)	0 (0%)	1 (3%)	0 (0%)	0 (0%)
It benefits me/my family	48	25 (66%)	8 (21%)	3 (8%)	2 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
It benefits society	48	6 (16%)	6 (16%)	6 (16%)	11 (29%)	0 (0%)	6 (16%)	2 (5%)	1 (3%)
Want to avoid negative consequences	47	7 (18%)	10 (26%)	10 (26%)	5 (13%)	2 (5%)	3 (8%)	0 (0%)	1 (3%)

Respondents that have set goals other than the four provided in the survey, also most strongly agreed with personal satisfaction (55%), rewards (36%) and benefits to oneself or one's family (55%) as being motivational factors to achieve these 'other' goals.

Questions A7 to A13 – Please indicate the degree to which you agree or disagree with the following statements:

Perceived Benefits:

A7 - I like setting goals because it helps me stay organised.
A8 - I find it motivating to see progress towards my goals.
A9 - I am the type of person that likes having a target to work towards.
A10 - I like breaking down goals into smaller tasks to make the process more manageable.

Perceived Barriers:

A11 - I believe that actively setting and managing goals takes a lot of effort.
A12 - In most cases, I don't like the pressure of meeting targets within specified time periods.
A13 - In most cases, I don't like the exercise of planning tasks.

Responses:

In Tables 10 and 11, the responses to the statements about perceived benefits and barriers of goal-setting are summarised and presented. The respondents reported that the most important perceived benefit to goal-setting, from the list provided in the survey, was that individuals find it motivating to see progress towards a goal as 79% of respondents at least 'agreed' with this statement. In addition, 60% of individuals said that they 'agree' and 89% at least 'somewhat agree' with the statement that breaking down goals into smaller tasks to make the process more manageable is a perceived benefit.

Table 10 – Participants' Opinions Regarding the Benefits of Goal-Setting

Perceived Benefit	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Helps me stay organised	66	16 (24%)	28 (42%)	14 (21%)	6 (9%)	0 (0%)	1 (2%)	0 (0%)	1 (2%)
Motivating to see progress	66	18 (27%)	34 (52%)	9 (14%)	2 (3%)	1 (2%)	0 (0%)	0 (0%)	2 (3%)
Likes having a target	65	19 (29%)	25 (38%)	14 (22%)	4 (6%)	0 (0%)	1 (2%)	1 (2%)	1 (2%)
Likes breaking down goals into smaller tasks	66	20 (30%)	20 (30%)	19 (29%)	4 (6%)	0 (0%)	0 (0%)	1 (3%)	1 (2%)

The findings from this survey would suggest that the most important perceived barrier (or inhibitor) of goal-setting is that they take a lot of effort to set and to manage. Seventy-eight percent of respondents at least 'somewhat agreed' with the statement that goal-setting takes a lot of effort; whereas only 40% at least 'somewhat agreed' with the statement that they don't like the pressure of targets and deadlines and only 32% acknowledged the same level of agreement that they don't like to plan.

Table 11 – Participants' Opinions Regarding the Barriers of Goal-Setting

Perceived Barrier	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Setting and managing goals takes a lot of effort	66	10 (15%)	24 (36%)	18 (27%)	5 (8%)	6 (9%)	2 (3%)	0 (0%)	1 (2%)
Don't like the pressure of targets and deadlines	65	2 (3%)	6 (9%)	18 (28%)	12 (18%)	10 (15%)	10 (15%)	6 (9%)	1 (2%)
Don't like to plan	66	2 (3%)	4 (6%)	15 (23%)	8 (12%)	14 (21%)	13 (20%)	9 (14%)	1 (2%)

In Question A14 of this survey, participants were asked to state the extent to which they agreed or disagreed with the following statement about goal choices: "In most cases, I prefer to set my own goals, rather than have goals provided to me." Table 12 summarises the responses to Question A14.

Table 12 – Participants' Regarding Self-Set and Assigned Goals

Question A.14	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Prefer self-set goals to assigned goals	66	25 (38%)	24 (36%)	7 (11%)	6 (9%)	3 (5%)	0 (0%)	0 (0%)	1 (2%)

Eighty-five percent of the individuals participating in this study at least somewhat agreed that they would prefer to manage goals that were self-set rather than goals that were assigned by someone else. This might be the case because setting one's own goal could increase their sense of control and add more meaning to the goal-setting exercise, although participants were not asked to comment on why they would prefer one of these approaches to the other.

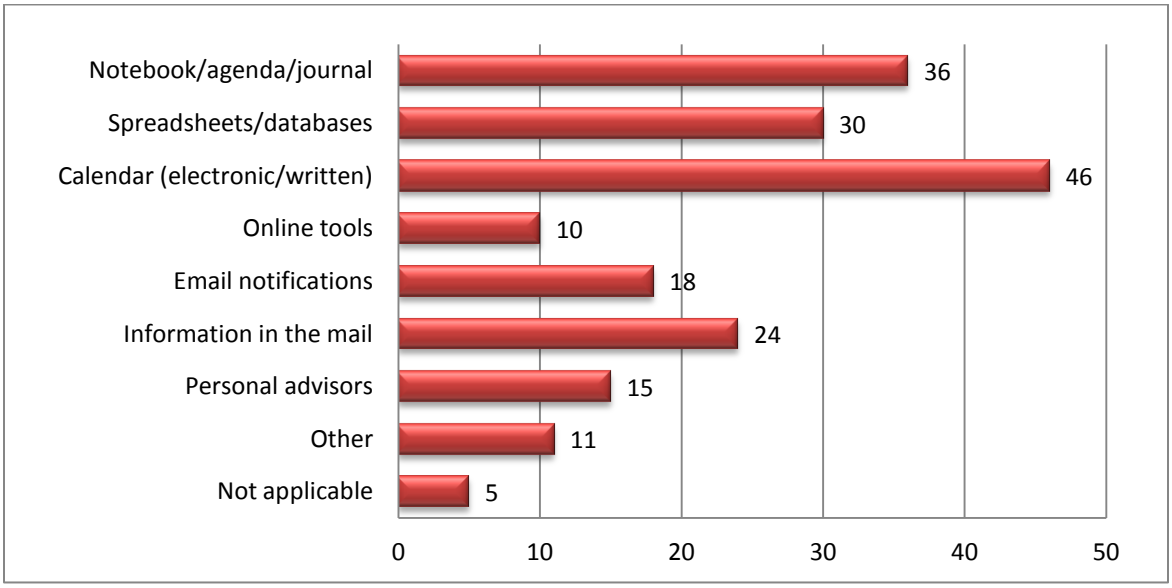
Question A15 – What tools and resources do you use to help you manage your goals? (Please select all that apply.)

Responses:

Calendars (either electronic or written on paper) were the most often noted tool used by participants in this study (70%) to help them set and keep track of their goals. Notebooks, agendas, and journals have also been commonly used (by 55% of respondents) as well as computer-based tools such as spreadsheets and databases (45%). Online tools have not yet been identified as a common tool used to setting and managing goals (only used by 15% of respondents). Figure 24 provides a snapshot of all the responses to Question A.15. The 11 'Other' responses to Question A.15 (written responses by participants with the ability to suggest more than one option) provided seven additional tools (or aids) to help set and manage these individuals' personal goals including (number of responses):

i. Mental notes (4)
ii. Family members (2)
iii. Experts in the field (2)
iv. Books (1)
v. Post-its (1)
vi. Instructional DVDs (1)
vii. Financial statements (1)

Figure 24 – Tools and Information to Assist with Management of Goals (n=66)



Question A16 – Do you tell others about your goals? If 'Yes', please describe who those people are (some examples might include: family, friends, neighbours, colleagues, etc.).

Responses:

Thirty-nine respondents (59%) indicated that they do tell others about their goals and 26 (39%) noted that they did not. One respondent of the 66 responding to this question selected 'Not applicable'. Of the 39 responding 'Yes', family members were the most common (74%) with whom they would share information about their goals. The following is a list of the types of people identified and the number of responses for each type of person:

i. Family members (29 responses; 74% of those saying 'Yes')
ii. Friends (15 responses; 38% of those saying 'Yes')
iii. Colleagues (6 responses; 15% of those saying 'Yes')
iv. Neighbours (2 responses; 5% of those saying 'Yes')
v. Anyone who will listen (1 response; 3% of those saying 'Yes')
vi. Doctor (1 response; 3% of those saying 'Yes')
vii. Boyfriend/girlfriend (1 response; 3% of those saying 'Yes')
viii. Supervisor (1 response; 3% of those saying 'Yes')

Question A17 – If you answered 'Yes' to the previous question, do you share your progress with them?

Responses:

Twenty-eight of the study participants responding admitted that they more specifically share their *progress* towards achieving their goal, while 10 reported that they do not, and 19 respondents marked this question as 'not applicable'.

Question A18 – Does goal-setting work well for you? If so, please describe why or if not, please describe why not.

Responses:

Respondents to this question could either select 'Yes' or 'No' and then were asked to explain their selection. Fifty-five of the 63 respondents (87%) to this question indicated that goal-setting worked well for them while eight (13%) indicated that it did not. Some respondents provided more than one reason. Table 13 presents the reasons why goal-setting worked or did not work for the individuals in this study and the full details are provided in Appendix F.

Table 13 – Participants' Reasons Why Goal-Setting Works or Does Not Work for Them

Yes, goal-setting works well for me because... (n=55)	No, goal-setting does not work well for me because... (n=8)
• It provides a sense of purpose/focus (18) • Seeing progress is satisfying (9) • It helps me stay organised (7) • I am goal-oriented (6) • It helps me measure progress/accomplishments (5) • Provides a guide for decision-making/prioritising (3) • It provides a sense of control/reassurance (2) • It prompts me to make progress (1) • I have self-discipline (1) • It is integrated into my lifestyle (1) • No explanation given (4)	• Rather go with the flow (2) • Too busy (2) • Get discouraged if do not achieve goal (1) • Get overwhelmed (1) • No progress was achieved (1) • No explanation given (1)

4.4.2 Home Energy Awareness, Attitudes and Behaviours

In this section of the thesis, the findings from 'Part B' of the online survey will be presented. There were 11 questions in this part of the survey and the first ten were Likert-scale

type questions about home energy awareness and attitudes. For Questions B1 to B10, the study participants were asked to state their level of agreement with the following ten statements:

Energy Awareness:

- B1 - I am aware of how much energy is used by my home each month.
- B2 - I am aware of how much money it costs to use energy in my home each month.
- B3 - I am aware of the environmental impact associated with using energy in my home each month.

Attitudes and Behaviours Regarding Home Energy Usage:

- B4 - I try to conserve as much energy in my home as possible.
- B5 - I try to reduce my electricity usage during on-peak times as much as possible.
- B6 - I have purchased energy efficient appliances, and I want to lower my energy usage even more.
- B7 - I want to reduce the environmental impact associated with the energy usage of my home.
- B8 - I want to reduce the costs of my home's energy usage as much as possible.
- B9 - I am interested in becoming more aware of my home's energy usage.
- B10 - I would like to learn more about the amount of energy my home's appliances consume.

Responses:

Table 14 provides a summary of all the responses to Questions B1, B2 and B3.

Table 14 – Home Energy Awareness of the Study Participants

Question	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
B1 – aware of monthly energy usage	66	10 (15%)	17 (26%)	21 (32%)	5 (8%)	6 (9%)	3 (5%)	4 (6%)	0 (0%)
B2 – aware of monthly energy costs	66	19 (29%)	21 (32%)	15 (23%)	3 (5%)	2 (3%)	4 (6%)	2 (3%)	0 (0%)
B3 – aware of environment impact from energy usage	65	15 (23%)	17 (26%)	25 (38%)	2 (3%)	1 (2%)	2 (3%)	3 (5%)	0 (0%)

The individuals in the study sample reported strong pro-sustainability and pro-conservation attitudes towards energy management in their homes. One notable finding shown in Table 15 for the 'attitudinal questions' was that 58% of respondents strongly agreed that they want to reduce the energy costs for their homes.

Table 15 – Home Energy Attitudes of the Study Participants

Question	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
B4 – try to conserve	66	26 (39%)	24 (36%)	13 (20%)	1 (2%)	2 (3%)	0 (0%)	0 (0%)	0 (0%)
B5 – try to reduce on-peak electricity	65	26 (40%)	23 (35%)	7 (11%)	3 (5%)	3 (5%)	0 (0%)	3 (5%)	0 (0%)
B6 – purchased efficient appliances	66	26 (39%)	17 (26%)	15 (23%)	6 (9%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)
B7 – want to reduce environmental impact from energy usage	65	26 (40%)	23 (35%)	12 (18%)	2 (3%)	2 (3%)	0 (0%)	0 (0%)	0 (0%)
B8 – want to reduce energy costs	65	38 (58%)	17 (26%)	8 (12%)	2 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
B9 – interest in becoming more energy aware	65	29 (45%)	18 (28%)	12 (18%)	2 (3%)	0 (0%)	3 (5%)	0 (0%)	1 (2%)
B10 – want to learn about appliance-specific usage	66	26 (39%)	19 (29%)	14 (21%)	1 (2%)	1 (2%)	4 (6%)	0 (0%)	1 (2%)

Question B11 – Do you currently keep track of your home's energy usage? If so, please explain what you are doing.

Responses:

Sixty-six individuals responded to this question, of which 28 (42%) indicated that they currently keep track of their home's energy usage and 38 (58%) indicated that they do not. Below is a list of the ways in which study participants have been currently keeping track of their home's energy usage.

i. Utility bills (25)
ii. Keep track of time-of-use schedules (2)
iii. Home energy evaluation (2)
iv. Used/purchased power meters to monitor appliances (2)
v. Use electric utility web-based monitoring system (1)
vi. Track usage on a spreadsheet (1)
vii. Read meter (1)

4.4.3 Participants' Opinions on Home Energy Goal-Setting

In this section of the thesis, the results from 'Part C' of the survey are presented. These results reflect the participants' opinions regarding home energy goal-setting. Each question is presented, followed by a summary of the responses.

Question C1 – Assuming you had a home energy management system (as described earlier) installed in your home, please indicate your level of agreement with the following statement: "I would be interested in setting goals to help me save energy, money and/or reduce my environmental impact."

Responses:

Sixty of the 66 participants responding to this question (91%) at least 'somewhat agreed' that they are interested in setting home energy goals and 24 respondents (36%) strongly agreed. Table 16 provides a detailed summary of the householders' interest in home energy goal-setting.

Table 16 – Interest in Home Energy Goal-Setting

Question C1	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
I am interested in setting home energy goals	66	24 (36%)	21 (32%)	15 (23%)	3 (5%)	1 (2%)	2 (3%)	0 (0%)	0 (0%)

Question C2 – In the space provided below, can you please explain your interest (or lack of interest), as described in C1, in setting home energy goals?

Responses:

The most common reasons why householders in this study were interested in home energy goal-setting were: 'looking to save money' (37%) and 'looking to reduce environmental impact' (32%). In addition, the most common reason why householders were not interested in home energy goal-setting was that fact that some feel they are 'already doing what they can.' Table 17 presents the various types of reasons why householders in this study were interested or disinterested in setting home energy goals. The raw responses are provided in Appendix F.

Table 17 – Reasons for Interest or Disinterest in Home Energy Goal-Setting

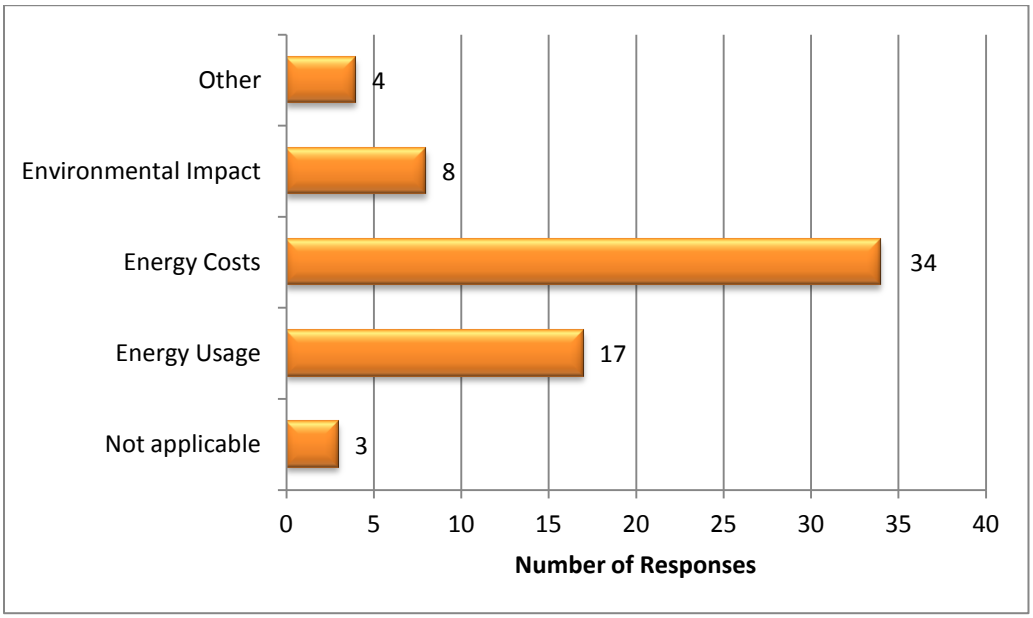
Responses: (n=59 ... multiple answers were permissible)	
Reasons for interest in home energy goal-setting	• Looking to reduce environmental impact (36) • Looking to save money (22) • Interested in becoming more energy aware (13) • Tool to help teach the kids/others about energy management (3) • Help manage rising costs of energy (2) • Alternative to purchasing efficient appliances (1) • I have the time to do it (1)
Reasons for disinterest in home energy goal-setting	• Already do what I can (6) • Concerned about time-commitment and difficulty to use (3) • Concerned about the costs of the system (2) • Don't agree with the premise "environmental impact" (1) • Seems like a waste of time (1)

Question C3 – What unit of preference would you want to use to set home energy goals?

Responses:

Thirty-four respondents (54%) interested in setting home energy goals indicated that they would be most interested in using 'energy costs' (e.g., dollars and cents) as their unit of preference. Seventeen participants (27%) indicated that they would be interest in using 'energy usage' (e.g., kWh for electricity or cubic metres for natural gas). Eight respondents (13%) indicated that they would prefer to use units measuring the environmental impact of their home's energy usage.

Figure 25 – Unit Preferred by Householders for Setting Home Energy Goals (n=66)



Other responses:

i. Combination of all three (3)

ii. KJ and kWh (1)

Questions C4 and C5 - Assuming you were setting goals to help you save energy in your home, please indicate your level of agreement with the following statements:

C4. I would be interested in learning how much energy my home appliances use to help me better track my progress towards my home energy goals.

C5. I would be interested in receiving customised energy savings tips to help me achieve my home energy goals.

Responses:

Eighty-nine percent of respondents to this survey at least 'somewhat agreed' that they would be interested in receiving appliance-specific feedback to help them manage home energy goals and 83% at least 'somewhat agreed' that they would be interested in receiving customised energy savings tips.

Table 18 – Householder Interest in Appliance-Specific Feedback and Energy Savings Tips

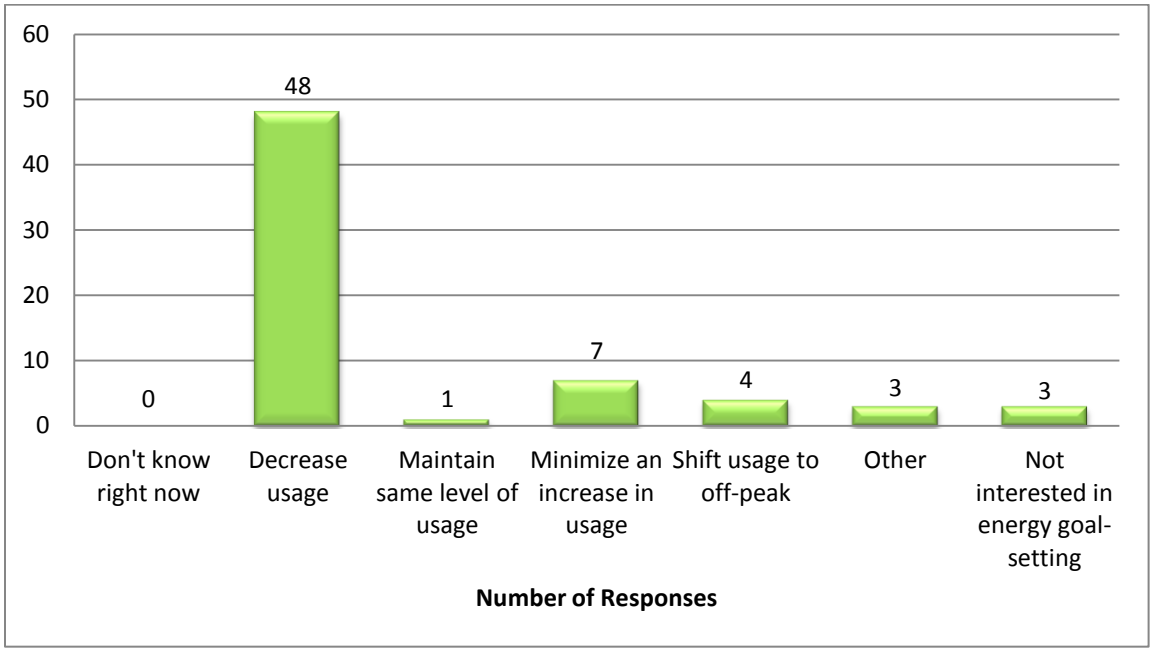
Question	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
C4 – Interested in appliance-based feedback	65	22 (34%)	26 (40%)	10 (15%)	2 (3%)	1 (2%)	2 (3%)	1 (2%)	1 (2%)
C5 – Interested in customised energy savings tips	66	23 (35%)	20 (30%)	12 (18%)	6 (9%)	2 (3%)	0 (0%)	2 (3%)	1 (2%)

Question C6 - Please indicate which of the following statements would <u>best describe your interest</u> in using a home energy management system to help you manage energy related goals.

Responses:

When asked what type of goal they would like to set, if managing home energy goals, participants in this study were most likely to indicate that they would like to set a 'conservation goal' (i.e. a decrease in energy usage, costs or environmental impact relative to a previous time period). Seventy-six percent of respondents selecting a goal type indicated that they would set a goal to reduce. Only one respondent (2%) indicated a desire to set a goal to 'maintain the same level of usage/costs/impact' and seven respondents (11%) would prefer to set a goal to 'minimize an increase.' Four respondents (6%) indicated that they would focus on shifting electricity consumption to off-peak time periods.

Figure 26 – Types of Home Energy Goals Preferred by Householders (n=66)



Five percent indicated that they were not interested in setting home energy goals. In the three 'other' responses, one householder indicated a desire to set goals to reduce consumption, costs and environmental impact while also being able to set goals to shift as much electricity as possible to off-peak times. The two other responses were: (1) reduce costs and (2) don't set goals. Figure 26 provides a visual summary of the types of home energy goals that would be preferred by householders.

Questions C7 to C9

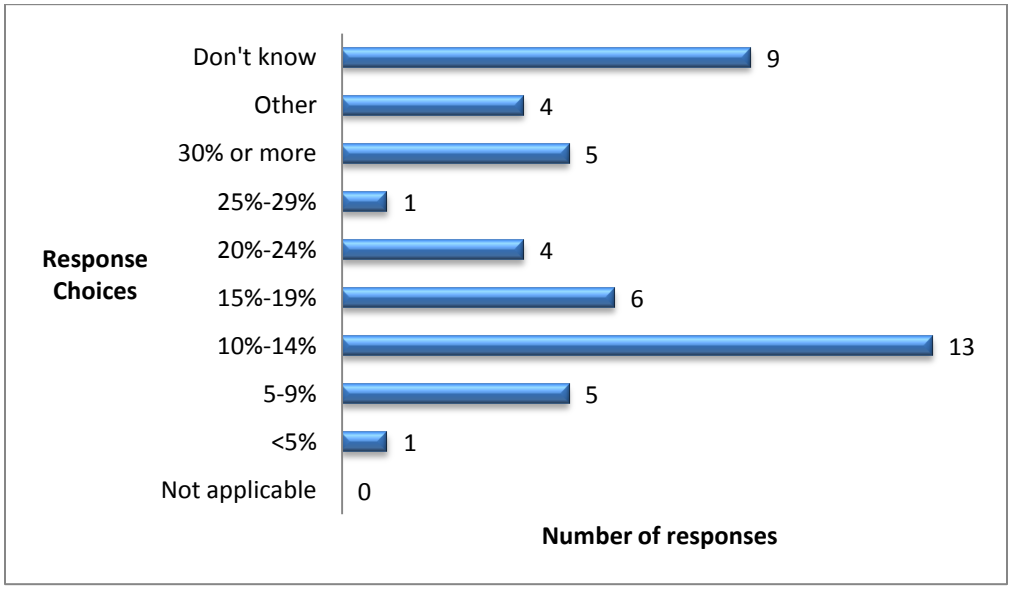
Only some respondents were asked one of the next three questions in the survey (Questions C7 to C9), depending how they responded to Question C6. If they selected a conservation goal (i.e. to decrease usage/cost/impact) they were prompted to answer Question C7. If they indicated that their goal would be to minimize an increase, they were asked to answer Question C.8. And, Question C9 was shown only to participants that wanted their goal to be a shift in electricity usage to off-peak times. If any other responses were selected in Question C6, the participant was not asked to respond to any of the next three questions.

Question C7 – In the previous question, you answered "decrease my home's energy usage/costs/environmental impact." How much of a decrease do you think you would like to achieve (i.e. what would be your goal)?

Responses:

The most common response (27%) was to set a goal to decrease energy usage, costs, or environmental impact by 10% to 14% relative to a previous timeframe. Approximately 60% of study participants wanting to decrease usage, costs or environmental impact were interested in setting a conservation goal of 10% or higher relative to a previous time period and 34% of householders in this study were interested in setting a goal to save at least 20%. Three respondents (6%) selecting the 'other' option and indicated that they would prefer not to set a percentage goal, just that they would do what they could. Twenty-one percent of respondents to this question were not sure what they would set as their conservation goal. The summary of results is presented in Figure 27.

Figure 27 – Goal Difficulty and Interest in Setting Conservation Goals (n=48)

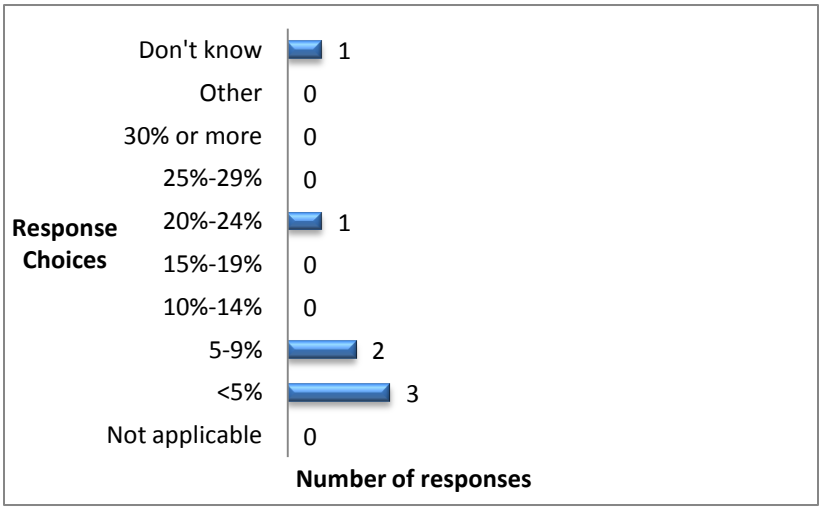


Question C8 – In the previous question, you answered "minimize an increase in my home's energy usage/cost/environmental impact." How much of an increase do you think you would like to allow (i.e. what would be your goal)?

Responses:

The most common response (43%) was to set a goal to minimize an increase of energy usage, costs, or environmental impact by less than 5% relative to a previous timeframe. Approximately 72% of study participants wanting to minimize an increase of usage, costs or environmental impact were interested in setting a goal to cap increases at 9% or less, relative to a previous time period. One respondent to this question was not sure of the amount that they would set for their goal. The summary of results is presented in Figure 28.

Figure 28 – Goal Difficulty and Interest in Setting Goals to Minimizing an Increase (n=7)

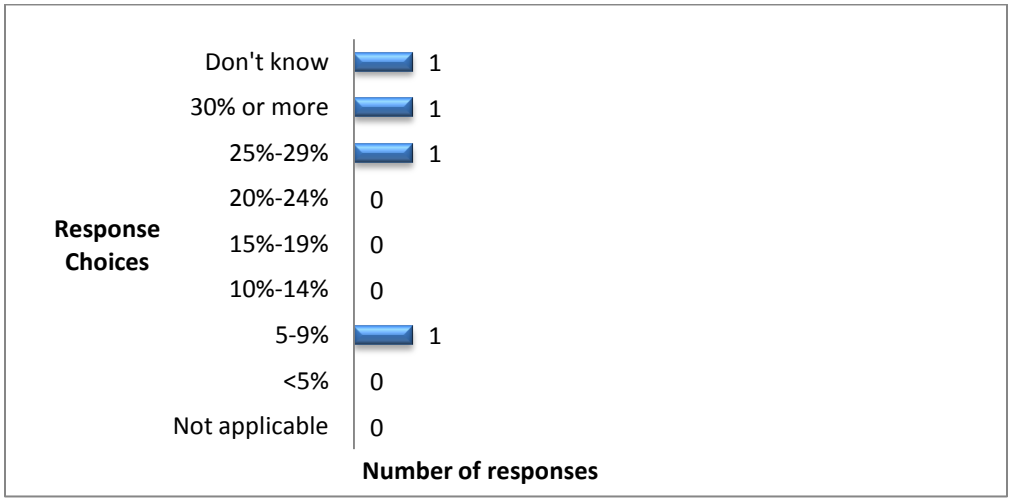


Question C9 – In the previous question, you answered "shift my electricity usage to off-peak time periods." How much do you think you would like to shift (i.e. what would be your goal)?

Responses:

Not many individuals selected a goal to 'shift electricity usage to off-peak times'; however, those who did select this option seemed to be willing to shift more electricity than others were willing to conserve (as a percentage of total usage). This is reflected in the two responses (50%) indicating that they would like to shift 25% or more of their electricity consumption to off-peak times.

Figure 29 – Goal Difficulty and Interest in Goals to Use Off-Peak Electricity (n=4)

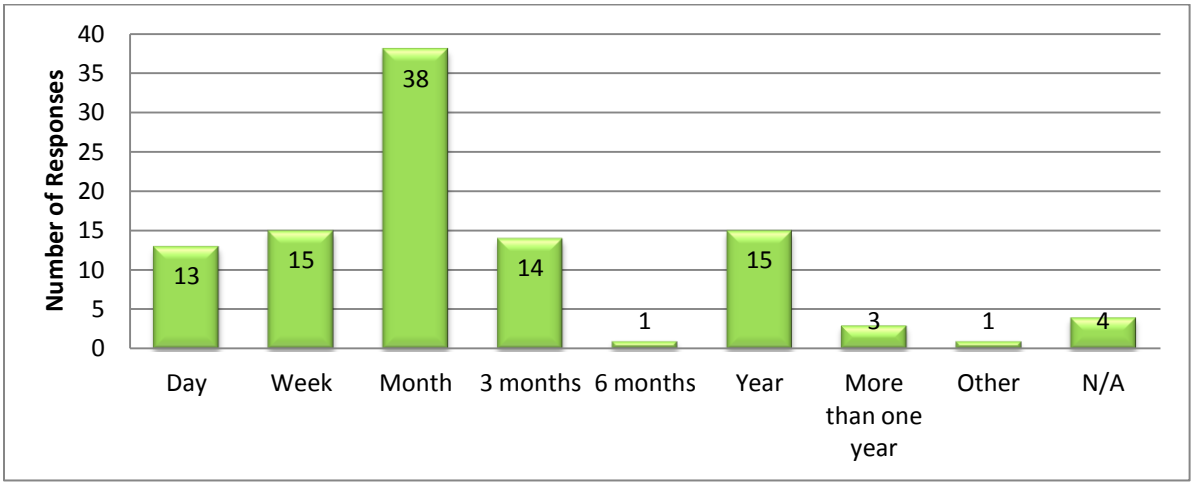


Question C10 – Please indicate what type(s) of time periods you would expect to use to manage energy related goals for your household. (Please select all that apply.)

Responses:

The most common timeframes selected by householders to manage home energy goals was 'monthly' (58% of respondents to this question selected this option). Twenty-three householders indicated that they would be interested in managing home energy goals 'weekly' or 'yearly'. Twenty percent of respondents acknowledged that they would expect to manage home energy goals 'daily'. One participant selected an 'other' option not appearing in the list provided and this householder suggested a two month timeframe for managing home energy goals. Eighteen respondents (27%) indicated that they would expect to use multiple timeframes simultaneously to manage their home energy goals. Figure 30 provides a graphical representation of the timeframes selected by respondents to this question.

Figure 30 – Timeframes Householders Would Expect to Use for Home Energy Goals (n=66)



Question C11 – Please use the space provided below to explain why you chose the timeframe(s) that you would expect to use if you were setting and managing energy related goals for your household.

Responses:

The most common rationale for timeframes to manage home energy goals were: (a) to align the goals with the home's billing cycle (16 responses), (b) to account for weekly/seasonality effects (12 responses), and (c) to help recall behaviour and make adjustments in the shorter-terms (10 responses). Table 19 provides a list of the types of explanations (and the number of times that explanation was given) for each type of timeframe.

Table 19 – Explanations for Preferred Timeframe When Managing Home Energy Goals

Timeframe Selected:	Explanations Given:
Daily only (n=4)	• Use energy on a daily basis, thus seems reasonable to track on a daily basis (2) • Energy usage is similar each day for us, therefore would be interested in daily monitoring (1) • We pay attention to time-of-use schedules (1)
Weekly only (n=6)	• Any longer and I would lose the specific details of what I was doing (2) • Because usage varies between weekdays and weekends, so averaging it out over the week is preferred. Daily is too often and more than week doesn't allow time to make adjustments if needed (1) • There are weekly effects such as working from home and laundry (1) • Seems like a logical timeframe to assess and react (1)

	• No comment given (1)
Monthly only (n=20)	• To align with the bill (10) • Realistic amount of time given other priorities (2) • Allows for periodic planning (2) • To 'iron out' rare occurrences (1) • Already manage energy on monthly basis (1) • No comment given (4)
Every 3 months only (n=8)	• Because energy usage is seasonal (3) • To align with bills (2) • Not too much, not too little (1) • Allows enough time to adjust (1) • No comment given (1)
Every 6 months only (n=0)	
Yearly only (n=3)	• Would need the long time to achieve the goal (2) • I don't like the structure and detailed agenda of a short timeframe (1)
More than 1 year only (n=1)	• Would be an ongoing indefinite goal timeframe (1)
Other (every 2 months) (n=1)	• To align with the utility bills (1)
Multiple timeframes (n=19) **(multiple reasons were sometimes given)**	• Yearly to see long-term results (4) • To align with billing cycle (4) • Short periods keep it 'top of mind' (4) • Longer to account for seasonal effects (3) • Shorter periods are easier to manage and develop patterns (2) • Short periods, like daily and weekly, would take too much effort (2) • Daily to help manage time-of-use schedules (2) • Some activities are done weekly (1) • To see differences over time (1) • Daily to compare Mondays to Mondays (1) • Multiple periods because it helps educate us (1) • No comment given (1)
Not applicable (n=4)	• Try to be efficient without the need to set goals (1) • Goals would vary given time of the year (1) • No comment given (2)

Question C12 – In the space provided, please indicate what, if any, reward you would expect to receive if you achieved your home energy goals. These can be monetary and/or non-monetary rewards from others (e.g., utility companies and/or governments) or from yourself.

Responses:

Table 20 – Rewards Expected by Householders for Achieving Home Energy Goals

Type of Goals:	Type of Motivation:
Home energy goals: n=60 **Number of respondents indicating both extrinsic and intrinsic benefits: n=20**	**Extrinsic: (53)** • Reductions in energy costs (46) • Government/utility incentive/rebates (7) **Intrinsic: (27)** • Satisfaction from reducing environmental impact (19) • Satisfaction from goal attainment (7) • Chance to share with others in the community (1) **Indicated 'none' or left blank (6)**

Question C13 – In the space provided, please indicate what, if any, negative consequences you would expect if you did not achieve your energy related goals for your household.

Responses:

Table 21 – Negative Consequence Expected by Householders for Not Achieving Home Energy Goals

Type of Goals:	Type of Motivation:
Home energy goals: n=49 **Number of respondents indicating both extrinsic and intrinsic consequences: n=7**	**Extrinsic: (23)** • Increased energy costs/lack of financial savings (21) • Lose our house (1) • Cost of upgrading appliances (1) **Intrinsic: (23)** • Negative feelings (disappointment, guilt, frustration, etc.) (13) • Environmental/social consequences (7) • Friction in the household (2) • Inconvenience of changing habits (1) **Indicated 'none' or left blank (17)**

Question C14 – What factors motivate you to achieve your home energy goal? Please describe your level of agreement with the following statement "I am motivated to achieve this type of goal because...

i. It is the responsible thing to do;
ii. I get personal satisfaction from achieving these goals;
iii. I want the reward associated with achieving these goals;
iv. It benefits me, and/or my family, to achieve these goals;
v. It benefits others in society for me to achieve these goals;
vi. I want to avoid the negative consequences associated with not achieving these goals."

Responses:

Table 22 summarises responses by householders regarding their motivations to achieve home energy goals. Householders seem to most strongly agree with the statement that they are motivated to achieve home energy goals because it is the responsible thing to do (41% strongly agreed). In addition, 38% of respondents strongly agreed that a motivating factor was the benefit to larger society. And, 86% of householders at least somewhat agreed that a motivating factor to achieve home energy goals would be personal satisfaction from goal attainment. Only 22% of householders participating in this study strongly agreed with 'avoidance of negative consequences' as a motivating factor to work towards home energy goal achievement.

Table 22 – Factors that Motivate Achievement of Home Energy Goals

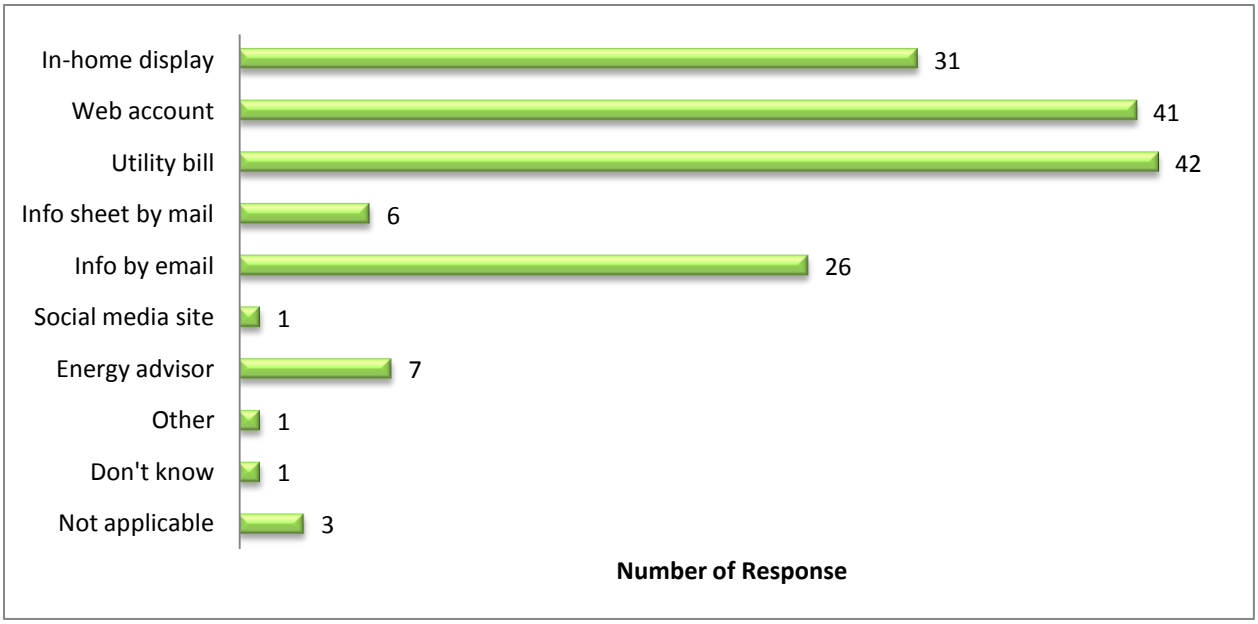
Motivational Factor	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	N/A
Responsible thing to do	63	26 (41%)	19 (30%)	15 (24%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)	1 (2%)
Personal satisfaction from goal achievement	64	21 (33%)	27 (42%)	7 (11%)	7 (11%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)
Want reward for goal achievement	64	22 (34%)	18 (28%)	9 (14%)	10 (16%)	4 (6%)	0 (0%)	0 (0%)	1 (2%)
It benefits me/my family	64	22 (34%)	31 (48%)	8 (12%)	2 (3%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)
It benefits society	64	24 (38%)	25 (39%)	11 (17%)	1 (2%)	0 (0%)	0 (0%)	2 (3%)	1 (2%)
Want to avoid negative consequences	64	14 (22%)	17 (27%)	18 (28%)	8 (12%)	2 (3%)	2 (3%)	1 (2%)	2 (3%)

Question C15 – Please indicate how you would like to keep track of your progress towards your home's energy goal?

Responses:

The most common ways in which householders wanted to keep track of their home energy goals were through their utility bill (70%) and through a web account (68%). Other popular methods that were selected by householders in this study included an in-home display (52%) and information by email (43%). Some participants also expressed interest in having an energy advisor help them keep track of goals (12%) and information sheets in the mail (10%). Figure 31 summarises all the tools and information that householders identified. The one 'other' response mentioned the use of a personal diary to keep a written log.

Figure 31 – Methods Preferred to Track of Home Energy Goals (n=64)



Question C16 – Of the options you selected in Question C.15, please indicate which is your most preferred and why.

Responses:

The most commonly chosen preferred method (i.e. it was householders' top choice) for receiving information about progress towards their home energy goals was a web account (37%). In addition, 26% of householders in this study thought an in-home display would be their

preferred choice and 24% indicated that the utility bill would be. A small percentage of participants indicated that an information sheet by mail (3%) and information received by email (5%) would be their most preferred option. Table 23 summarises the reasons that participants chose their preferred option and in some cases, respondents provided multiple reasons.

Table 23 – Reasons for Preferred Method to Track Home Energy Goals

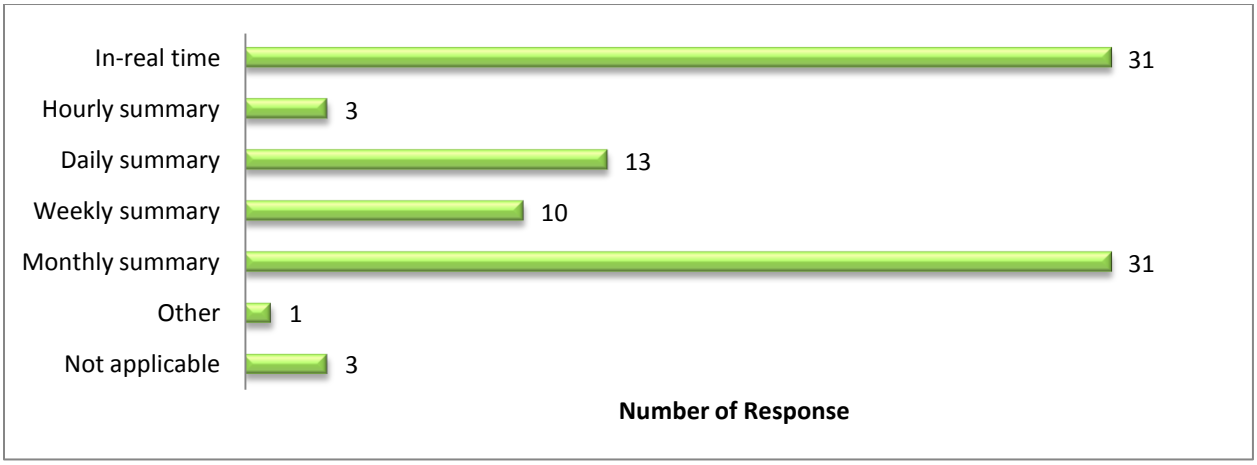
Most Preferred Option	Reason (number of occurrences) ... multiple reasons were permissible
In-home display (n=16)	• Easily accessible (8) • Available continuously (5) • Visible for everyone in the household to see (3) • Good for daily monitoring (2) • Avoids being on computer and/or using paper (2) • Stays visible/top of mind (2) • To help manage time-of-use pricing (1) • It's niftier (1) • Doesn't clutter my email inbox (1)
Web account (n=23)	• Accessible from anywhere/anytime (10) • Easily accessible (10) • Uses the computer often (3) • More information can be presented/analysed (2) • Hopes information would be printable/downloadable (2) • No need for paper (2) • More interactive (1) • Less likely to be 'broken by kids' (1) • Information can be kept private (1) • Information is less likely to get lost (1) • No reason given (1)
Utility bill (n=15)	• Familiar with billing format/presentation (4) • Prefer to receive this type of information on paper (3) • Receiving with the bill prompts me to look at it (3) • Relates to other information on bill (2) • Don't need more than the bill (2) • Makes the most sense (1)
Info sheet by mail (n=1)	• Convenient (1)
Info by email (n=4)	• Reduce paper use (1) • Common way to track data (1) • Often use email (1) • Easy to manage (1)
Social media site (n=0)	
Energy advisor (n=0)	
Other (n=1)	• Would like to keep track by writing in a diary and adding my own ideas (1)

Question C17 – How often would you prefer to receive or choose to access energy usage information about your household to help you keep track of your progress towards your goal? (Please select all that apply.)

Responses:

Householders seem to be most interested in choosing to access their energy usage information in real-time and/or to receive monthly summaries of their progress. Just over half of the respondents (51%) preferred monthly summaries and the same percentage of participants were interested in accessing the information in real-time. Daily summaries were the third most often selected frequency (21%). Figure 32 presents a summary of all the responses to this question. Sixteen respondents (25%) preferred multiple timeframes.

Figure 32 – Preferred Frequencies for Tracking Home Energy Goal Progress (n=64)



Question C18 – Do you think that you would tell others about your goals and share your progress with them? If you answered 'Yes', please identify who these people might be.

Responses:

Participants were prompted to provide a 'Yes' or 'No' response to this question and if they responded 'Yes', they were prompted to add a written responses. Thirty-three respondents (52%) indicated that they would tell others about their home energy goals and 22 (34%) noted that they would not. Eight respondents (12%) stated that they did not know if they would share

this information with others, and one respondent (2%) selected 'not applicable'. Sixty-four study participants responded to Question C18. Of the 33 respondents responding 'Yes', friends (67%) and family members (64%) were the most common people with whom participants would likely share information about their home energy goals. The following is a list of all the types of people identified and the number of responses cited for each type of persons:

i. Friends (22 responses; 67% of those saying 'Yes')
ii. Family members (21 responses; 64% of those saying 'Yes')
iii. Colleagues (4 responses; 12% of those saying 'Yes')
iv. Neighbours (3 responses; 9% of those saying 'Yes')
v. Students (1 response; 3% of those saying 'Yes')

Question C19 – If you answered 'Yes' for the previous question, do you think that you would share your progress with them?

Responses:

Thirty-three individuals responded either 'Yes' or 'No' to this question and 31 of them noted that they would specifically share their *progress* towards achieving their home energy goals with others. Two more respondents indicated that they did not know if they would share their progress and 21 respondents marked this question as 'not applicable'.

4.4.4 Householders' Reactions to a Home Energy Goal-Setting Interface

In this section of the thesis, the participants' thoughts and reactions to the four screenshots of a home energy goal-setting interface will be presented. In the online survey, each screenshot was presented with a brief explanation so that the participants understood the context in which they would be using this screen. The first screenshot demonstrated how a household would select a monthly energy goal for their household. In the second screenshot, a 'performance indicator' was presented. In the third screenshot, appliance-specific information was presented relative to a household goal. In the fourth, and final, screenshot, a vertical bar graph of daily electricity costs was presented relative to a 'daily average goal'. Each participant was asked to provide text responses and to score the degree to which they felt the screen would be helpful to them in managing a home energy goal.

4.4.4.1 Reactions to the Selecting a Home Energy Goal Screenshot

Figure 33 shows the first screenshot that was presented to the study participants and the reactions to this screenshot are provided in Tables 24 and 25. When the screenshot was presented the following explanation was provided to the study participants in the online survey:

*In this screen, you can input a monthly goal in kilowatt-hours, dollars, or grams of carbon dioxide (CO2) emissions for electricity usage in your home. You can also 'breakdown' the goal into appliance-specific goals for the month as proportions of the total household goal. In this example, the goal is to spend **$60 or less** on electricity costs in the month of **May 2011** and this is a **10% decrease from May 2010**. The appliance-specific allocations are also shown. Initially the system will provide default values based on what was done in the same month in the previous year (e.g., May 2010), but you can change the values to set your own home energy goals for this year's month (e.g., May 2011).*

Figure 33 – Select a Home Energy Goal Screenshot

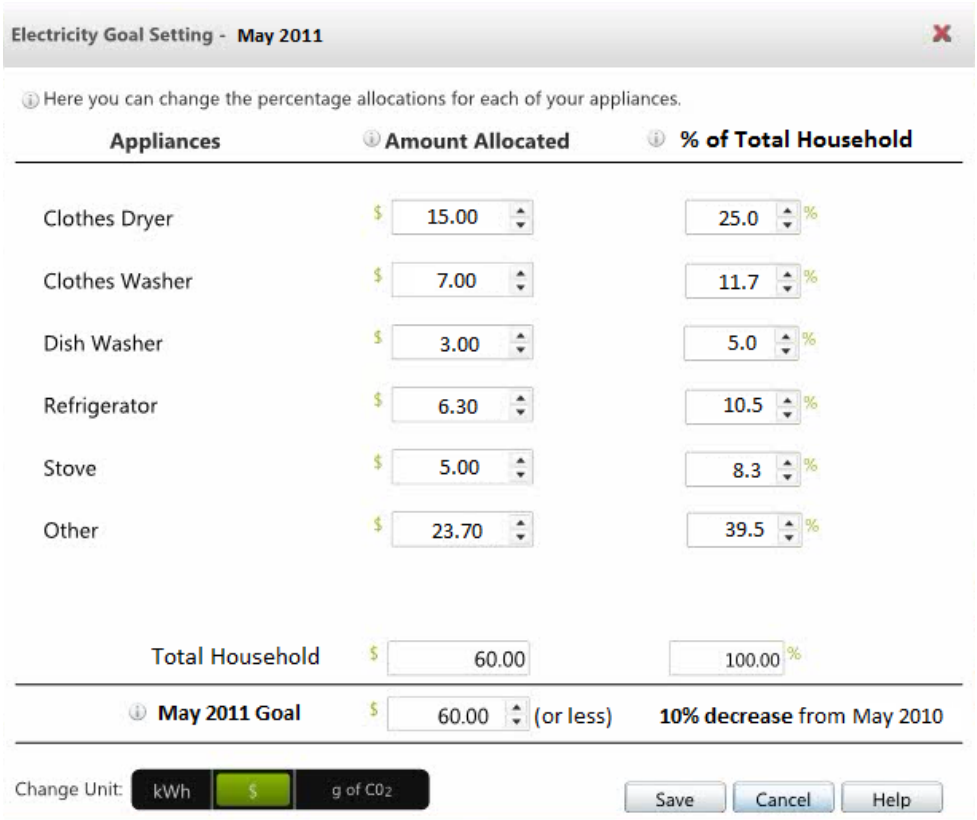


Table 24 – Qualitative Responses to the Selecting a Home Energy Goal Screenshot

Question	Types of Responses (number of occurrences)
D1a - What do you like? (n=51) **Number of multiple response: n=14**	• The breakdown by appliance (20) • Simple and easy to read format (19) • Option to change to/use different units (13) • Actual and percentage values shown (4) • Ability to customise goals (1) • Comparison to previous year (1) • The concept/idea overall (3) • Nothing (2) • Not applicable (1)
D1b - What don't you like? (n=43) **Number of multiple response: n=13**	• The 'Other' category is too large (11) • Don't know how the initial values would be calculated (8) • No option to exclude/include other appliances (5) • No lighting or small electronics (5) • Missing actual savings (4) • Not clear what actual current usage/progress is (3) • The word choice for '% of Total Household' (3) • The percentage column (3) • Too much work/effort (3) • Need to understand time-of-use implications (2) • Would prefer to rank appliances by usage (1) • Don't know how to change the amounts (1) • The breakdown by appliance (1) • The layout/format (1) • Lack of colour (1) • Missing visuals (1) • Missing normative comparisons to establish goal (1) • Would like to see energy savings tips (1) • Would like to see hours of usage (1) • Nothing (1)
D1c – What is clearly understood? (n=31) **Number of multiple response: n=5**	• The breakdown by appliance (11) • Everything (6) • Goals are clearly stated (5) • How to make adjustments to the goals (3) • The values (5) • Percentages and actual amounts (2) • The concept/idea overall (1) • What is being monitored (1) • Most of it (1) • All but "other" (1)
D1d - What is confusing to you? (n=30) **Number of multiple response: n=0**	• Don't know how the initial values are calculated (9) • The $ unit (2) • The term 'Amount Allocated' (2) • Need to see how this fits into the system (2) • The term '% of Household' (1) • Would prefer to test webpage than screenshot (1)

	• Would want to know historical on-peak usage (1) • Do percentages automatically adjust? (1) • How much money = one cycle of appliance usage? (1) • Not sure what is in the 'Other' category (1) • Why is the fridge included? (1) • Most of it (1) • Nothing (8)

Table 25 – Degree to Which Householders Find the Select a Home Energy Goal Screen Helpful

Question D1e	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Don't Know
The selecting a goal screen would be helpful to manage electricity in my home	63	10 (16%)	21 (33%)	9 (14%)	7 (11%)	5 (8%)	4 (6%)	4 (6%)	3 (5%)

Sixty-three of respondents at least 'somewhat agreed' that the 'select a goal' screen would be helpful for them to manage electricity in their home, but only 16% 'strongly agreed' with this statement.

4.4.4.2 Reactions to the Home Energy Goal Performance Indicator

Figure 34 shows the second screenshot that was presented to the study participants and the reactions to this screenshot are provided in Tables 26 and 27. When the screenshot was presented the following explanation was provided to the study participants in the online survey:

With this indicator, the system can keep track of how you are doing in relation to the monthly electricity goals. In the example shown, we set a goal to spend $60 or less on electricity in the month of May 2011. We also receive feedback on how much money we have spent so far in the month, and how much money we have remaining to spend in order to achieve our goal.

The system also provides a symbol to let us know how we are tracking relative to the amount of 'expected' consumption at this point in the month. As indicated in the legend, a green check mark means that we are using less than expected so far for the month, a yellow exclamation means that we are using more than expected so far for the month, and a red 'X' means that we have used too much electricity and we will not be able to achieve our goal.

In this example, it is just over one-third of the way through the month (May 11th, 2011, noted on the bottom), and the household is 'on track' to meet its energy management goal for the month.

Figure 34 – Home Energy Goal Performance Indicator

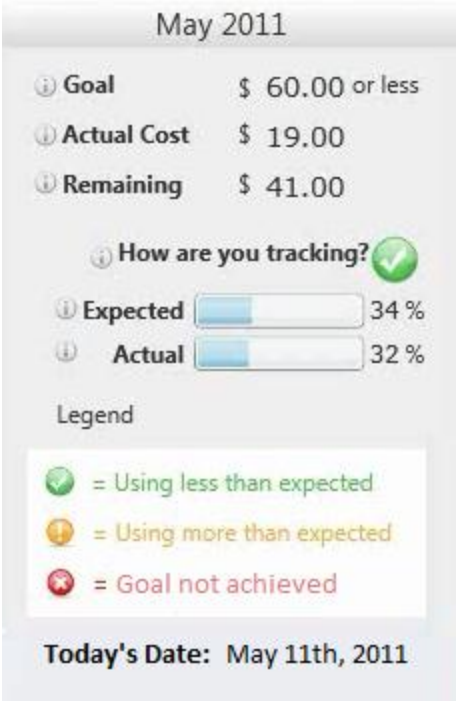


Table 26 – Qualitative Responses to Home Energy Goal Performance Indicator

Question	Types of Responses (number of occurrences)
D2a - What do you like? (n=54) **Number of multiple response: n=14**	• Simple/clear/user-friendly (24) • Shows progress/tracking (16) • Use of colours/symbols (8) • The horizontal bar graph comparison (8) • Shows 'what is remaining' (4) • Using actual costs (6) • The concept/idea - in general (2) • Everything (2) • Less granularity is good (1) • It's comprehensive (1) • It's cool – make it into a mobile application (1)
D2b - What don't you like? (n=33) **Number of multiple response: n=3**	• Lack of appliance granularity (13) • Missing historical comparison (3) • Wording of 'Remaining' (3) • Too much work (2) • The formatting (2) • Wording 'Actual Cost' is confusing (1)

	• Don't like percentages (1) • Doesn't have daily breakdown (1) • Not related to environmental impacts (1) • No breakdown by base-load and variable load (1) • Missing energy savings tips (1) • Can't change units (1) • Use of colours/symbols (1) • Nothing (6)
D2c – What is clearly understood? (n=32) **Number of multiple response: n=2**	• Everything (11) • Progress/tracking (10) • Actual usage (4) • Most of it (2) • The goal set for this month (2) • The values (1) • The legend (1) • This indicator (1) • The general concept (1) • Remaining (1) • How the system works (1)
D2d - What is confusing to you? (n=25) **Number of multiple response: n=1**	• Nothing (12) • What are appliances' contributions? (5) • Term 'Actual Cost' (2) • Are the goals based on historical usage? (1) • Placement of symbol – should be below bars (1) • Breakdown by utility is missing (1) • Does 'Today's Date' indicate this represents today's usage or usage to date? (1) • How much of the month is left? (1) • Concept of 'Remaining' (1) • $60 'or less' is confusing (1)

Table 27 – Degree to Which Householders Find the Performance Indicator Helpful

Question D2e	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Don't Know
The goal performance indicator would be helpful to manage electricity in my home	63	22 (35%)	18 (29%)	11 (17%)	6 (10%)	2 (3%)	3 (5%)	1 (2%)	0 (0%)

Eighty-one percent of respondents at least 'somewhat agreed' that this 'home energy goal performance indicator' would be helpful for them to manage electricity in their home and 35% 'strongly agreed' with this statement.

4.4.4.3 Reactions to the Appliance-Specific Feedback Relative to the Home Energy Goals

Figure 35 shows the third screenshot that was presented to the study participants and the reactions to this screenshot are provided in Tables 28 and 29. When the screenshot was presented the following explanation was provided to the study participants in the online survey:

With this screen, we have 'drilled down' to get more detailed information about how we are using energy in the home by major household appliance – and how this relates to our goals. Note, this is the same day and time as shown in the previous screen – so $60 as a goal for the month of May, and we have, so far (to May 11th, 2011), spent $19 – but it is showing information in greater detail.

Figure 35 – Appliance-Specific Feedback Relative to the Home Energy Goals

Table 28 – Qualitative Responses to the Appliance-Specific Feedback Screenshot

Question	Types of Responses (number of occurrences)
D3a - What do you like? (n=51) **Number of multiple response:**	• The granularity and detail (31) • Clear layout/format (13) • The tracking progress and instant feedback (12) • The symbols (4)

n=11	• Everything (2) • Allocation in actual amounts (1) • The general idea/concept (1)
D3b – What don't you like? (n=35) **Number of multiple response: n=2**	• The 'other' category is not broken down more (6) • Nothing (5) • Too much information/granularity (4) • Would prefer alternative unit (3) • The little appliance images (2) • Not enough granularity (2) • The symbols/tracking column (2) • Total household goal is missing (1) • Data visualisation – add horizontal bars for '% of allocation' and 'tracking' (1) • Does not provide daily breakdown (1) • Time period costs (1) • Missing vertical lines between column s (1) • The use of percentages (1) • Too much work/effort (1) • Current date is missing (1) • Is information worth the cost to get it? (1) • Historical comparison is missing (1) • Missing the 'expected amount' in the table (1) • The order of the columns (1)
D3c - What is clearly understood? (n=29) **Number of multiple response: n=3**	• Everything (11) • Progress/tracking (6) • Use of colour/symbols (4) • Actual usage/costs (4) • The layout and presentation (3) • Most of it (2) • The concept (1) • The goals (1)
D3d - What is confusing to you? (n=31) **Number of multiple response: n=2**	• Nothing (9) • How appliances will be monitored/allocations set (8) • Term '% of allocation used' (4) • 'Other' usage (4) • The headings (3) • How to adjust behaviour for a fridge (2) • Term 'Actual cost' should be 'actual cost to date' (1) • What is the '% expected to be used' so far? (1) • How this adds up to the household goal (1) • Can the appliance list change? (1) • Can goals change part way through the month? (1)

Table 29 – Degree to Which Householders Find the Appliance-Specific Feedback Helpful

Question D3e	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Don't Know
The appliance-specific feedback relative would be helpful to manage electricity in my home	63	25 (40%)	16 (25%)	10 (16%)	7 (11%)	1 (2%)	1 (2%)	3 (5%)	0 (0%)

Eighty-one of respondents at least 'somewhat agreed' that the more detailed 'home energy goal performance indicators' showing appliance-specific feedback relative to appliance-specific goals would be helpful for them to manage electricity in their home and 40% 'strongly agreed' with this statement.

4.4.4.4 Reactions to the Daily Consumption Graph Screenshot

Figure 36 shows the fourth screenshot that was presented to the study participants and the reactions to this screenshot are provided in Tables 30 and 31. When the screenshot was presented the following explanation was provided to the study participants in the online survey:

In this screen, we can keep track of how much energy, money or carbon dioxide (CO2) emissions are associated with our appliances each day. In this example, the vertical bars in the graph represent the amount of money spent on electricity each day so far in the month of May 2011. The different colours in the vertical bars each represent the usage costs of a respective appliance listed on the right.

The red line across the graph is the 'daily average goal' calculated by the system, based on the monthly goal that we selected ($60 divided by 31 days = $1.94/day).

On the right of this screen, you can see how you are doing relative to your 'daily average goal' under the section labelled 'Daily Actual Avg'. You can also keep track of how many days in the month you met this daily goal (labelled as 'Days Below Avg'). In this example, we were 'under the red line' on three days so far. The more days below this red line, the better we would be doing at meeting our daily average goals.

Figure 36 – Daily Consumption Graph Screen

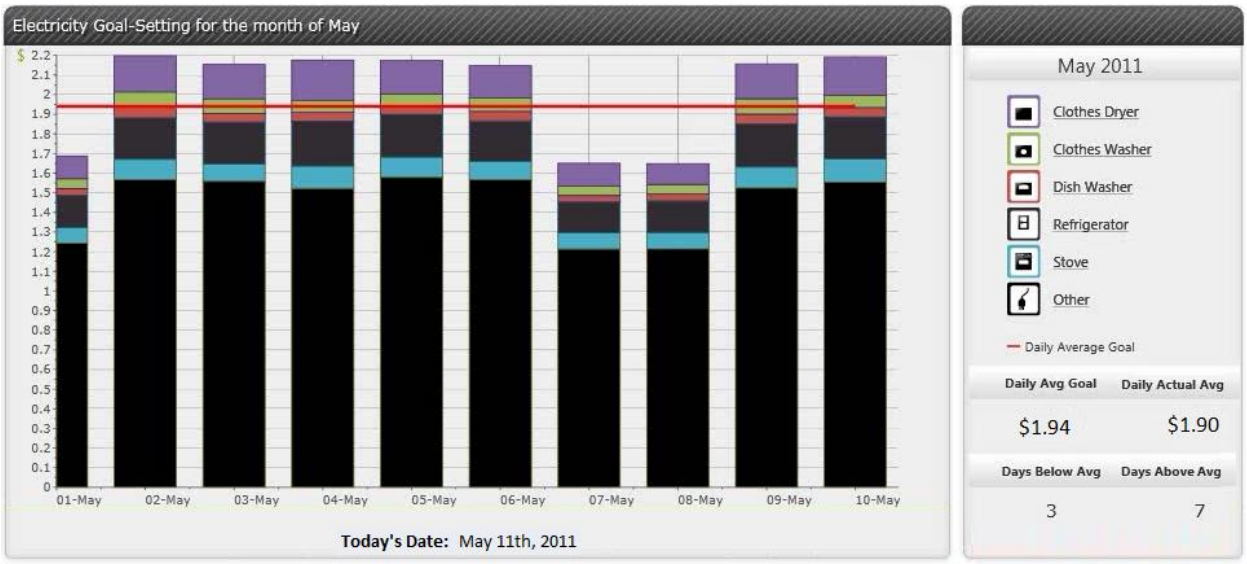


Table 30 – Qualitative Responses to the Daily Consumption Graph Screenshot

Question	Types of Responses (number of occurrences)
D4a - What do you like? (n=36) **Number of multiple response: n=4**	• Nothing (10) • Graphical presentation (9) • The red line/Daily average goal (6) • Daily summary (5) • The detail/appliance granularity (5) • Number of days below/above (3) • The use of colours (1)
D4b - What don't you like? (n=46) **Number of multiple response: n=18**	• Less user-friendly/clear (11) • Graphical presentation (10) • The use of colours in the vertical bars (6) • The 'other' category is too dominant (5) • Daily feedback (5) • Use of appliance images/icons (5) • The appliance amounts are not precise (4) • Too much information (4) • Colour around the appliance images is too thin (3) • Everything/anything (3) • Goal for each appliance is missing (3) • Would like the 'day of week' indicated (2) • The idea/concept (1) • Lack of split between base-load and variable (1) • Progress to monthly goal is missing (1) • Labels on the graph/axis are too small (1) • Nothing (1)
D4c - What is clearly understood?	• Nothing/very little (11)

(n=27) **Number of multiple response: n=1**	• Everything/most of it (4) • Daily actual average (3) • Usage per day (2) • The concept (2) • Tracking relative to daily goal (1) • Appliance-specific contributions (1) • Above/below average (1) • Dates on the x-axis (1) • This indicator (1) • The labels (1)
D4d - What is confusing to you? (n=30) **Number of multiple response: n=5**	• Graphical presentation (10) • The colours in the vertical bars (6) • Everything/Most of it (4) • Nothing (4) • The red line/daily average goal (3) • Precise amounts are harder to see (3) • What's in the 'other' category? (2) • Hard to understand progress (1) • The numbers (1) • The legend (1)

Table 31 – Degree to Which Householders Find the Daily Consumption Graph Helpful

Question D4e	n	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Don't Know
The daily consumption graph would be helpful to manage electricity in my home	63	11 (17%)	8 (13%)	8 (13%)	9 (14%)	5 (8%)	8 (13%)	12 (19%)	2 (3%)

Forty-three percent of respondents at least 'somewhat agreed' that this 'daily consumption graph' with feedback relative to a 'daily average goal' would be helpful for them to manage electricity in their home and 17% 'strongly agreed' with this statement.

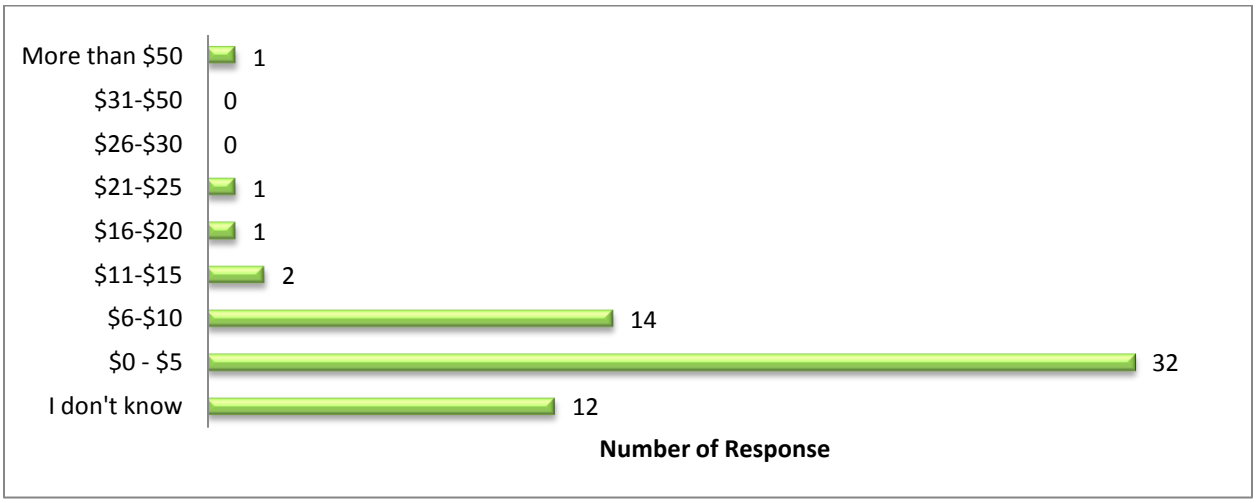
4.4.5 Householders' Willingness to Pay for Home Energy Goal-Setting Technology

Question D5 – Up to how much do you think you would be willing to pay for a home energy management system that would allow you to set and to manage your home energy goals like the examples shown here?

Responses:

Most householders (51%) participating in this study indicated that they would spend up from $0 to $5 per month to have an energy management system installed in their homes to help them set and manage home energy goals. However, it is not clear whether they would not be willing to pay anything, or simply only willing to pay up to $5. Twenty-two percent of householders were willing to pay from $6 to $10 per month and 19% indicated that they did not know right now. Figure 37 provides a summary of all the responses regarding householders' willingness to pay for this technology.

Figure 37 – Amount Householders are Willing to Pay for Home Energy Goal-Setting Technology (n=63)



Chapter 5: Analysis and Discussion

5.1 Introduction and Chapter Outline

In this chapter of the thesis, the findings from the survey will be analysed to help meet the research objectives that were stated at the end of Chapter 2. Therefore, it is worthwhile here to revisit the research objectives. The first research objective – that is, to explore the extent to which householders will be interested in home energy goal-setting and why – will be discussed in Section 5.2. The second research objective was to understand who, in particular, would be most interested in home energy goal-setting. This analysis will be discussed in Section 5.3. The third objective was to collect and analyse householders' opinions and reactions to a proposed home energy goal-setting interface to help determine what elements of the design are preferred and worth further testing or future deployment. The analysis of householders' opinions to the design of the interface will be presented in Section 5.4. The fourth objective was to determine some of the perceived benefits and barriers to home energy goal-setting – and this will be discussed in Section 5.5. A summary of the key findings is provided at the beginning of the next chapter.

5.2 Extent to Which Householders Are Interested in Home Energy Goal-Setting

The first stated research objective was to determine the extent to which householders would be interested in home energy goal-setting. In order to determine this, the responses to Question C1 (shown in Table 16) were analysed. In this case, the objective was to generalise the results of the sample (the 66 respondents to this question) to a broader population of householders in Ontario. However, let us first revisit the demographic and household characteristics of the study sample and clarify some limitations about inference here.

In Table 1 (shown in Chapter 4), the demographic and household characteristics of the study sample were compared to similar data for the city of Waterloo and the province of Ontario. One method to test how well the survey sample represents the data for the 'typical' Ontario household is to use the chi-squared goodness-of-fit test. For each (applicable) point in Table 1, another table of observed and expected frequencies was developed to calculate the chi-squared statistic. This statistic would be able to indicate whether the differences between the observed frequencies (from the 'Survey Participant' data) and the expected frequencies (from the 'Ontario'

census data) were statistically significant. If they were not statistically different, then it would be argued that the particular demographic trait is representative of the Ontario household. In addition, an energy intensity score was calculated by dividing the average monthly electricity usage by the reported square footage of the home (the mid-point of the ranges given was used for each of these two categories in this calculation). The tables constructed to calculate the chi-squared statistic are shown in Appendix G, and the summary of the results is presented here in Table 32.

Table 32 – Results of Chi-Squared Goodness-of-Fit Test for Sample Representativeness

Variable	Chi-squared statistic	Critical value	Statistically significant difference?*
% of males in sample	2.4693	3.8415	No
Median age	1.2430	3.8415	No
% lived in same residence one year ago	0.0866	3.8415	No
Median household income (after-tax)	490.7489	3.8415	Yes
% with college or university education	58.1395	3.8415	Yes
% employed	0.0766	3.8415	No
% owner-occupied dwelling	8.1393	3.8415	Yes
Avg. number of home occupants	0.0031	3.8415	No
Avg. house size	252.0833	3.8415	Yes
Typical monthly electricity usage	3.1250	3.8415	No

*If the chi-squared statistic was greater than the chi-squared critical value (for 95% confidence level of one degree of freedom), then the difference between the study sample and the Ontario sample was found to be statistically significant.

As shown in Table 32, there was no statistically significant difference between this study's survey data and the Ontario data for several demographic and household traits including: male/female split, age, percentage of householders that lived in the same residence one year ago, percentage employed, average number of household occupants, typical monthly electricity usage (mid-point of the cited study range – 750 kWh – was used), and energy intensity. For these variables, it could be argued that the study's sample represents the data found for Ontario

households as cited by the Canadian Census, the Ontario Ministry of Energy and the Ontario Energy Board. However, four demographic and household traits in the table were found to be different *with* statistical significance; therefore, when considering these variables, it is more difficult to argue that the study participants, as a whole, represented 'typical' Ontario householders. Each of these four variables will be discussed individually.

(1) ***House size***: The median house size of survey participants was reported to be in the range of 1500 and 1999 square feet (including finished basement if applicable). To calculate the chi-squared statistic, the mid-point of the range – 1750 sq. ft – was used. However, it is assumed that the 1200 square feet for an 'average' Ontario household (as reported on the Ontario Ministry of Energy website) did not include square footage of the basement. If this difference in data was corrected by reducing the median household size, by say one-third since 53% of respondents lived in at least a two-storey detached house, then the mid-point of the range of household sizes in the survey reduces to 1,155 sq. ft. Relative to 1200 sq. ft of the 'average' Ontario household, this difference was not found to be statistically significant using the chi-squared goodness-of-fit test and could be argued as representative.

(2) ***Household Income***: The median household incomes, as reported in the table in Chapter 4, were $58,756 for the survey participants (in 2010 dollars) and $53,626 for households in Ontario (in 2000 dollars as reported in the 2001 census data). More recent sources have reported the average Ontario household income to be quite a bit higher. For example, the before tax average Ontario household income has been estimated by one source to be $87,755 (FPmarkets, 2010, as reported by, City of Thunder Bay, 2009), which is within the median range of household income for this study's participants ($80,000 to $89,999). Therefore, for practical purposes it could be argued that the respondents' median household income level is actually fairly representative of Ontario householders.

(3) ***Percentage of Owner-Occupied Dwellings***: Although the difference between the study sample and the census data was found to be statistically significant, this difference was not unexpected since it was believed that homeowners would be more likely to participate in the study – after all, they are more likely to manage the energy bills. In order for the difference between the study and the census samples to have not been

statistically significant, five fewer respondents needed to be tenants rather than homeowners (n=62). Although this was not the case, and limitations exist, there were advantages to getting more homeowners to participate in the study beyond the representativeness of the population. For example, it was assumed that homeowners were more likely to give richer qualitative feedback for open-ended survey questions – particularly those relating to the design of the goal-setting tool interface. So, for now, the limitation regarding a slightly disproportionate number of homeowners is noted as a word of caution when interpreting inferences made about householders more broadly.

(4) ***Percentage of Sample with Post-Secondary Education***: This last demographic trait of respondents that was shown to be different, with statistical significance, was education level. Indeed, it should be acknowledged that participants, as a whole, were more educated (90% of participants had a college or university education) than the broader population of Ontario householders and this limits the ability to generalise the survey findings to *all* Ontario households. Although this particular issue of non-response bias – that is, citizens with lower education levels have been found to be less likely to volunteer to participate in survey work – is common (McLafferty, 2003).

Practical judgement could also be used to decide whether this study's sample is sufficiently representative of Ontario householders – or at least who the sample is likely to represent. As discussed at the end of Chapter 3 and many more studies before this one, social science studies are likely to contain some degree of sampling bias, which limits the ability of the research to generalise study results about a broader population. However, in this study, it can be reasonably argued that eight of the ten demographic and household traits used to measure the sample's representativeness of Ontarians did not differ significantly enough between the respondents' data and the broader Ontario data. In addition, the 'energy intensity' of the sample's homes was calculated by dividing the average monthly electricity usage (750 kWh) by the average house size (1,155 square feet) to create an average 'energy intensity score' for the sample homes of 0.65. Similarly an average 'energy intensity score' was calculated for the Ontario data and resulted in a score of 0.67. The difference between the two scores was not found to be statistically significant (the table of the chi-squared goodness of fit test is shown in Appendix G).

The limitations regarding demographic and household attributes that are most notable in terms of sample representativeness are home ownership and education levels, where in both cases the study sample was disproportionately higher. Assuming that these eleven traits (the ten in Table 32 and the energy intensity score) are appropriate measures to gauge the representativeness of the sample, it could still be worth generalising the results with the caveat that the inferential analysis is *most likely* suited for the urban Ontario householders that have a post-secondary education (or live with someone who does) and own the home in which they are living. The adjective 'urban' is also added to describe the sample since rural homes were not included in the study. The objective of using inferential statistics here is to understand better the percentage of the broader population that would likely be interested in home energy goal-setting.

Since the data collected for Question C1 were from a seven-point Likert scale, they were categorical data. As presented in Chapter 4, 60 of the 66 respondents (91%) at least 'somewhat agreed' that they are interested in setting home energy goals and 24 (36%) respondents strongly agreed. In order to make inferences about the broader population, the following calculations were made:

Level of confidence = 95%

Percentage of sample that 'somewhat agreed' (SWAG) = 91%

Percentage of the sample that 'strongly agreed' (STAG) = 36%

Percentage of the population that would at least 'somewhat agree':

$= \text{SWAG} +/- 1.96 * \sqrt{(\text{SWAG} * (1 - \text{SWAG}) / \text{n})}$

$= .91 +/- 1.96 * \sqrt{(.91 * .09) / 66)}$

$= .91 +/- 1.96 * (0.035)$

$= .91 +/- 0.07$

Percentage of the population that would 'strongly agree':

$= \text{STAG} +/- 1.96 * \sqrt{(\text{STAG} * (1 - \text{STAG}) / \text{n})}$

$= .36 +/- 1.96 * \sqrt{(.36 * .64) / 66)}$

$= .36 +/- 1.96 * (0.003)$

$= .36 +/- 0.007$

Therefore, interpreting the results of these calculations, it would be understood, with 95% confidence, that 84 to 98 percent of the urban Ontario homeowners with post-secondary education would at least 'somewhat agree' that they are interested in setting home energy goals and approximately 35 to 37 percent would strongly agree.

Another analysis was worth conducting regarding Ontario householders' interest in home energy goal-setting and how this related to their willingness to pay for home energy goal-setting technology (responses from Question D5). Understanding this relationship helps to explain the *extent* of householders' interest (i.e., are they highly interested, but not willing to pay much/enough for the technology?). In this question, as presented in Figure 38 in Chapter 4, 19 of 63 respondents (30%) indicated that they were willing to pay at least $6 per month to have a home energy management system installed in their homes that would help them to set and to manage home energy goals. Table 33 shows the Spearman's rank order correlation coefficient (labelled as 'Spearman's rho') between willingness to pay for the technology and interest in home energy goal-setting and indicates that indeed a positive association (r= 0.3674) between them exists (and is significant with a 99% confidence level). The correlation analysis was done with 51 respondents because that is how many participants provided a response to both questions. Since the association was positive and statistically significant, it is suggested that willingness to pay for the technology increases when (but is not necessarily because of) interest in setting home energy goals increases.

Table 33 – Relationship between Willingness to Pay for Home Energy Management Technology and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
D5 – Willingness to Pay for Home Energy Management Technology with Goal-Setting Tool				
Willingness to pay for home energy goal-setting technology	51	0.3674	0.0094	Yes

Since the extent of householder interest in home energy goal-setting included willingness to pay for the technology to help with the exercise, it was logical to wonder how much of the broader population would likely indicate that they would also be willing to pay for the

technology. Again, this involved inferential statistics, which, as stated earlier, had its limitations here because we cannot show with confidence that the study participants represent 'typical' Ontario householders. But, knowing what we know about the characteristics of the sample for this study, we can generalise about a larger group of Ontario householders with similar household characteristics to those in this study (in general, the caveats are that we are discussing urban households that are owner-occupied with at least one occupant who has some college or university education). Similar to the calculation made earlier to generalise the findings of Question C1, the following calculation was made to generalise the findings of householders' willingness to pay for home energy goal-setting technology:

Level of confidence = 95%
Percentage of sample that was willing to pay at least $6 per month for home energy management technology with goal-setting capabilities (WTPsix) = 30%

Percentage of the population that would be willing to pay at least $6 per month for home energy management technology with goal-setting capabilities would be:

$= (\text{WTPsix}) +/- 1.96 * \sqrt{(\text{WTPsix}) * (1 - \text{WTPsix}) / n)}$

$= .30 +/- 1.96 * \sqrt{(.30 * .70) / 63)}$

$= .30 +/- 1.96 * (0.003)$

$= .30 +/- 0.007$

Therefore, it is understood, with 95% confidence that approximately 29 to 31 percent of the urban homeowners with college or university education would be willing to pay at least $6 per month for a home energy management system with goal-setting functionality and feedback.

The written responses in Question C2 could help to explain why urban Ontario homeowners with post-secondary education appear to be at least somewhat interested in home energy goal-setting and therefore those responses are discussed here. Fifty-nine respondents offered an explanation for their interest (or lack of interest) in home energy goal-setting and several of them offered more than one reason in their explanation (Table 17). Of the explanations relating to one's favourable (positive) interest in home energy goal-setting, 77 reasons were given, while only 13 reasons were given for explanations relating to disinterest in

home energy goal-setting (likely in part because participants indicated more interest than disinterest). As presented in Chapter 4, the most common reasons for indicating interest in home energy goal-setting was to reduce their energy usage or environmental impact (this was true for 61% of respondents to Question C2) and to save money or help manage rising energy costs (this was true for 41% of respondents to Question C2). Therefore, it might be the case that householders' interest in home energy goal-setting increases if they see it as a technique to help reduce their usage or home's environmental impact and/or save money. To investigate more closely, an examination of the responses to Question C1 and C2 was conducted. Table 34 presents the relationship between the number of occurrences for each reason type relative to levels of interest in home energy goal-setting. The reasons were categorised as either (1) environmental (including reductions in environmental impact and/or reductions in energy usage), (2) financial (including wanting to save money or manage increasing energy costs) and (3) some other reason. A chi-squared test of a contingency table was conducted to determine whether there was a relationship between the two variables.

Table 34 – Relationship between interest in Home Energy Goal-Setting and Reasons for Interest

Interested in setting home energy goals	Reasons (# of occurrences)
Strongly agree (n=24)	Environmental reasons (20) Financial reasons (15) Some other reason (1)
Agree (n=21)	Environmental reasons (12) Financial reasons (4) Some other reason (5)
Somewhat agree (n=15)	Environmental reasons (4) Financial reasons (5) Some other reason (7)

The chi-squared statistic was 15.582 which was statistically significant at the 99% confidence interval (p-value = 0.0036). This suggests that there is a relationship between the reasons for householder interest and the level of interest in home energy goal-setting. And, it is clear from Table 34 that the environmental reasons (e.g., reducing environmental impact and/or reducing energy usage) and the financial reasons (e.g., saving money and/or managing rising

energy costs) are more often cited as explanations for higher levels of interest in home energy goal-setting than for lower levels of interest.

5.3 Describing Characteristics that Relate to Interest in Home Energy Goal-Setting

The second stated research objective was to describe *which* householders were interested (or disinterested) in home energy goal-setting, and in particular who likely be the early adopters. In order to do this, the study's independent variables (e.g., goal-setting experiences and opinions, 'energy awareness', pro-sustainability attitudes and behaviours, and household attributes) were correlated with the study's main dependent variable (householder interest in home energy goal-setting) represented in the responses to Question C1. The Spearman's rank order correlation test was used, rather than the Pearson's test, because the dependent variable (and nearly all the independent variables) consisted of ordinal data, rather than interval or ratio data. However, in the first analysis presented in Section 5.3.1, crosstabs are used to determine whether experience in setting non-energy goals is a good predictor of interest in setting home energy goals.

5.3.1 Experience with 'Non-Energy' Goals and Interest in Home Energy Goal-Setting

Of the 66 respondents to Question C1, 12 of them indicated that they do not set non-energy goals, but 10 of those 12 (84%) at least somewhat agreed that they would be interested in setting home energy goals – and four of them (42%) strongly agreed. Similarly, of the 66 respondents to Question C1, 62 of them responded to Question A18 and 10 of those indicated that goal-setting does not work for them. Of those 10, all of them (100%) at least somewhat agreed that they would be interested in setting home energy goals – but only one (13%) strongly agreed. These findings would suggest that previous or existing experience with non-energy goal-setting is not a good predictor of interest in home energy goal-setting. Perhaps this was because some respondents found the concept of home energy goal-setting novel and thus more interesting than goal-setting for other areas of their lives. To investigate this more closely, a correlation analysis between the motivations to achieve specific types of goals and interest in setting home energy goals was conducted and will be presented in the next section.

5.3.2 Motivations to Achieve 'Non-Energy' Goals and Interest in Home Energy Goal-Setting

Table 35 shows the results of the Spearman's correlation coefficient and whether there was a relationship between each motivation to achieve each goal type and interest in home energy goal-setting. The relationship was also tested for statistical significance at the 95% confidence level (i.e., if the p-value was less than 0.05, the result was significant).

Table 35 - Relationship between Motivation to Achieve 'Non-Energy' Goals and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
A6.1 - Motivations to achieve personal financial goals				
Responsible thing to do	47	0.0858	0.5606	No
Get personal satisfaction from goal achievement	48	-0.0912	0.532	No
Want the reward	48	0.0524	0.7196	No
Benefit me and/or my family	48	0.1498	0.3046	No
Benefits others in society	48	0.1720	0.2384	No
Want to avoid negative consequences	47	0.1294	0.3800	No
A6.2 – Motivations to achieve nutritional/dieting goals				
Responsible thing to do	36	0.1612	0.3404	No
Get personal satisfaction from goal achievement	36	0.2600	0.1240	No
Want the reward	36	0.2967	0.0792	No
Benefit me and/or my family	36	0.2349	0.1708	No
Benefits others in society	35	0.3473	0.0400	Yes
Want to avoid negative consequences	36	0.0186	0.9126	No
A6.3 – Motivations to achieve fitness goals				
Responsible thing to do	38	0.0552	0.737	No
Get personal satisfaction from goal achievement	38	0.1919	0.243	No

Want the reward	38	0.2493	0.1294	No
Benefit me and/or my family	37	0.0061	0.9706	No
Benefits others in society	38	0.2577	0.1170	No
Want to avoid negative consequences	37	0.3348	0.0446	Yes
A6.4 – Motivations to achieve educational/career goals				
Responsible thing to do	37	0.0437	0.7934	No
Get personal satisfaction from goal achievement	37	-0.0399	0.8110	No
Want the reward	37	0.2868	0.0852	No
Benefit me and/or my family	37	0.2008	0.2282	No
Benefits others in society	37	0.2265	0.1742	No
Want to avoid negative consequences	37	0.0711	0.6696	No
A6.5 – Motivations to achieve other goals				
Responsible thing to do	11	0.3345	0.2902	No
Get personal satisfaction from goal achievement	11	0.2141	0.4984	No
Want the reward	11	0.1890	0.5500	No
Benefit me and/or my family	11	-0.2141	0.4984	No
Benefits others in society	11	0.2056	0.5156	No
Want to avoid negative consequences	11	0.5587	0.0772	No

There were only two instances where the relationship between specific motivations to achieve 'non-energy' goals related to interest in home energy goal-setting. The first one found in the table was participants' motivations to achieve nutritional and/or dieting goals because of the benefits to others in society (r=0.3473) and the second was participants' motivations to achieve a fitness goal to avoid the negative consequences of not achieving this goal (r=0.3348). In both cases, the association between the independent and dependent variables was positive – meaning that, those who signalled this motivation were more likely to be interested in home energy goal-setting – but it was difficult, at this point, to explain why these variables were positively associated.

Additional analysis was carried out to explore the relationship between these two specific motivations to achieve 'non-energy' goals and how they might relate to similar motivations to achieve home energy goals. A Spearman's rank correlation analysis was conducted and the results are shown in Table 36. In this case, the specific motivations to achieve 'non-energy' goals were the independent variables and specific motivations to achieve home energy goals became the dependent variables.

It was found, with statistical significance (p-value < 0.05), that the motivation to achieve nutritional and dieting goals for the benefits to society was positively associated (r=0.3407) with the motivation to achieve home energy goals for the benefits to society. Therefore, in describing individuals who would be interested in home energy goal-setting, it is reasonable to suggest that those who are motivated to achieve their nutritional and dieting goals for the altruistic benefits will also exhibit the same type of motivation to achieve home energy goals.

Similarly, it was found, with statistical significance (p-value < 0.05) that the motivation to avoid the negative consequences of not achieving fitness goals was positively associated (r=0.4564) with the motivation to avoid the negative consequences of not achieving home energy goals.

Table 36 – Relationship between Specific Motivations to Achieve 'Non-Energy' Goals and Motivations to Achieve Home Energy Goals

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
Motivation to achieve goals because it would benefit others in society				
A6.2e – Motivation to achieve nutritional/dieting goals because it would benefit others in society	36	0.3407	0.0438	Yes
Motivation to achieve goals due to avoidance of the negative consequences for not achieving the goals				
A6.3f – Motivations to achieve fitness goals in order to avoid negative consequences of not achieving the goals	36	0.4564	0.007	Yes

Therefore, these findings would suggest that, in some cases, interest in setting home energy goals is dependent on certain motivations to achieving 'non-energy' goals. And, we can go further to suggest that when these specific motivations exist – that is, benefits to society for achieving nutritional and dieting goals and avoidance of negative consequences to achieve fitness goals – that similar motivations will exist in householders wanting to achieve home energy goals. Other than those two cases, interest in home energy goal-setting was independent of motivations to achieve non-energy related goals.

5.3.3 Perceived Benefits/Barriers to Goal-Setting and Interest in Home Energy Goal-Setting

Table 37 shows the results from the Spearman's rank correlation analysis of the perceived benefits to goal-setting relative to interest in setting home energy goals. Four perceived benefits to goal-setting were examined and it was found that none of them were significantly related to interest in home energy goal-setting.

Table 37 – Relationship between Perceived Benefits to Goal-Setting and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
A7 – A10: Perceived Benefits to Goal-Setting				
Helps me to stay organised	64	0.1864	0.143	No
Motivating to see progress	63	0.0772	0.5432	No
Like having a target to work towards	63	0.0318	0.8022	No
Like breaking down goals into smaller tasks	64	0.1670	0.1850	No

Similarly, no statistically significant findings resulted from the Spearman's rank order correlation analysis of the perceived barriers to goal-setting and interest in setting home energy goals – as shown in Table 38. Therefore, interest in home energy goal-setting is not related to the perceived relevance of the benefits of, and barriers to, goal-setting more broadly.

Table 38 - Relationship between Perceived Barriers to Goal-Setting and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
A11 – A13: Perceived Barriers to Goal-Setting				
Takes a lot of effort	64	0.1398	0.2670	No
Don't like pressure of targets with deadlines	63	0.1433	0.2592	No
Don't like planning	64	0.2241	0.0752	No

Participants were also asked to describe their preference between self-selecting their goals and having goals assigned for them, and, as reported in Chapter 4, 85% of respondents at least 'somewhat agreed' that they would prefer to manage self-set goals rather than goals assigned by someone else (perhaps not surprisingly). However, part of the original motivation to ask this question was to see if interest in home energy goal-setting was related to preference towards self-set goals. To measure this relationship, Spearman's rank order correlation was calculated and the variables were not found to be related. The results are shown in Table 39. Here it is clear that interest in home energy goal-setting is not dependent upon preference to set one's own goal, meaning householder are as likely to be interested in home energy goal-setting with self-set goals or assigned goals.

Table 39 - Relationship between Preference to Manage Self-Set Goals and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
A14: Self-Set Goals vs. Assigned Goals				
Prefer self-set goals to assigned goals	64	0.0815	0.5176	No

5.3.4 Energy Awareness and Interest in Home Energy Goal-Setting

In this section, the relationship between householders' self-reported levels of 'energy awareness' and their interest in home energy goal-setting will be discussed. Similar to the

analysis presented in the preceding section, Spearman's rank order correlation analysis was conducted to measure the relationship among these variables. The results are presented in Table 40 and you will notice that one relationship was found to be statistically significant – that was, when householders' awareness of the environmental impact of their home's energy usage increased, householders' interest in setting home energy goals also increased (r=0.2654). Perhaps this is not surprising since, as presented in Section 5.2, the most often cited reason for householders to express interest in home energy goal-setting was to reduce their environmental impact and/or energy usage.

Table 40 – Relationship between Energy Awareness and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
B1 to B3: Energy Awareness				
Aware of monthly usage	66	0.1463	0.2382	No
Aware of monthly costs	66	0.0641	0.6056	No
Aware of environmental impact from energy usage	65	0.2654	0.0338	Yes

5.3.5 Pro-Sustainability Attitudes and Behaviours and Interest in Home Energy Goal-Setting

In this section, the independent variables on householders' self-reported attitudes and behaviours are related to householders' interest in home energy goal-setting. Table 41 shows the results from the Spearman's analysis and indicates that all these variables showed statistically significant, positive associations with interest in home energy goal-setting. In summary, it would be reasonable to suggest that householders that exhibit stronger pro-sustainability attitudes and behaviours will be more likely to exhibit stronger interests in setting goals relating to energy consumption in their homes. Most notably, and perhaps not surprisingly given other findings presented in this chapter, the strongest relationship existed between householders wanting to reduce their environmental impact from their home's energy usage and interest in home energy goal-setting (r=0.6061).

Table 41 - Relationship between Preference to Manage Self-Set Goals and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
B4 to B10: Pro-Sustainability Attitudes and Behaviours				
Tries to conserve energy	66	0.4908	0.0000	Yes
Tries to reduce on-peak electricity usage	65	0.2763	0.0270	Yes
Purchased efficient appliances and wants to reduce usage even more	65	0.3465	0.0056	Yes
Wants to reduce environmental impact	65	0.6061	0.0000	Yes
Wants to reduce costs	65	0.5374	0.0000	Yes
Interested in becoming more 'energy aware'	64	0.4508	0.0004	Yes
Wants to learn about appliance-specific usage	65	0.4972	0.0000	Yes

5.3.6 Design Features and Behaviours and Interest in Home Energy Goal-Setting

In this section, interest relating to two specific design elements of home energy feedback (appliance-specific feedback and customised energy savings tips) will be described relative to interest in home energy goal-setting. Recall from Chapter 4 that 89% of respondents to Question C.4 at least 'somewhat agreed' that they would be interested in receiving appliance-specific feedback to help them manage home energy goals and that 83% at least 'somewhat agreed' that they would be interested in receiving customised energy savings tips. In Table 42, the results of a Spearman's correlation analysis between these specific design elements and interest in home energy goal-setting is presented. In both cases, the relationship between these variables is positively associated with each other and statistically significant. Indeed, the relationship between interest in customised energy savings tips and interest in home energy goal-setting appears to be quite strong (r=0.7246), particularly relative to other independent variables being examined in this thesis.

Table 42 – Relationship between Specific Design Features and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
C4 and C5: Interest in Appliance-Specific Feedback and Customised Energy Savings Tips				
Interested in appliance-specific feedback	64	0.6671	0.000	Yes
Interested in customised energy savings tips	65	0.7246	0.000	Yes

5.3.7 Choice of Goal Difficulty and Interest in Home Energy Goal-Setting

In Questions C6 of the survey, householders were asked to indicate the type of goal that they would likely set for their household. And, in Questions C7 to C9, they were asked to choose the 'level of goal difficulty' if they indicated that they would like to set a goal to conserve, minimize an increase or shift electricity usage to off-peak times of the day. In this section, the relationship between goal difficulty and interest in home energy goal-setting is presented. It was found, as indicated in Table 43, that goal difficulty relating to only one type of householder (those wanting to set conservation goals) was significantly related to interest in home energy goal-setting (p-value<0.05). As indicated by the correlation coefficient (r=0.4356), the relationship was positive meaning that as interest in setting home energy goals increases householders' desire to set more difficult conservation goals increases. This is a particularly important finding as it suggests that developing householders' interest in home energy goal-setting would be positively associated with developing desires to conserve more energy usage in their homes. Or put another way, the more householders want to save, the more they are interested in home energy goal-setting to help them do so. And, after removing the five respondents to Question C7 that indicated they would select the most difficult goal option suggested, that was to save more than 30%, the relationship between goal difficulty and interest in home energy goal-setting was relatively unchanged (r=0.4053) and still significant (p-value=0.029). Unfortunately the sample sizes for the two other goal types: (1) minimize an increase and (2) shift to off-peak usage, were too small to produce significant results.

Table 43 - Relationship between Goal Difficulty and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
C7 and C9: Goal Difficulty Various Goal Types				
Conservation goal	35	0.4356	0.011	Yes
Minimize an increase goal	6	-0.3000	0.5024	No
Shift to off-peak goal	4	0.2108	0.715	No

5.3.8 Motivations to Achieve Home Energy Goals and Interest in Home Energy Goal-Setting

In this section, the relationship between specific motivations to achieve home energy goals and interest in home energy goal-setting is presented. Table 44 summarises the results from the Spearman correlation analysis and all but one motivation type (want the reward associated with achieving home energy goals) was found to be statistically significant. And, similar to other findings presented in this chapter, altruistic benefits of goal achievement – that is the benefits to others in society – are most strongly related to interest in home energy goal-setting (r=0.5841). Interestingly, as presented in Chapter 4, extrinsic rewards were cited about two and a half times more often than intrinsic ones as the rewards expected from achieving *home energy* goals. This would suggest that although some monetary benefits could be realised from achieving home energy goal-setting, this motivation did not significantly increase as householders' interest in setting home energy goals increased. Instead, interest in doing so is more strongly related to other motivations to achieve home energy goals including the personal satisfaction enjoyed from goal attainment and other benefits to householders and society. This is in contrast to the findings in Section 5.2 that reported *both* environmental and financial reasons increased when householders expressed increased interest in setting home energy goals. The nuances here are subtle, and perhaps the interpretation of 'reward' in Question C14 was different for each respondent, potentially muddling the results shown in Table 44. However, as presented in Chapter 2, the financial 'rewards' of periodic energy conservation are usually small when compared to household income in the same period. So, it is not surprising that interest in home energy goal-setting is most strongly correlated with the non-monetary benefits of achieving home energy goals.

Table 44 - Relationship between Motivations to Achieve Home Energy Goals and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
C14 – Motivations to Achieve Home Energy Goals				
Responsible thing to do	62	0.4379	0.0006	Yes
Get personal satisfaction from goal achievement	63	0.3923	0.0020	Yes
Want the reward	63	0.2238	0.0780	No
Benefit me and/or my family	63	0.4495	0.0004	Yes
Benefits others in society	63	0.5841	0.0000	Yes
Want to avoid negative consequences	62	0.4161	0.0012	Yes

5.3.9 Household Traits and Interest in Home Energy Goal-Setting

Table 45 shows the relationships between demographic and household traits and interest in home energy goal-setting. Only one household trait (estimated number of years remaining in current home) demonstrated a modest negative relationship (r= - 0.2502) with interest in setting home energy goals – which appears to be counter-intuitive, although it was not found to be statistically significant (p-value=0.1636). In addition, an energy intensity score for each participant was calculated by dividing its average monthly electricity usage (reported three times in kilowatt-hours to account for seasonal effects) by its house size (reported in square footage). In both cases electricity usage and square footage was reported in a range, so the mid-point of the range was used to calculate the energy intensity score. No significant relationship was found between energy intensity of the homes and interest in home energy goal-setting, which suggests that it was not only the energy efficient households that were interested. And, perhaps not surprisingly, energy intensity did not significantly correlate with choice of goal difficulty either (r=0.013 and p-value=0.9548).

Table 45 – Relationship between Household Traits and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
Demographic Traits and Household Attributes				
Years spent in current home	61	0.1838	0.1546	No
Estimated number of years remaining in current home	32	-0.2502	0.1636	No
Number of occupants	62	0.0193	0.8802	No
Age of respondent	59	0.1419	0.2798	No
House size	57	0.1274	0.4146	No
Household income	37	0.1215	0.4658	No
Electricity usage in the summer	43	0.1178	0.4452	No
Electricity usage in the winter	42	0.1213	0.4374	No
Electricity usage in the spring and fall	42	0.0978	0.5314	No
Energy intensity score	36	0.1226	0.7598	No

An alternative statistical technique, the chi-squared test of a contingency table, was used to describe the relationship between nominal data such as gender and education levels to interest in home energy goals-setting. The results from this test showed that there was no statistically significant difference between males and females with regards to interest in home energy goal-setting. Similarly the chi-squared test results also showed that there was no statistically significant difference between levels of education in terms of interest in home energy goal-setting. The results from these two tests are presented in Table 46 below and the contingency tables are provided in Appendix H.

Table 46 – Results of Chi-Squared Test of a Contingency Table for Gender Type and Education Levels Relative to Interest in Home Energy Goal-Setting

Variable	Chi-squared statistic	Critical value	Statistically significant difference?*
Gender Type	0.948	11.0705 **	No
Education Levels	43.0509	49.8018 ***	No

*If the chi-squared statistic was greater than the chi-squared critical value (for 95% confidence level), then the difference was found to be statistically significant.
** Five degrees of freedom
*** Thirty-five degrees of freedom

Therefore, based on this analysis, interest in home energy goal-setting was found to be independent from the demographic and household characteristics examined in this study.

5.3.10 Willingness to Share Goal-Setting Experiences and Interest in Home Energy Goal-Setting

Similar to gender type and education level, participants' willingness to share their home energy goal-setting experiences with others would be considered nominal data (it was a 'Yes/No' type question), and as such, the chi-squared test of a contingency table was used to test this variable's relationship with interest in home energy goal-setting. The results of the test revealed that interest in home energy goal-setting differed significantly (p-value=0.0048) from those who indicated that they were willing to share their experiences about home energy goals than those who were not willing to do so. And, by looking at the contingency table (shown in Appendix H), it was clear that those who were willing to share their experiences are more interested in home energy goal-setting than those who were not willing to share. However, within the group of householders who were willing to share, there was no significant difference (95% confidence level) between those willing to share *their progress towards goal achievement* and those not willing to share their progress. The results from the chi-squared test are shown in Table 47.

Table 47 – Results of Chi-Squared Test of a Contingency Table for Willingness to Share Home Energy Goal-Setting Experiences Relative to Interest in Home Energy Goal-Setting

Variable	Chi-squared statistic	Critical value	Statistically significant difference?*
Willingness to share experiences with home energy goals	16.8353	11.0705 **	Yes
Willingness to share progress towards goal achievement	3.6790	5.9915 ***	No

*If the chi-squared statistic was greater than the chi-squared critical value (for 95% confidence level), then the difference was found to be statistically significant.
** Five degrees of freedom
*** Two degrees of freedom

5.4 Analysing the Design Elements of a Web-Based Home Energy Goal-Setting Interface

In this section of the chapter, the analyses relating to the design of the home energy goal-setting interface will be discussed. You may recall that the third research objective of this study was to examine householders' opinions and reactions to various 'goal-based' home energy feedback designs and to develop recommendations for feedback designers. To elaborate, the following two types of analyses were conducted:

(1) A Spearman's rank order correlation test to describe the extent to which householders' felt that the information, as shown to them in a screenshot, would help them to manage electricity usage in their homes relative to householders' interest in home energy goal-setting.

(2) A qualitative analysis of the descriptive written responses explaining householders initial reactions to the four screenshots shown.

In Table 48, the results from the Spearman's correlation tests are shown for each of the four screenshots that were presented in the survey.

Table 48 – Relationship between Helpfulness of Screenshot Information/Functionality and Interest in Home Energy Goal-Setting

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
D1 – D4: Helpfulness of Each of the Screenshots				
Select a Goal Screen	60	0.4006	0.002	Yes
Performance Indicator	63	0.3219	0.011	Yes
Appliance-Specific Tracking	63	0.3766	0.003	Yes
Daily Consumption Graph	61	0.0164	0.8992	No

This correlation analysis shows that the perceived helpfulness of the information shown in the first three screenshots was positively associated with householder interest in home energy goal-setting at the 95% confidence level, while the relationship was not statistically significant for the fourth.

In the qualitative remarks provided for each of the first three screenshots, one of the most commonly cited reason for liking them was the simplicity in which the information was presented (19 times – or 37% of respondents that left positive responses – for the 'Select a Goal Screen'; 22 times – or 44% – for the 'Performance Indicator'; and 13 times – 25% – for the 'Appliance-Specific Tracking'). It is likely not surprising to learn that householders appreciate receiving feedback in a simple manner. However, respondents also frequently cited 'data granularity' or 'detailed information' as another commonly liked feature of the first and third screens (20 times – or 39% -- for the 'Select a Goal Screen'; 31 times – or 61% - for the 'Appliance-Specific Tracking'), which suggests that preferences for simple presentations did not necessarily imply less granularity. Instead, preferences from the group of participants as a whole suggested more detail with easy-to-understand concepts and presentation. For example, the use of colour and/or the horizontal bars to indicate progress towards goal achievement in the second and third screens were cited several times as being features that were liked and easily understood (use of colour/symbols were 'liked' eight and four times and the progress bars were 'liked' eight and twelve times, respectively for the second and third screenshots). And, these symbols and indicators were not cited by participants as confusing – while only three times combined for both screens were they cited as 'dislikes' of the design. And, the most common dislike with the third

screen showing appliance-specific feedback was that the 'other' category was not disaggregated enough (for example, some householders called for greater granularity to include a lighting category and others for small electronics – such as televisions, computers and microwaves).

The only screenshot that did not have a positive relationship between its perceived helpfulness and household interest in home energy goal-setting was the 'Daily Consumption Graph'. While some participants did indicate that they found the graph to be helpful (43% at least 'somewhat agreed' and 17% 'strongly agreed'), it was not as well liked as the other designs tested in the survey. Several specific design features were identified as 'dislikes' – e.g., using graphical presentation in general, the use of multiple colours to represent appliance usage within each vertical bar, the small appliance icons in the legend, and according to some the colour around the appliance icons was too thin to decipher which colour represented which appliance. In addition, some 'dislikes' included critiques regarding missing information such as the lack of precise measures for appliance usage, missing 'days of the week' along the x-axis to help identify intra-week trends, and no identification of an appliance-specific goal.

Since at least some of the householders participating in this study found the daily consumption graph useful (43% at least 'somewhat agreed'), it was worth investigating who those people were to understand who might still benefit from graphical design elements such as those presented in the 'Daily Consumption Graph' screenshot. To do this, the following variables were related to perceived helpfulness of the screenshot using two statistical techniques:

Chi-squared test of a contingency table:

(1) Gender type (E7)
(2) Education level (E15)
(3) Preferred timeline for managing home energy goals (C10)
(4) Preferred tool to keep track of progress towards home energy goals (C16)
(5) Preferred frequency at which participants would like to have access to information (C17)

Spearman's rank order correlation analysis:

(1) Age (E6)
(2) Household income levels (E13)
(3) Interest in becoming more aware of energy usage (B9)
(4) Desire to learn about appliance-specific energy usage (B10)

These independent variables were selected for this more in-depth examination because it was felt that only these variables were relevant to perceived helpfulness of the 'Daily Consumption

Graph'. The results from the chi-squared test of a contingency table are presented in Table 49 and the results for the Spearman's correlation test are shown in Table 50. The contingency tables used to calculate the chi-squared statistic are provided in Appendix H.

Table 49 – Results of Chi-Squared Test of a Contingency Table for Householder Characteristics Relative to Perceived Usefulness of the Daily Consumption Graph

Variable	Chi-squared statistic	Critical value	Statistically significant difference?*
Gender type	3.9675	12.5916**	No
Education level	41.8615	58.1240***	No
Preferred timeline	26.7534	50.9985****	No
Preferred tool	35.002	43.773*****	No
Preferred feedback frequency	21.6595	43.7730******	No

*If the chi-squared statistic was greater than the chi-squared critical value (for 95% confidence level), then the difference was found to be statistically significant.
** Six degrees of freedom
*** Forty-two degrees of freedom
****Thirty-six degrees of freedom
***** Thirty degrees of freedom
****** Thirty degrees of freedom

Table 50 – Relationship between the Relevant Independent Variables and the Perceived Usefulness of the Daily Consumption Graph

Independent Variable	n=	Spearman's rho	p-value (2-tail)	Statistically significant? (95% confidence level)
Age	58	-0.2098	0.1132	No
Household income levels	51	0.0056	0.9684	No
Interest in becoming more aware of energy usage	59	-0.0730	0.5784	No
Desire to learn about appliance-specific usage	60	-0.0305	0.8146	No

There were no significant differences between the variables tested and their relationship to perceived usefulness of the daily consumption graph. In the correlation analysis, householders' age appears to be the only variable related to perceived helpfulness of the 'Daily Consumption Graph'. There was a very modest negative association (r=-0.2098) and this could

suggest that the perceived helpfulness of the daily consumption graph decreases for 'older' householders, although the relationship was not shown to be statistically significant at the 95% confidence level (p-value=0.1132).

5.5 Analysing the Potential Benefits and Barriers to Home Energy Goal-Setting

The fourth and final research objective of the thesis was to determine some of the relevant perceived benefits of, and barriers to, home energy goal-setting. In addition to determining, or confirming, what the benefits and barriers were, in this section of the thesis, an analysis will be presented to decipher which benefits appear to be most appealing and which barriers pose the strongest challenges to householders in general. Recommendations to home energy feedback designers will be presented in the next, and final, chapter.

Four types of survey responses were included in the analysis for this section. First, an analysis of the responses to Questions A7 to A13 in the survey will be presented. The responses to these seven questions were quantitative (seven-point Likert scale) and represented householders' opinions on a series of potential benefits and barriers to goal-setting in general. In addition, the written responses to an open-ended question (A18) will be incorporated into this discussion to ensure that all significant benefits and barriers identified by householders were analysed. Second, a qualitative analysis of written responses regarding expected rewards and disincentives to achieving or not achieving home energy goals will be presented. In that analysis, the frequency and type of rewards and disincentives (extrinsic versus intrinsic) will be discussed related to householders' perceived benefits and barriers to home energy goal achievement. Third, a correlation analysis will be presented which will reveal the nature of the relationship between motivations to achieve 'non-energy' goals and motivations to achieve home energy goals. This analysis will help determine whether the perceived benefits and barriers to home energy goal attainment 'dove tail' with other types of goals. Fourth, a discussion will be presented regarding the willingness of householders to set (or adopt) challenging conservation goals for their home's energy usage. After all, in the larger picture, if the objective is to reduce energy usage throughout the 'energy system', setting goals to maintain consumption levels or minimize an increase do not serve to meet those objectives. Conservation needs to be the result across the system. This begs the question about the willingness of householders to set

conservation goals, rather than just any goal (which may not be to reduce energy usage, costs or environmental impact at all).

5.5.1 Householders' Opinions Regarding the Potential Benefits and Barriers to Goal-Setting

An analysis of the householders' responses to Questions A7 to A13 revealed that the potential benefits to goal-setting are more often relevant to householders than the potential barriers. For example, four potential benefits to goal-setting were presented to survey respondents and on average, 91% of the respondents 'somewhat agreed' that all suggested benefits were relevant to them. On the contrary, three potential barriers of goal-setting were presented to the participants, and on average, only 51% of respondents 'somewhat agreed' that all the suggested barriers were relevant to them. So, in general, the enablers (or benefits) to goal-setting seem to be stronger than the inhibitors (or barriers). However, some caution would be wise at this point not to overstate the averages. Surely, if other benefits or barriers were presented, then the averages could have been different. Respondents did have the opportunity to suggest other potential benefits and barriers in Question A18, which was an open-ended question and will be discussed shortly. What is likely more important to understand is the 'perceived strength' of each benefit and each barrier, and whether one barrier will over-power all benefits (or vice versa). Indeed, of the three barriers presented, one barrier was more relevant to individuals than the other two – that the exercise of goal-setting takes a lot of effort. And, in the written responses to Question A18, four of the eight participants (50%) indicating that goal-setting does not work for them cited busyness or too much effort as being the reason. One advantage to home energy goal-setting is that the 'monitoring' of energy usage, costs and environmental impact, can all be done 'automatically' for the householder with advanced monitoring technology. For other goals, such as financial goals or nutritional goals, much more self-monitoring was found to be required with calendars, journals, spreadsheets, etc. If half the effort is simply keeping track of 'performance', and a home energy management system removes the need to keep track manually, then the remaining effort required is more focused and simplified on (a) setting periodic goals and (b) making choices to stay on track.

As discussed, all four potential benefits to goal-setting (in general) were well-recognised by the study participants. One benefit, in particular, appeared to be the most salient with respondents – that was seeing progress towards a goal motivates behaviour to stay on track. This suggests that continually emphasising progress, even a 'small' progress, might be a worthwhile strategy to fostering pro-sustainability behaviours in the home (such as conservation or load shifting). Implementation of continually emphasising progress will be part of the challenge and will be discussed more in the final chapter of the thesis.

Since Question A18 was an open-ended question, it allowed participants to identify benefits and barriers that were not included in the list provided in Questions A7 to A13. One other benefit to goal-setting was often reported by respondents in the written responses to Question A18. The most often cited reason given by participants for why goal-setting works for them was that it gives them a sense of control, purpose and/or focus (33% of respondents), which is quite easily seen as a benefit to fostering pro-sustainability behaviours if householders exhibit such a focus or purpose.

5.5.2 Expectations Regarding Rewards and Disincentives to Achievement of Home Energy Goals

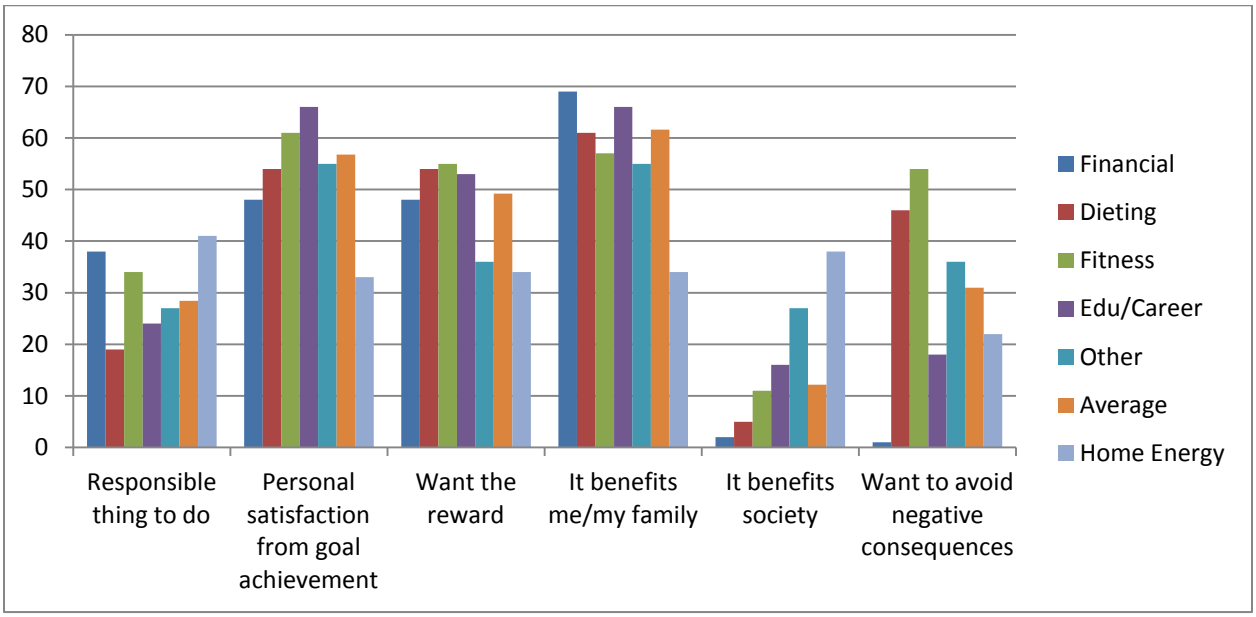
Another way to evaluate potential benefits and barriers to home energy goal-setting is to examine how the study participants described their expectations regarding rewards and disincentives to goal achievement (Questions C12 and C13). As presented in Chapter 4, the responses to these two questions were categorised into 'extrinsic' and 'intrinsic' motivations. Participants reported, as a whole, more extrinsic motivations in terms of rewards (such as reductions in energy bills or government rebates) than intrinsic motivations (such as satisfaction from reducing environmental impact or goal attainment) to home energy goal-setting; however, part of the reason might have had to do with the way the question was worded since several 'extrinsic' rewards were provided as examples in the question itself. When asked to identify negative consequences or disincentives expected for not attaining their home energy goals, intrinsic motivations (such as feelings of disappointment, guilt, etc.) were cited the same number of times as extrinsic motivations (such as increased energy costs).

Rather than trying to identify whether perceived benefits and barriers would be extrinsic or intrinsic, the more important point may be that both seem salient with householders as both were often cited. Similar results were found with responses to rewards and disincentives for 'non-energy' goals, as shown in Tables 3 and 4 in Chapter 4. Therefore, designers of home energy management systems that incorporate goal-setting capability should be aware of the perceived benefit of both extrinsic and intrinsic motivations associated with goal attainment and decide which type of benefit should be emphasised at what time. For example, for shorter-term achievements, such as meeting a daily goal, achievements and successes might be better presented for their intrinsic benefit to help encourage householders to 'keep going'; whereas, longer-term achievements might warrant extrinsic benefits such as a statement of financial savings in the year or a financial rebate from an external source.

5.5.3 Relationship between Motivations to Achieve 'Non-Energy' Goals and Home Energy Goals

Similar to the analysis presented in Section 5.5.2 regarding rewards and disincentives of multiple types of goals, an analysis was conducted to explore the nature of the relationship between motivations to achieve non-energy goals and motivations to achieve home energy goals. This was done to help articulate better whether the perceived benefits to goal achievement 'carry over' from non-energy goal-setting to home energy goal-setting. To conduct this analysis the 'average scores' relating to each of the six motivations for non-energy goal achievement were graphed next to the scores relating to motivations for all types of goal achievement. Three graphs were constructed to illustrate the importance of each type of motivation for each type of goal – and overall for non-energy goals. Therefore, by evaluating the average scores and the home energy goal-setting scores, conclusions can be drawn regarding the similarities and differences between motivations to achieve non-energy goals and motivations to achieve home energy goals. The graphs are shown in Figures 38, 39, and 40.

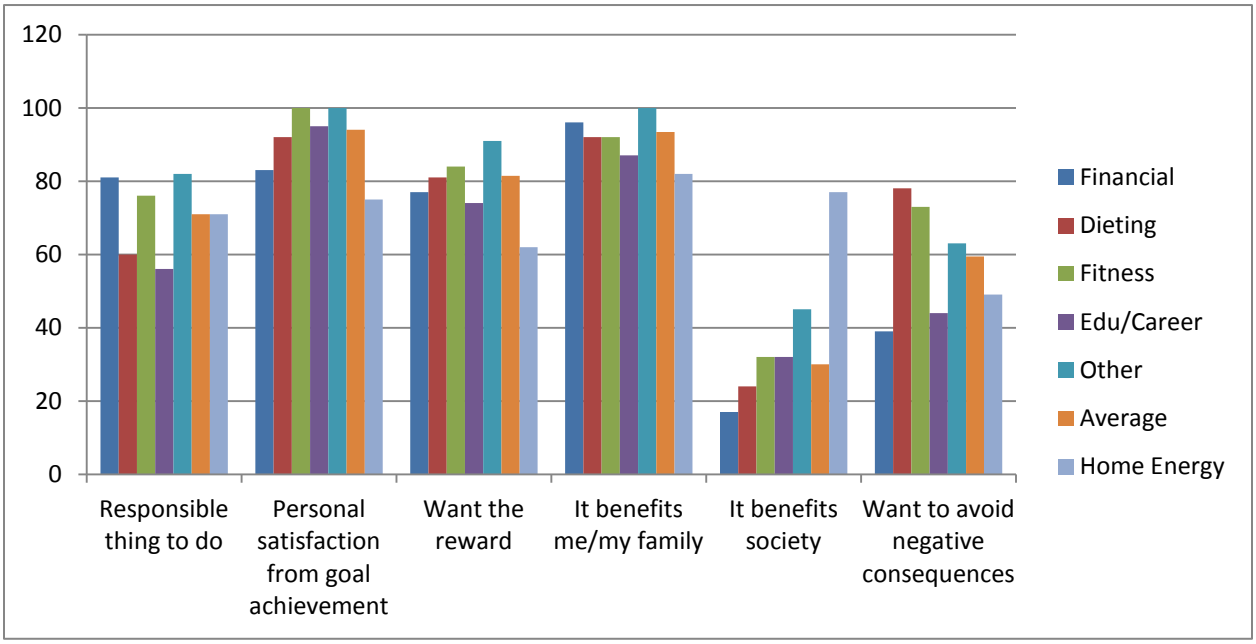
Figure 38 – Percentage of Respondents Indicating they 'Strongly Agree' With the Relevance of Various Motivation Types



In Figure 38, the percentage of respondents indicating that they 'strongly agreed' with the existence of each type of motivation is shown. Also, the *average percentage* for all 'non-energy' goal types is shown and labelled as 'Average'. When interpreting the average 'non-energy' scores relative to the 'home energy' scores, a few general conclusions can be made. First, there were two types of motivations where the 'home energy' score is higher than the 'average non-energy' score – (1) 'It is the responsible thing to do'; and (2) 'It benefits others in society'. Therefore these two types of motivations (and arguably benefits to goal attainment) appear to be more important factors to motivate goal achievement in home energy goals than in other goal types (as a whole). And, second, on average it appears that three types of motivations are more salient with individuals setting non-energy goals than with home energy goal-setting – (1) 'Personal satisfaction from goal achievement'; (2) 'Wanting the reward associated with goal achievement'; and (3) 'The benefits to me and/or my family'. Therefore, when interpreting these results, these three types of motivations appear to be less important factors to motivate goal achievement in home energy goals than in other goal types (as a whole). However, the range of 'scores' for these five types of motivations is arguably small *within* the 'home energy goal type' itself (maximum = 41%; minimum = 33%), suggesting that all of these factors motivating home energy goal achievement are relatively similar in relevance. However, the disparity, and thus the

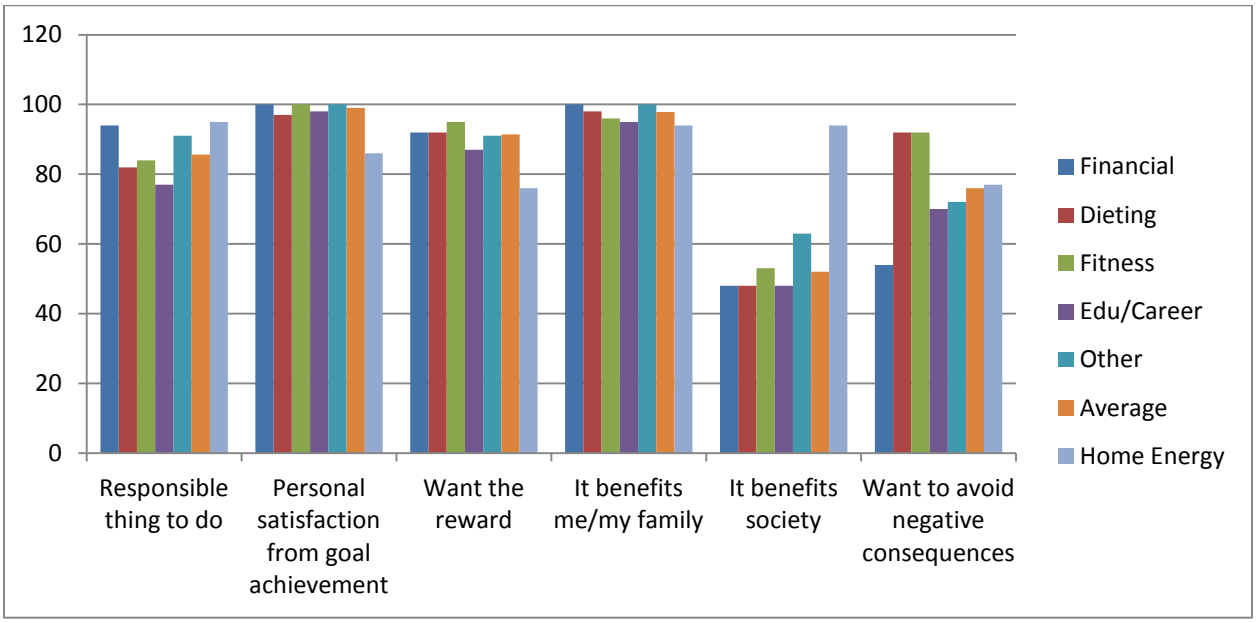
relevance, is much greater within each 'non-energy' goal type. Perhaps the lack of disparity might be because home energy goal-setting was still a new and abstract concept, whereas with the non-energy goals, respondents were already experienced with them.

Figure 39 – Percentage of Respondents Indicating they At Least 'Agree' With the Relevance of Various Motivation Types



By simply observing the graph in Figure 39 – which shows the frequency of respondents that at least 'agreed' – it can be seen that the disparity between the relevance of motivational factors is reduced quite substantially relative to Figure 38. For example, the only substantial difference, it appears, between the 'non-energy' goals average score and the home energy goals score would be with the motivation that 'goal achievement benefits others in society'.

Figure 40 – Percentage of Respondents Indicating they At Least 'Somewhat Agree' With the Relevance of Various Motivation Types



When examining the same graph with the percentage of respondents at least 'somewhat agreed' to the statements of the motivation types, the disparity between 'non-energy' goals and home energy goals becomes even less obvious still – as shown in Figure 40. A chi-squared goodness-of-fit test was conducted to determine whether there was a statistically significant difference between each type of motivation to achieve non-energy goals and each type of motivation to achieve home energy goals. The observed frequencies for the goodness-of-fit table were the 'home energy scores' and the expected frequencies were the 'average non-energy score'. The results were organised into three categories, 'strongly agreed', 'agreed', and 'somewhat agreed' with the relevance of the motivation type. The results from the test are shown in Table 51.

Table 51 – Results of Chi-Squared Goodness-of-Fit Test for Motivation to Achieve 'Non-Energy' Goals Relative to Motivation to Achieve Home Energy Goals

Variable	Chi-squared statistic	Critical value	Statistically significant difference?*
Responding 'Strongly Agree'			
Responsible thing to do	5.5901	3.8415	Yes
Personal satisfaction from goal achievement	9.9725	3.8415	Yes
Want the reward	4.6959	3.8415	Yes
It benefits me/my family	12.3662	3.8415	Yes
It benefits society	54.5607	3.8415	Yes
Want to avoid negative consequence	2.6129	3.8415	No
Responding At Least 'Agree'			
Responsible thing to do	0	3.8415	No
Personal satisfaction from goal achievement	3.8404	3.8415	No
Want the reward	4.6236	3.8415	Yes
It benefits me/my family	1.3914	3.8415	No
It benefits society	73.6333	3.8415	Yes
Want to avoid negative consequence	1.8209	3.8415	No
Responding At Least 'Somewhat Agree'			
Responsible thing to do	1.0322	3.8415	No
Personal satisfaction from goal achievement	1.7071	3.8415	No
Want the reward	2.5945	3.8415	No
It benefits me/my family	0.1476	3.8415	No
It benefits society	33.9231	3.8415	Yes
Want to avoid negative consequence	0.0132	3.8415	No

*If the chi-squared statistic was greater than the chi-squared critical value (for 95% confidence level and one degree of freedom), then the difference was found to be statistically significant.

One of the key findings when comparing these three graphs is that in only one case, in all three graphs, is there a statistically significant difference between the benefits to achieving non-energy goals and the benefits to achieving home energy goals – that was with the motivational factor that goal achievement benefits others in society. Therefore, it should be recognised that this benefit is more relevant to home energy goal-setting than it is to other types of goals on the

whole. However, if the 'standard' for what makes a type of motivational factor relevant changes to 'strongly agree'(rather than 'somewhat agree'), then the results may be interpreted differently to suggest that the personal satisfaction from goal achievement, the desire for a reward and the benefits to one's family might also be more relevant to non-energy goals.

5.5.4 Benefits and Barriers to Setting Challenging Conservation Goals for Home Energy Usage

So far in Section 5.5 of this thesis, the salient benefits and barriers to home energy goal-setting have been presented. By now, the relevance of several benefits and barriers should have been made clearer – in so far as to state their perceived relevance to home energy goal-setting. However, it is worth going a little bit further now to understand the likelihood that *conservation goals* – that is, a reduction in energy usage, costs, and/or environmental impact – will be set by householders. As presented in the introductory paragraph to this section, reduction in home energy consumption, in the bigger picture, could be argued as a core objective to 'energy system' sustainability. And, if this is the case, than the willingness of householders to set substantial conservation goals is important to understand. Two questions, in particular, sought to understand this phenomenon (C6 and C7).

In Question C6, 63 of 66 respondents (95%) were interested in setting home energy goals and 50 of the 63 (79%) were interested in setting goals *to conserve*. These findings were encouraging; however the degree to which householders are willing to set a substantial conservation goal is also important. Forty-eight householders responded to this question and 69% of them indicated that they would be interested in conserving at least 10% from a previous time period (e.g., relative to last year, etc.). In addition, 42% of respondents indicated that they were willing to conserve at least 15% and 30% of respondents indicated they would set a goal to conserve at least 20%. Table 52 below shows the percentage of respondents (n=66) willing to set conservation goals at each tier.

Table 52 – Respondents' Willingness to Set Conservation Goals

Goal Difficulty	Number of Respondents	% of Total Respondents (n=66)
At least 5% reduction	34	52%
At least 10% reduction	29	44%
At least 15% reduction	16	24%
At least 20% reduction	10	15%
At least 25% reduction	6	9%
At least 30% reduction	5	8%

Unfortunately, defining a conservation goal as 'substantial' can be a difficult exercise since the dynamics and capabilities of each household will vary and labelling a conservation goal can quickly become a subjective concept. For example, at what point does the conservation goal become substantial? Is it 10%, 20%, 30% or something else? In previous studies examining residential energy goal-setting, 15% to 20% would likely have been considered a 'challenging' goal (Becker, 1978; Van Houwelingen & Van Raaij, 1989; McCalley and Midden, 2002). Additionally, Becker (1978) showed that householders are more likely to conserve significantly higher amounts of energy if they set 'challenging' goals (his example was 20%) than vague goals (e.g., as much as possible) or 'easy' goals (his example was 2%). And, in the context of the Ontario electricity system, Chapter 1 touched on the OPA *Integrated Power System Plan* that has a stated conservation goal of 14% by the year 2025%. Therefore, 'the line' that indicates a goal of substance might be something like 15% reductions. Again, caution should be taken here since willingness to set more challenging goals will be based on a set of multiple variables relating to one's perceived and real ability to conserve, but nevertheless, 15% will be used for this discussion.

A Spearman's rank order correlation test did not reveal a statistically significant relationship between goal difficulty and any of the following: (a) electricity usage, (b) house size, and (c) 'energy intensity score' (measured by dividing average monthly electricity consumption by the reported square footage of the home). Therefore, householders were not more or less likely to set difficult goals based on their existing or previous efforts (or lack of effort) to efficiently use electricity in their homes.

By using inferential statistics, as done earlier in Chapter 5, we can predict the degree to which urban Ontario homeowners with some college or university education would be willing to set a substantial goal of 15% reductions in energy usage.

In order to make inferences about these results the following calculations were made:

Level of confidence = 95%

Percentage of sample willing to set a conservation goal of 10% (WTSCG10%) = 44%

Percentage of sample willing to set a conservation goal of 15% (WTSCG15%) = 24%

Percentage of sample willing to set a conservation goal of 20% (WTSCG20%) = 15%

Percentage of the population that would be willing to set a conservation goal of at least 10%:

$= (\text{WTSCG10\%}) +/- 1.96 * \sqrt{((\text{WTSCG10\%}) * (1 - (\text{WTSCG10\%})) / n)}$

$= .44 +/- 1.96 * \sqrt{(.44 * .66) / 66)}$

$= .44 +/- 1.96 * (0.066)$

$= .44 +/- 0.130$

Percentage of the population that would be willing to set a conservation goal of at least 15%:

$= (\text{WTSCG15\%}) +/- 1.96 * \sqrt{((\text{WTSCG15\%}) * (1 - (\text{WTSCG15\%})) / n)}$

$= .24 +/- 1.96 * \sqrt{(.24 * .76) / 66)}$

$= .24 +/- 1.96 * (0.053)$

$= .24 +/- 0.103$

Percentage of the population that would be willing to set a conservation goal of at least 20%:

$= (\text{WTSCG20\%}) +/- 1.96 * \sqrt{((\text{WTSCG20\%}) * (1 - (\text{WTSCG20\%})) / n)}$

$= .15 +/- 1.96 * \sqrt{(.15 * .85) / 66)}$

$= .15 +/- 1.96 * (0.044)$

$= .15 +/- 0.086$

Therefore, interpreting these calculations, it would be understood with 95% confidence that 31 to 57 percent of urban Ontario homeowners with some college or university education would be willing to set conservation goals of at least 10%; approximately 14 to 34 percent would

being willing to set conservation goals of at least 15%; and approximately 6 to 24 percent would be willing to set conservation goals of at least 20%. Of course, it should be realised that these statistics are simply suggesting what college or university educated, urban Ontario homeowners would likely aim to do, and is not a measure of what they achieved or would likely achieve. Further research that compared Ontario households using home energy goal-setting with similar Ontario households that were not using home energy goal-setting would be needed to predict such results.

Chapter 6: Conclusion

6.1 Summary of Research Objectives and Key Findings

At the end of Chapter 2 of this thesis, several research objectives were presented in order to explore householder interest in home energy goal-setting. These objectives were inspired by previous research on goal-setting that had shown it to enhance the conservation effects of home energy feedback in jurisdictions other than the province of Ontario. Although the literature overwhelmingly suggested that the conservation effects of combining goal-setting with feedback are significantly enhanced to feedback alone, previous research did not examine the extent to which householders would be willing to set challenging but realistic conservation goals for their home that could help address some of the broader 'social and energy system issues' presented in Chapter 1. In addition, several articles in the literature reviewed for this thesis suggested that many householders in other jurisdictions preferred more granularity in their home energy usage feedback (Fischer, 2008; Wood and Newborough, 2007), but no published study to-date has examined how disaggregated feedback in a central display may be coupled with goal-setting to help enhance householders' willingness and ability to conserve.

To what extent are Ontario householders interested in home energy goal-setting?

In this study, 91% of the participants at least 'somewhat agreed' that they would be interested in setting home energy goals and 36% at least 'strongly agreed'. And, 30% of participants reported that they would be willing to spend at least $6 per month to have access to home energy goal-setting technology through an online web-portal similar to the screenshots presented. Householders cited environmental and financial reasons for their interest in home energy goal-setting, although the strongest motivations to achieve home energy goals were reported to be intrinsic motivations such as personal satisfaction from goal attainment and benefits to society. Inferential statistics showed, with 95% confidence, that 35% to 37% of the urban Ontario homeowners with some college or university education would be at least strongly interested in setting home energy goals and 29% to 31% would be willing to pay at least $6 per month for the technology. In addition, it was found that 14% to 34% of the broader population would set 'substantial' energy conservation goals of at least a 15% overall reduction of usage,

costs and/or environmental impact. A 15% reduction was deemed substantial, in part, because it was greater than the province's goal of conserving 14% of electricity by 2025.

To help develop effective strategies going forward, several other research questions were examined including: (1) Who would likely be the early adopters of home energy goal-setting? (2) What elements of the goal-based feedback designs would householders find most helpful? And, (3) What would be the perceived benefits and barriers to setting home energy goals?

Who are likely to be the early adopters of home energy goal-setting?

The data gathered from the web-based survey were used to examine the relationship between interest in home energy goal-setting (the dependent variable) and several independent variables including elements of non-energy goal-setting experience and opinions, energy awareness, pro-sustainability attitudes and behaviours, and household characteristics. This analysis revealed that early adopters of home energy goal-setting:

- Did not necessarily have to have experience or interest in setting non-energy goals;
- Reported to be highly aware of the environmental impact of their home's energy usage;
- Reported that they were already trying to conserve energy and reduce on-peak electricity usage;
- Wanted to reduce their energy usage, costs and environmental impact even more;
- Wanted to learn more about their usage patterns and how to improve;
- Were motivated to do the 'responsible thing' and feel good about doing it, while benefiting themselves and society overall;

It was also found that those most interested in setting home energy goals were willing to set more difficult conservation goals (measured as percentage reductions from a previous period) and were more willing to share their experiences with others. These relationships provided a clearer understanding of what the characteristics of the potential early adopters of this innovation would likely be.

What design elements would be most helpful to householders?

The design elements of the tools that these people were interested in using to help manage their home energy goals will be presented next. A web account was the most preferred 'top-choice' (38%) as a medium to receive goal-based home energy feedback, although four methods in general were alternative possibilities since 68% of respondents indicated that they would also like to receive goal-based feedback on their utility bills; 64% via a web account; 48% indicated an in-home display and 41% expressing interest in receiving information by email.

Opinions and reactions to four screenshots of a home energy goal-setting interface were collected and analysed and three of the four screen designs were positively received by study participants overall. Their opinions reinforced the arguments in the literature for more granularity by end-use category or appliance (Darby, 2006; Fischer, 2008), while keeping data visualisation as simplified as possible (Wood and Newborough, 2007). The level of appliance-specific granularity in screenshots of this study contained six major energy consuming appliances and one additional category labelled 'other' for the remaining household consumption. Many participants indicated that they would have preferred to see more appliances included in the breakdown, specifically suggesting that the 'other' category should be disaggregated even further to include categories for small electronics, such as entertainment and office devices, and lighting.

On a whole, the precision of feedback offered by numerical data and tables was preferred more than graphical representations of appliance usage when including information about multiple appliances on one screen. This confirms feedback design suggestions presented by Roberts and Baker (as reported in Wood and Newborough, 2007) that bar graphs do not show well the 'degree of difference' between variables (or in this case between appliances). However, Wood and Newborough (2007) also suggested that graphs are appropriate for centralised displays, but the findings in this study would suggest that such is true only in certain conditions. The 'Daily Consumption Bar Graph' examined in this study showed daily energy costs relative to a 'daily average goal' and was generally less preferred because of its added complexity. Instead, some householders suggested simplifying the concept by presenting the daily average goal for each for the 'total household' and the individual appliance on their own graph, rather than confusing the graph with multiple appliances.

Householders responded well to a 'performance indicator' that used symbols and colour codes representing actual usage versus expected usage to inform them about progress towards achieving their goals. The three-tiered 'traffic light' analogy for goal-based performance feedback was well received (green = on-track; yellow = off-track; red = goal not achieved) and thus was a good adaptation of the two-tiered happy face and sad face system for performance feedback that led to effective conservation results in the study by Shultz et al (2007).

What are the perceived benefits and barriers to home energy goal setting?

The final objective of the study was to determine the potential benefits and barriers for householders to set (or adopt) home energy goals. Self-set goals were indicated as preferred to assigned goals, but interest in home energy goal-setting was not positively associated with preference to self-set goals. This would suggest that either self-set or assigned goals are in the realm of possibilities to engage householders in home energy goal-setting and confirms findings from McCalley & Midden (2002) that there likely would not be a significant difference in choice of goal difficulty and conservation effects between two such approaches/groups.

Several benefits were reinforced as relevant to goal-setting including its ability to help individuals stay organised, the willingness to continue a type of behaviour because seeing progress towards goal achievement is motivational, the desire to have a specific target to work towards, and the helpfulness to breakdown goals into manageable tasks. In addition, qualitative responses to open-ended questions suggested more benefits to goal-setting including: the development of a sense of control and purpose, and to help prioritise tasks and make decisions. One potential barrier was stronger than most – that was that goal-setting in general takes a lot of effort. However, since a home energy management system would keep track of usage automatically, it was argued that much of the effort spent to monitor 'progress' with other types of 'non-energy' goals would not 'carry over' and inhibit management of home energy goals. Additionally, both extrinsic reasons (e.g., financial savings) and intrinsic reasons (e.g., personal satisfaction) were used to explain interest in home energy goal-setting and reported as relevant motivators for householders to achieve their home energy goals. The recognition of these motivations, particularly the importance of intrinsic motivations to achieve home energy goals, reinforces work done by Locke et al (1981) on goal-setting more broadly.

6.2 Recommendations

In this section of the thesis, recommendations will be made in two forms. First, recommendations that help marketers of home energy goal-setting technology will be presented and second, recommendations for technology designers are provided. In the following section, recommendations for the research community and future work are shared.

When considering how to market or promote home energy goal-setting, emphasis should be placed on the broader environmental benefits of energy management and the enhanced ability to manage energy usage through simple, easy-to-use monitoring technology. It is also recommended that marketers of this innovation explain how goal-setting is made easier with this technology since keeping track of progress towards goal achievement is done automatically – unlike some other types of goal management techniques of the past. When considering approaches to appeal to the likely early adopters of this innovation, target the environmentally-aware householders that want to do more to learn about their energy usage patterns, better manage their energy bills or save money and reduce their environmental impact.

When considering the design of a home energy management system, provide householders with opportunities to set disaggregated home energy goals that match their billing cycle and provide them with continuous feedback on their progress towards goal achievement. Use symbols and colours to represent performance towards the goal. In this case, a green check mark was positively received by householders to indicate good performance (or positive feedback), while a yellow exclamation point and red 'X' did well to represent degrees of poor performance (or negative feedback). Do not overcomplicate goal-based feedback with graphs showing usage of multiple appliances in the same graph. Instead, use numerical grids and tables to show precise goal-based feedback of multiple appliances at the same time and when using graphs show the performance relative to one appliance-specific goal at a time or the total household goal to keep the graph relatively simple.

Also, if possible, allow householders to customise the list of appliances that appear in the home energy goal-setting interface, rather than providing them with just the typical major consuming devices. One of the most statistically significant relationships ($r=0.6671$) was the positive association between householders' desire to learn about appliance-specific usage and interest in home energy goal-setting. And, several respondents to the survey indicated that *even more* granularity would have been preferred than just the major appliances in the home (the

'other' category in the sample screenshot was too large according to many). This also confirms the suggestion from Wood and Newborough (2007) that 'plug-and-play' (or out-of-the-box) energy management technology should allow the householder to customise the level of granularity in case new appliances are added in the future.

The relationship between interest in customised energy savings tips and interest in home energy goal-setting was also positively associated (r=0.7246) and highly significant, therefore, if possible, technology designers should incorporate energy savings tips that are specific to the areas in which householders are not meeting their appliance-specific goals. In other words, resist the temptation to provide generic tips to everyone because it is very simple to do and, instead, provide the tips when specific issues arise to help householders move from learning to action. Such an important finding builds on suggestions in the literature that generic tips have not been found as appealing to householders (Fischer, 2008).

6.3 Future Work

Looking forward, the effectiveness of, and justification for, deployment of home energy goal-setting technology still needs further examination. Indeed this research has presented recommendations regarding who is interested in home energy goal-setting, the extent of their interest, and what they would prefer to do and use to set and manage their goals. However, additional research could look at the extent to which home energy goal-setting 'engages' householders in home energy management activities and improves pro-sustainability attitudes and behaviours in the long-term. We know that many home energy conservation strategies have been shown to lose their effectiveness over time as the novelty of the intervention wears-off, but we do not yet know the extent to which home energy goal-setting can help to keep householders interested in home energy management, potentially mitigating the 'fallback' effect (Wilhite and Ling, 1995) and 'rebound' effect (Greening et al, 2000) that so often prevail in the long-term. To adequately measure these dynamics, it is recommended that observational research be conducted in pilot sites with householders using home energy goal-setting technology for longer than one year. The long-term recommendation for future work would help to account for seasonal effects and the initial technological enthusiasm that may or may not be short-lived.

Bibliography

Abrahamse W., L. Steg, C. Vlek, T. Rothengatter. (2005). "A Review of Intervention Studies Aimed at Household Energy Conservation." *Journal of Environmental Psychology*. Vol. 25, pg.273-291.

Ajzen, I. (1991). "The Theory of Planned Behavior." *Organizational Behavior and Human Decision Processes.* Vol. 50, pp179-211.

Anderson, W. & V. White. (2009). "The Smart Way to Display." London, UK: Energy Saving Trust.

Babbie, E. (1999). *The Basics of Social Research*. Belmont, CA: Wadsworth Publishing Company.

Becker, L. (1978). "Joint Effect of Feedback and Goal-Setting on Performance: A Field Study of Residential Energy Conservation." *Journal of Applied Psychology*. Vol. 63, (4), pp.428-433.

Canada Revenue Agency (CRA). (2011). "What are the Income Tax Rates in Canada for 2011?" Canada Revenue Agency. Accessed 22 August 2011 from http://www.cra-arc.gc.ca/tx/ndvdls/fq/txrts-eng.html.

Centre for Energy (CE). (2010). "United Nations Climate Change Conference." Calgary, AB: Centre for Energy. Accessed 21 March 2010 from http://www.centreforenergy.com/AboutEnergy/CanadianEnergy/COP15/Copenhagen.asp

City of Thunder Bay. (2009). "Demographics." Accessed 24 August 2011 from http://www.thunderbay.ca/CEDC/Reports_and_Publications/Community_Profile_Facts_and_Statistics/Demographics.htm.

Darby, S. (2000). "Making it Obvious: Designing Feedback into Energy Consumption." A paper presented at the *2nd International Conference on Energy Efficiency in Household Appliances and Lighting.* Naples, IT: Italian Association of Energy Economists/ECSAVE Programme.

Darby, S. (2006). "The Effectiveness of Feedback on Energy Consumption." Oxford, UK: Environmental Change Institute, University of Oxford.

Dietz, T., G. Gardner, J. Gilligan, P. Stern, M. Vandenbergh. (2009). "Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions." *Proceedings of the National Academy of Sciences (PNAS) of the United States of America*. Vol. 106, (44), pp.18452-18456.

Faruqui, A., S. Sergici & A. Sharif. (2009). “The Impact of Informational Feedback on Energy Consumption – A Survey of the Experimental Evidence”. Cambridge, MA: The Brattle Group and Social Science Research Network.

Festinger, L. (1957). *A Theory of Cognitive Dissonance*. USA: Stanford University Press.

Fischer, C. (2008). “Feedback on Household Electricity Consumption: A Tool for Saving Energy?” *Energy Efficiency*. Vol. 1, p.79-104.

Froehlich, J., L. Findlater, J. Landay. (2010). “The Design of Eco-Feedback Technology.” A paper presented at the *Chi 2010 Conference on Human Factors in Computing Systems*. New York, NY.

Gardner, G. & P. Stern. (2009). “The Short List: The Most Effective Actions US Households Can Take to Curb Climate Change.” *Environment*. Accessed 4 June 2011 from http://www.environmentmagazine.org/Archives/Back%20Issues/September-October%202008/gardner-stern-full.html.

Gonzales, M., E. Aronson & M. Costanzo. (1988). "Using Social Cognition and Persuasion to Promote Energy Conservation: A QuasiExperiment." *Journal of Applied Social Psychology*, Vol. 18 (12), pg. 1049-1066.

Greening, L., D. Greene, & C. Difiglio. (2000). “Energy Efficiency and Consumption – the Rebound Effect – a Survey.” *Energy Policy*. Vol. 28 (6-7), pg.389-401.

Google. (2011). “Google Maps.” Accessed 5 August 2011 from http://maps.google.ca/maps?hl=en&tab=wl.

Hirst, E., L. Berry, & J. Soderstorm. (1981). “Review of Utility Home Energy Audit Programs”. *Energy*. Vol. 6 (7), pg. 621-630.

Independent Electricity System Operator (IESO). (2010). Data received in an email from Ontario’s IESO, also available at http://reports.ieso.ca/index.html.

International Energy Agency (IEA). (2010). “Key World Statistics.” Paris, FR: International Energy Agency.

Katzev, R. & T. Johnson. (1984). “Comparing the Effects of Monetary Incentives and Foot-in-the-Door Strategies in Promoting Residential Electricity Conservation.” *Journal of Applied Social Psychology*. Vol. 14, (1) pg.12-27.

Locke, E. (1991). “Goal-Setting Theory vs. Control Theory: Contrasting Approaches to Understanding Work Motivation.” *Motivation and Emotion*. Vol. 15, (1), pp.9-28.

Locke, E., K.N. Shaw, L.M. Saari, G.P. Latham. (1981). “Goal-Setting and Task Performance.” *Psychological Bulletin*. Vol. 90, (1), pp.125-152.

McCalley, L. & C. Midden. (2002). "Energy Conservation through Product-Integrated Feedback: The Roles of Goal-Setting and Social Orientation." *Journal of Economic Psychology.* Vol. 23, pp.589-603.

McClelland, L. & S. Cook. (1980). "Promoting Energy Conservation in Master-Metered Apartments through Group Financial Incentives." *Journal of Applied Psychology*. Vol. 10, (1), pp.20-31.

McKenzie-Mohr, D & W. Smith. (1999). *Fostering Sustainable Behaviour: An Introduction to Community-Based Social Marketing.* Gabriola Island, B.C.: New Society Publishers.

McLaffery, S. (2003). "Conducting Questionnaire Surveys." In N. Clifford and G. Valentine (Eds.) *Key Methods in Geography*. London, UK: Sage Publications, Ltd. (pp.87-100).

Natural Resources Canada (NRCan). (2010a). "Canada's Secondary Energy Use by Sector, End-Use and Sub-Sector." Ottawa, ON: Natural Resources Canada. Accessed 9 July 2011 from http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/aaa_ca_2_e_2.cfm?attr=0.

Natural Resources Canada (NRCan). (2010b). "Energy Efficiency." Ottawa, ON: Natural Resources Canada. Accessed 9 July 2011 from http://nrcan.gc.ca/eneene/effeff/resintro-eng.php.

Natural Resources Canada (NRCan). (2010c). "Electricity Generation GHG Emissions by Energy Source." Natural Resource Canada's Office of Energy Efficiency. Accessed 9 July 2011 from http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tablestrends2/egen_ca_2_e_4.cfm?attr=0#footnotes.

Ontario Energy Board (OEB). (2011). "Your Electricity Utility: For Residential Consumers." Accessed 10 August 2011 from http://www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Your+Electricity+Utility.

Ontario Ministry of Energy and Infrastructure (OMEI). (2010a). "Ontario's Green Energy Act." Ontario Ministry of Energy and Infrastructure website, accessed 9 July 2011 from http://www.mei.gov.on.ca/en/energy/renewable/?page=gea

Ontario Ministry of Energy and Infrastructure (OMEI). (2010b). "Nuclear Energy, Electricity Supply." Ontario Ministry of Energy and Infrastructure website, accessed 9 July 2011 from http://www.mei.gov.on.ca/en/energy/electricity/?page=nuclear-electricity-supply.

Ontario Ministry of Energy and Infrastructure (OMEI). (2010c). "Comparing Energy Costs." Ontario Ministry of Energy and Infrastructure website, accessed 9 August 2011 from

http://www.mei.gov.on.ca/en/energy/conservation/?page=heating-and-cooling-your-home_chapter-13

Ontario Power Authority (OPA). (2010a). "Ontario's Energy Landscape." OPA website, accessed 9 July 2011 from http://www.powerauthority.on.ca/ontarios-energy-landscape.

Ontario Power Authority (OPA). (2010b). "Conservation Fund." OPA website, accessed 9 July 2011 from http://www.powerauthority.on.ca/tdfund.

Ontario Power Authority (OPA). (2010c). "Conservation." OPA website, accessed 9 July 2011 from http://www.powerauthority.on.ca/conservation.

Pays, T. (1997). *Research Decisions: Quantitative and Qualitative Perspectives (Second Edition).* Toronto, ON: Harcourt Brace & Company Canada, Ltd.

Relich, D. (2010). "Smart Meters on a Roll in Canada." *Utilities.* Vol. 8. Accessed 12 October 2010 from http://mthink.com/utilities/utilities/smart-meters-roll-canada.

Rogers, E.M. (1995). *Diffusion of Innovation (Fourth Edition).* New York, NY: The Free Press: A Division of Simon & Schuster Inc.

Shipman, M. (1972). *The Limitations of Social Research.* London, UK: Longman Group Limited.

Shultz, P.W., J.M. Nolan, R.B. Cialdini, N.J. Goldstein, V. Griskevicius. (2007). "The Constructive, Destructive, and Reconstructive Power of Social Norms." *Psychological Science.* Vol. 18, (5), pp.429-434.

Siero, F.W., A.B. Bakker, G.B. Dekker, T.C. van den Burg. (1996). "Changing organizational energy consumption behavior through comparative feedback." *Journal of Environmental Psychology* Vol. 16, pp.235-246.

Silverman, D. (2000). *Doing Qualitative Research: A Practical Handbook.* London, UK: Sage Publications Ltd.

Simon, R., H. Humphries, V. Hyldon. (2004). "Consumer Preferences for Improving Energy Consumption Feedback." Bristol, UK: Centre for Sustainable Energy.

Slavin, R., J. Wodanski, B. Blackburn. (1981). "A Group Contingency for Electricity Conservation in Master-Metered Apartments." *Journal of Applied Behavior Analysis*. Vol. 14, (3), pp.357-363.

Statistics Canada. (2007). Community Highlights for Waterloo and Ontario. 2001 Canadian Census Survey Results. Accessed 5 August 2011 from http://www12.statcan.ca/english/Profil01/CP01/Details/Page.cfm?Lang=E&Geo1=CSD&

Code1=3530016&Geo2=PR&Code2=35&Data=Count&SearchText=Waterloo&SearchType=Begins&SearchPR=35&B1=All&Custom=

United Nations Framework Convention on Climate Change (UNFCCC). (No date). "Kyoto Protocol." Bonn, DE: United Nations Framework Convention on Climate Change. Accessed 12 October 2010, from http://unfccc.int/kyoto_protocol/items/3145.php.

University of Waterloo (UW). (No date). "Sustainable Energy Research. The Energy Hub Management System: Enabling and Empowering Energy Managers through Increased Information and Control." Access 10 January 2011 from http://www.energyhub.uwaterloo.ca/

Van Houwelingen J.H. & W.F. Van Raaij. (1989). "The Effect of Goal-Setting and Daily Electronic Feedback on In-Home Energy Use." *Journal of Consumer Research*. Vol. 16, pp.98-105

Waterloo North Hydro. (2011). "Smart Meters." Accessed 22 August 2011 from http://www.wnhydro.com/smart_meters/pricing.shtml.

Wilhite, H., R. Ling. (1995). "Measured Energy Savings From a More Informative Energy Bill." *Energy and Buildings*. Vol. 22, pp.145-155.

Winett, R., I. Leckliter, D. Chinn, B. Stahl, & S. Love. (1985). "Effects of Television Modeling on Residential Energy Conservation." *Journal of Applied Behavior Analysis.* Vol. 18, pp.33-44.

Winett, R., S. Love, & C. Kidd. (1982-1983). "The Effectiveness of an Energy Specialist and Extension Agents in Promoting Summer Energy Conservation by Home Visits." *Journal of Environmental Systems*. Vol. 12, (1), pp.61-70.

Wood, G. & M. Newborough. (2003). "Dynamic Energy-Consumption Indicators for Domestic Appliances: Environment, Behaviour and Design." *Energy and Buildings*. Vol. 35, pp.821-841.

Wood, G. & M. Newborough. (2005). "Consumer Preferences for Energy-Use Information in the Future Home. Report to TAHI.

Wood, G. & M. Newborough. (2007). "Energy-Use Information Transfer for Intelligent Homes: Enabling Energy Conservation with Central and Local Displays." *Energy and Buildings*. Vol. 39, pp.495-503.

Appendix A – Text and Questions Presented in the Web-Based Survey

Welcome to this online survey conducted by researchers in the Department of Environment and Resource Studies at the University of Waterloo.

Thank you for your interest in participating in this research.

Participation in this study is voluntary. You may decline to answer any questions that you do not wish to answer by leaving them blank and you can withdraw your participation at any time by not submitting your responses. If you prefer not to complete the survey on the web, please contact us and we will make arrangements to provide you another method of participation. There are no known or anticipated risks from participating in this study.

While completing the survey, please follow these instructions:

- If you would like to alter a response to a previous question you will have the option to click the "back" button on the bottom of the screen to correct your response from an earlier page.
- The survey is designed to be completed in one session. Once you have clicked the "Submit" button at the end of the survey you will no longer be able to alter your responses.
- In the final page of the survey, you will be asked for an approximate estimate of how much electricity you consume in a typical month. Having your electricity bill(s) nearby may be helpful, although it is not required.
- The survey will not 'time you out' at any point, so take whatever time you need to respond.

Please note that any personal information obtained in this survey is confidential and is not shared or distributed to any third parties. Only the researchers conducting the survey will have access to this information and any personal information collected is only for the purpose of contacting you if you win the draw.

You are free to provide as much or as little information as you wish throughout the survey and you can complete the survey with anonymity -- even if you are providing your name and email address for the draw. At the end of the survey, you will be provided with a link to submit this information, so that it is not associated with your survey responses.

It is important for you to know that any information that you provide will be confidential. All of the data will be summarised and no individual could be identified from these summarised results. Furthermore, the web site is programmed to collect responses alone and will not collect any information that could potentially identify you (such as machine identifiers).

The data, with no personal identifiers, collected from this study will be maintained on a password-protected computer database in a restricted access area of the university. As well, the

data will be electronically archived after completion of the study and maintained for two years and then erased.

If you have any questions about this survey or this research more broadly, please feel free to contact the researcher, Eric Mallia, by email at the University of Waterloo at: emallia@uwaterloo.ca or Dr. Ian Rowlands at 519-888-4567 ext. 32574 or by email at: irowland@uwaterloo.ca.

I assure you that this study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo. If you have any comments or concerns resulting from your participation in this study, please feel free to contact Dr. Susan Sykes, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or by email at sskyes@uwaterloo.ca.

Consent to Participate:

I acknowledge that I am 18 years of age and with full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

[ ] I am 18 years of age and agree to participate.
[ ] I do not wish to participate (please close your web browser now).

Thank you again for your interest and participation!

PART A – Interest and Experience in Goal-Setting

A1. Do you set goals in any area of your life? For example, do you set personal financial goals, nutritional/dieting goals, fitness goals, educational goals, etc.?

1) Yes

2) No

A2. If you selected 'Yes', please select the types of goals you set and manage (<u>select all that apply</u>). If there is another type of goal that is not included in the list below, please identify it in the 'Other' option.

1. Personal financial goals
2. Nutritional/dieting goals
3. Fitness goals
4. Educational/career goals
5. Other, please specify _____

A3. What types of rewards or incentives do you get for achieving your goals? (e.g., money you save, increased purchasing ability, feel better about your health, less risk of illness, better chance at employment/promotion, etc.)

If you receive rewards or incentives for achieving your goal, please describe them next to the goal that you typically set. If you do not receive rewards for achieving your goal, please write 'none' in the space provided. (Note that rewards and incentives could be monetary and/or non-monetary.)

1. Personal financial goals _____
2. Nutritional/dieting goals _____
3. Fitness goals _____
4. Educational/career goals _____
5. Other, please specify _____
6. Not applicable

A4. What types of negative consequences or disincentives are there if you do not achieve your goals? (e.g., decreased money saved, don't fit in clothes, increased risk of illness, bad grades, lost income, etc.).

If there are no negative consequences for not achieving your goal, please write 'none'. Please explain the negative consequences for each applicable type of goal. (Note that negative consequences and disincentives could be monetary and/or non-monetary.)

1. Personal financial goals _____
2. Nutritional/dieting goals _____
3. Fitness goals _____
4. Educational/career goals _____
5. Other, please specify _____

A5. For each of the types of goals that you selected, please specify the timeframe you use to manage your goals? (For the options that do not apply to you, please select 'Not applicable'.)

A5.1. Personal financial goals:

I tend to set personal financial goals for each:

- o Day
- o Week
- o Month
- o Every 3 months
- o Every 6 months
- o Year
- o More than one year
- o Other, please specify _____
- o Not applicable

A5.2. Nutritional/dieting goals

I tend to set nutritional/dieting goals for each:

- o Day
- o Week
- o Month
- o Every 3 months
- o Every 6 months
- o Year
- o More than one year
- o Other, please specify _____
- o Not applicable

A5.3. Fitness goals:

I tend to set fitness goals for each:

- o Day

- Week
- Month
- Every 3 months
- Every 6 months
- Year
- More than one year
- Other, please specify _____
- Not applicable

A5.4. Educational/career goals:

I tend to set educational goals for each:

- Day
- Week
- Month
- Every 3 months
- Every 6 months
- Year
- More than one year
- Other, please specify _____
- Not applicable

A5.5. Other (type of goal) _____:

I tend to set these goals for each:

- Day
- Week
- Month
- Every 3 months
- Every 6 months
- Year
- More than one year
- Other, please specify _____
- Not applicable

A6. What factors motivate you to achieve your goal?

Please describe your level of agreement with the following statements regarding the factors that motivate you to achieve your goals.

A6.1. Personal financial goals:

I am motivated to achieve this type of goal because...	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
It is the responsible thing to do.								
I get personal satisfaction from achieving these goals.								
I want the reward associated with achieving these goals.								
It benefits me, and/or my family, to achieve these goals.								
It benefits others in society for me to achieve these goals.								
I want to avoid the negative consequences associated with not achieving these goals.								

A6.2. Nutritional/dieting goals

I am motivated to achieve this type of goal because...	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
It is the responsible thing to do.								
I get personal satisfaction from achieving these goals.								
I want the reward associated with achieving these goals.								

It benefits me, and/or my family, to achieve these goals.								
It benefits others in society for me to achieve these goals.								
I want to avoid the negative consequences associated with not achieving these goals.								

A6.3. Fitness goals:

I am motivated to achieve this type of goal because...	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
It is the responsible thing to do.								
I get personal satisfaction from achieving these goals.								
I want the reward associated with achieving these goals.								
It benefits me, and/or my family, to achieve these goals.								
It benefits others in society for me to achieve these goals.								
I want to avoid the negative consequences associated with not achieving these goals.								

A6.4. Educational/career goals:

I am motivated to achieve this type of goal because...	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
It is the responsible thing to do.								
I get personal satisfaction from achieving these goals.								
I want the reward associated with achieving these goals.								
It benefits me, and/or my family, to achieve these goals.								
It benefits others in society for me to achieve these goals.								
I want to avoid the negative consequences associated with not achieving these goals.								

A6.5. Other (type of goal) _____:

I am motivated to achieve this type of goal because...	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
It is the responsible thing to do.								
I get personal satisfaction from achieving these goals.								
I want the reward associated with achieving these goals.								

It benefits me, and/or my family, to achieve these goals.								
It benefits others in society for me to achieve these goals.								
I want to avoid the negative consequences associated with not achieving these goals.								

Please indicate the degree to which you agree or disagree with the following statements:

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
A7. I like setting goals because it helps me stay organized.								
A8. I find it motivating to see progress towards my goals.								
A9. I am the type of person that likes having a target to work towards.								
A10. I like breaking down goals into smaller tasks to make the process more manageable.								
A11. I believe that actively setting and managing goals takes a lot of effort.								
A12. In most cases, I don't like the pressure of meeting targets within specified time periods.								
A13. In most cases, I don't like the exercise of planning tasks.								
A14. In most cases, I prefer to set my own goals, rather than have goals provided to me.								

A15. What tools and resources do you use to help you manage your goals? (Please select all that apply.)

1. Notebook/agenda/journal
2. Spreadsheets/databases
3. Calendar (electronic or written)
4. Online tools
5. Email notifications
6. Information received by mail (e.g., bills, etc.)
7. Personal advisors/supervisors
8. Other, please specify _____
9. Not applicable

A16. Do you tell others about your goals? If 'Yes', please describe who those people are (some examples might include: family, friends, neighbours, colleagues, etc.).

- Yes _____
- No

A17. If you answered 'Yes' to the previous question, do you share your progress with them?

- Yes
- No
- Not applicable

A18. Does goal-setting work well for you? If so, please describe why or if not, please describe why not.

- Yes, goal-setting works well for me because _____
- No, goal-setting does not work well for me because _____

PART B – Energy Awareness, attitudes and behaviours

Please indicate how you perceive your level of awareness with regards to the following.

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
B1. I am aware of how much energy is used by my home each month.								
B2. I am aware of how much money it costs to use energy in my home each month.								
B3. I am aware of the environmental impact associated with using energy in my home each month.								

To what extent do the following statements describe your attitudes towards energy management in your home? (Please indicate one response for each statement in the table below.)

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
B4. I try to conserve as much energy in my home as possible.								
B5. I try to reduce my electricity usage during on-peak times as much as possible.								
B6. I have purchased energy efficient appliances, and I want to lower my energy usage even more.								
B7. I want to reduce the environmental impact associated with the energy usage of my home.								

B8. I want to reduce the costs of my home's energy usage as much as possible.								
B9. I am interested in becoming more aware of my home's energy usage.								
B10. I would like to learn more about the amount of energy my home's appliances consume.								

B11. Do you currently keep track of your home's energy usage? If so, please explain what you are doing.

- o Yes _____
- o No

PART C – Reactions to the Idea of Home Energy Goal-Setting

A home energy management system is a relatively new technology that could help householders keep track of and manage energy usage in their homes. This type of system monitors the amount of energy used for your entire household and for individual appliances over various periods of time and provides instantaneous usage information to home occupants (similar to a meter, with more detailed monitoring and display capabilities).

One of the main objectives of developing a system like this is to provide you, an occupant in a home, with information that is both meaningful and useful to enable you to manage better your home's energy usage. This may also include providing detailed information in the form of graphs, tables, pictures, and numbers regarding the monetary cost and environmental impact of your home's energy usage.

Assuming you had such a system installed in your home, please indicate your level of agreement with the following statement:

C1. I would be interested in setting goals to help me save energy, money and/or reduce my environmental impact.

- o Strongly agree
- o Agree
- o Somewhat agree
- o Neither agree nor disagree
- o Somewhat disagree
- o Disagree
- o Strongly disagree
- o I don't know

C2. In the space provided, can you please explain your interest (or lack of interest), as described in C1, in setting home energy goals?

C3. What unit of preference would you want to use to set home energy goals?

- o Energy usage (e.g., kilowatt-hours, etc.)
- o Energy costs (e.g., dollars)
- o Environmental impact associated with energy usage (e.g., grams of CO_2 emissions)
- o Other, please specify _____
- o I don't know
- o Not applicable

Assuming you were setting goals to help you save energy in your home, please indicate your level of agreement with the following statements:

C4. I would be interested in learning how much energy my home appliances use to help me better track my progress towards my home energy goals.

- o Strongly agree
- o Agree
- o Somewhat agree
- o Neither agree nor disagree
- o Somewhat disagree
- o Disagree
- o Strongly disagree
- o I don't know

C5. I would be interested in receiving customised energy savings tips to help me achieve my home energy goals.

- o Strongly agree
- o Agree
- o Somewhat agree
- o Neither agree nor disagree
- o Somewhat disagree
- o Disagree
- o Strongly disagree
- o I don't know

C6. Please indicate which of the following statements would <u>best describe your interest</u> in using a home energy management system to help you manage energy related goals.

Relative to my past energy usage, I would like to work towards goals that help:

1) DECREASE my home's energy usage/costs/environmental impact.
2) MAINTAIN THE SAME LEVEL of my home's energy usage/costs/environmental impact.
3) MINIMIZE AN INCREASE of my home's energy usage/costs/environmental impact.
4) SHIFT my electricity consumption to off-peak time periods.
5) Other, please specify: _____
6) I am not interested in setting and managing energy related goals for my home.
7) I do not know what my goals would be right now.

C7. If you answered "decrease my home's energy usage/costs/environmental impact" in Question C6, how much of a decrease do you think you would like to achieve?

- o < 5%
- o 5-9%
- o 10-14%

- 15-19%
- 20-24%
- 25-29%
- 30% or more
- Other, please specify
- I don't know
- Not applicable

C8. If you answered "minimize an increase in my home's energy usage/costs/environmental impact" in Question C6, how much of an increase do you think you would like to allow?

- < 5%
- 5-9%
- 10-14%
- 15-19%
- 20-24%
- 25-29%
- 30% or more
- Other, please specify
- I don't know
- Not applicable

C9. If you answered "shift my electricity usage to off-peak time periods" in Question C6, how much do you think you would like to shift?

- < 5%
- 5-9%
- 10-14%
- 15-19%
- 20-24%
- 25-29%
- 30% or more
- Other, please specify
- I don't know
- Not applicable

C10. Please indicate what type(s) of time periods you would expect to use to manage energy related goals for your household. (Please select all that apply.)

I would like to manage energy related goals for each...

- Day
- Week
- Month
- 3 months

- 6 months
- Year
- More than one year
- Other _____
- I don't know

C11. Please use the space provided below to explain why you chose the timeframe(s) that you would expect to use if you were managing energy related goals for your household.

C12. In the space provided, please indicate what, if any, reward you would expect to receive if you achieved your energy related goals for your household. These can be monetary and/or non-monetary rewards from others (e.g., utility companies and/or governments) or from yourself.

C13. In the space provided, please indicate what, if any, negative consequence you would expect if you did not achieve your energy related goals for your household.

C14. What factors would motivate you to achieve your home energy related goals?

Please describe your level of agreement with the following statements regarding the factors that would motivate you to achieve your home energy related goals.

I am motivated to achieve this type of goal because...	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Not applicable
It is the responsible thing to do.								
I would get personal satisfaction from achieving these goals.								
I want the reward associated with achieving these goals.								
It benefits me, and/or my family, to achieve these goals.								
It benefits others in society for me to achieve these goals.								
I want to avoid the negative consequences associated with not achieving these goals.								

C15. Please indicate how you would like to keep track of your progress towards your home's energy goal?

(Please select all that could appeal to you.)

- o In-home display (e.g., on a counter top or mounted on a wall)
- o An online web account for your household, accessible from your computer
- o Information included in your utility bill
- o Information sheet received by mail
- o Information received by email
- o Information received to my profile on a social media site (e.g., Facebook, etc.)
- o Home energy advisor
- o Other, please specify _____
- o I don't know
- o Not applicable

C16. Of the options you selected in C15, please indicate which is your most preferred and why.

- In-home display (e.g., on a counter top or mounted on a wall)
- An online web account for your household, accessible from your computer
- Information included in your utility bill
- Information sheet received by mail
- Information received by email
- Information received to my profile on a social media site (e.g., Facebook, etc.)
- Home energy advisor
- Other, please specify _____
- I don't know
- Not applicable

Explanation for preferred choice: _____

C17. How often would you prefer to receive or choose to access energy usage information about your household to help you keep track of your progress towards your goal?

(Please select all that apply.)

- Check whenever I want in real-time
- Receive hourly summaries
- Receive daily summaries
- Receive weekly summaries
- Received monthly summaries
- Other, please specify _____
- Not applicable

C18. Do you think that you would tell others about your goals? If you answered 'Yes', please identify who these people might be.

- Yes _____
- No
- I don't know
- Not applicable

C19. If you answered 'Yes' for the previous question, do you think that you would share your progress with them?

- Yes
- No
- I don't know
- Not applicable

PART D – Reactions to Home Energy Goal-Setting Tool

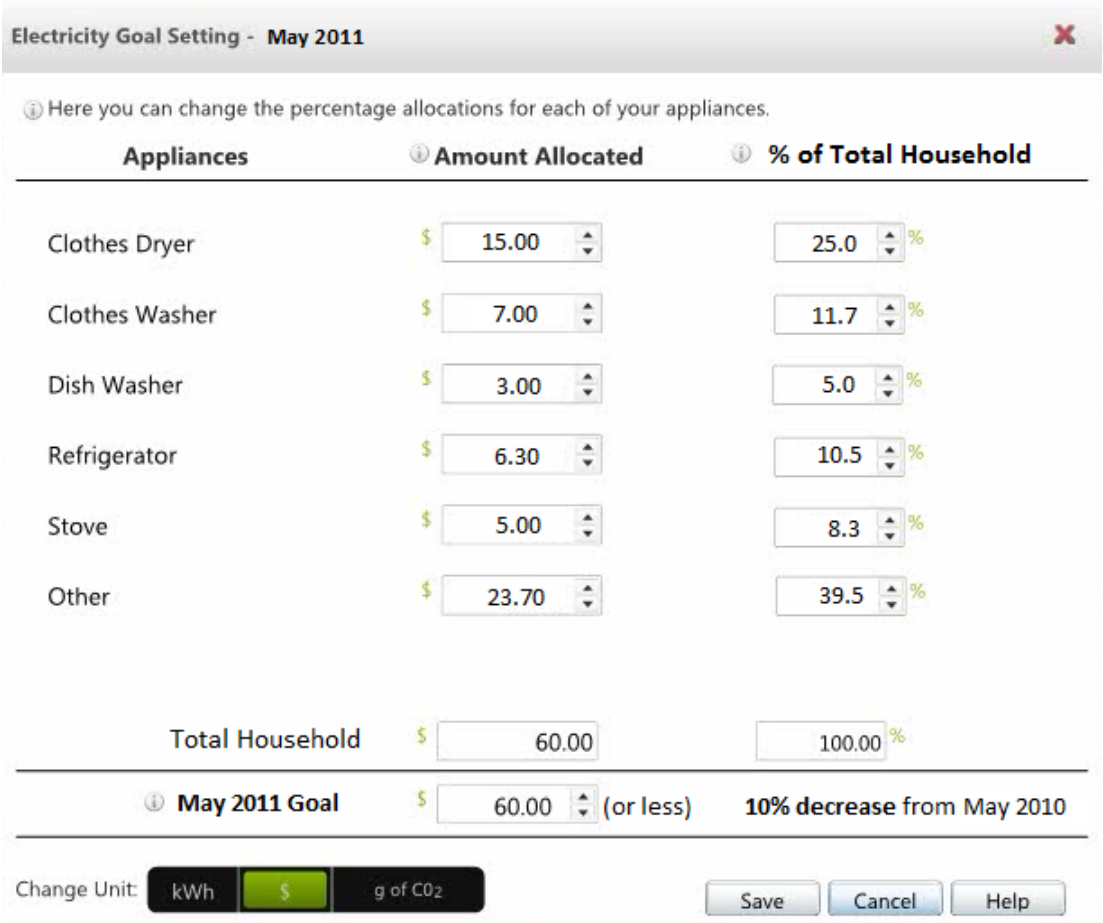
In this section of the survey, we would like to get your reactions to screenshots of a web-based interface that is being developed in a University of Waterloo-led project. There are four screenshots in total and we will describe each one briefly while showing it on your screen.

Please provide comments on the features of the tool for each screenshot in the space provided and what you think could be improved to make things clearer or more interesting or more useful to you. Also, feel free to provide comments about things that might be confusing or unclear.

D1. Inputting a Monthly Home Energy Goal

Explanation of the screen shown:

In this screen, you can input a monthly goal in kilowatt-hours, dollars, or grams of carbon dioxide (CO2) emissions for electricity usage in your home. You can also 'breakdown' the goal into appliance-specific goals for the month as proportions of the total household goal. In this example, the goal is to spend **$60 or less** on electricity costs in the month of **May 2011** and this is a **10% decrease from May 2010**. The appliance-specific allocations are also shown. Initially the system will provide default values based on what was done in the same month in the previous year (e.g., May 2010), but you can change the values to set your own home energy goals for this year's month (e.g., May 2011).



In the space provided can you please explain what you like or what you don't like about how this information is presented. Also, please let us know what you think is clearly understood or confusing when trying to interpret this screen.

I like...

I don't like...

I clearly understand...

Some things that I find confusing are...

Please explain the level to which you agree or disagree with the following statement:

I believe that this information would be helpful for me to manage better the electricity used in my home.

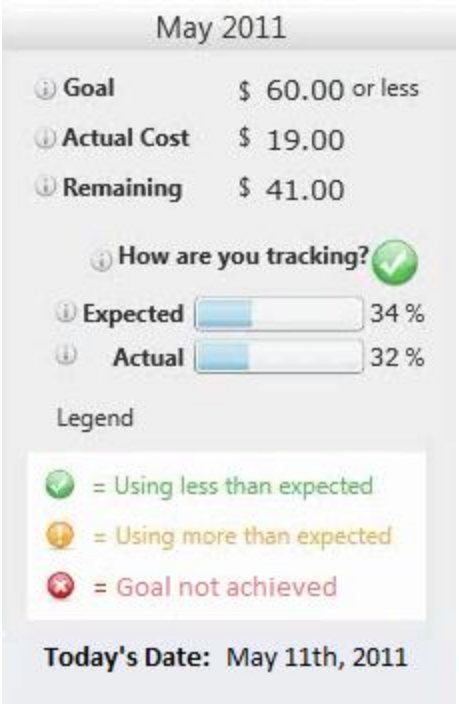
- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
- I don't know

D2. Goal-Based Feedback Indicator

Explanation of the screen shown:

With this indicator, the system can keep track of how you are doing in relation to the monthly electricity goals. In the example shown, we set a goal to spend $60 or less on electricity in the month of May 2011. We also receive feedback on how much money we have spent so far in the month, and how much money we have remaining to spend in order to achieve our goal.

The system also provides a symbol to let us know how we are tracking relative to the amount of 'expected' consumption at this point in the month. As indicated in the legend, a green check mark means that we are using less than expected so far for the month, a yellow exclamation means that we are using more than expected so far for the month, and a red 'X' means that we have used too much electricity and we will not be able to achieve our goal. In this example, it is just over one-third of the way through the month (May 11th, 2011, noted on the bottom), and the household is 'on track' to meet its energy management goal for the month.



In the space provided can you please explain what you like or what you don't like about how this information is presented. Also, please let us know what you think is clearly understood or confusing when trying to interpret this screen.

I like...

I don't like...

I clearly understand...

Some things that I find confusing are...

Please explain the level to which you agree or disagree with the following statement:

I believe that this information would be helpful for me to manage better the electricity used in my home.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
- I don't know

D3. Goal-Based Tracking Report by Major Appliance

Explanation of the screen shown:
With this screen, we have 'drilled down' to get more detailed information about how we are using energy in the home by major household appliance – and how this relates to our goals. Note, this is the same day and time as shown in the previous screen – so $60 as a goal for the month of May, and we have, so far (to May 11th, 2011), spent $19 – but it is showing information in greater detail.

Electricity Goal-Setting for the month of May

Appliances	Allocated	Actual Cost	% of Allocation Used	Tracking
Clothes Dryer	$ 15.00	$ 1.42	9 %	
Clothes Washer	$ 7.00	$ 0.60	9 %	
Dish Washer	$ 3.00	$ 4.00	133 %	
Refrigerator	$ 6.30	$ 1.87	30 %	
Stove	$ 5.00	$ 0.85	17 %	
Other	$ 23.70	$ 10.26	43 %	

In the space provided can you please explain what you like or what you don't like about how this information is presented. Also, please let us know what you think is clearly understood or confusing when trying to interpret this screen.

I like...

I don't like...

I clearly understand...

Some things that I find confusing are...

Please explain the level to which you agree or disagree with the following statement:

I believe that this information would be helpful for me to manage better the electricity used in my home.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
- I don't know

D4. Goal-Based Usage Chart

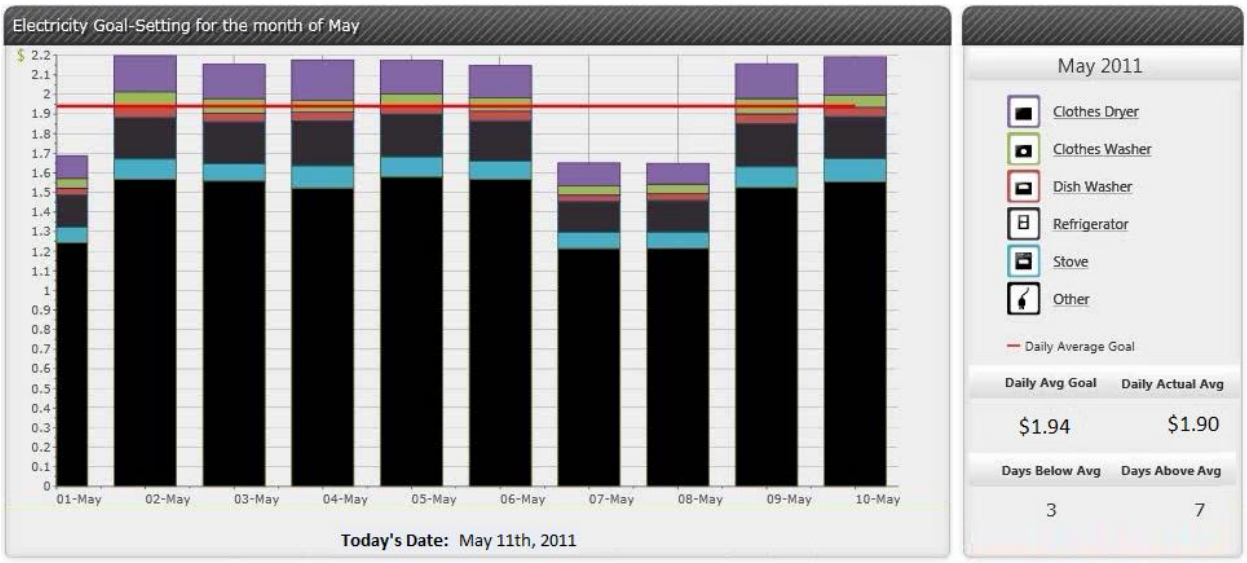
Explanation of the screen shown:

In this screen, we can keep track of how much energy, money or carbon dioxide (CO2) emissions are associated with our appliances each day. In this example, the vertical bars in the graph represent the amount of money spent on electricity each day so far in the month of May 2011. The different colours in the vertical bars each represent the usage costs of a respective appliance listed on the right.

The red line across the graph is the 'daily average goal' calculated by the system, based on the monthly goal that we selected ($60 divided by 31 days = $1.94/day).

On the right of this screen, you can see how you are doing relative to your 'daily average goal' under the section labelled 'Daily Actual Avg'. You can also keep track of how many days

in the month you met this daily goal (labelled as 'Days Below Avg'). In this example, we were 'under the red line' on three days so far. The more days below this red line, the better we would be doing at meeting our daily average goals.



In the space provided can you please explain what you like or what you don't like about how this information is presented. Also, please let us know what you think is clearly understood or confusing when trying to interpret this screen.

I like...

I don't like...

I clearly understand...

Some things that I find confusing are...

Please explain the level to which you agree or disagree with the following statement:

I believe that this information would be helpful for me to manage better the electricity used in my home.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree

- Disagree
- Strongly disagree
- I don’t know

D5. Up to how much do you think you would be willing to pay for a home energy management system that would allow you to set and to manage your home energy goals like the examples shown here?

- $0 - $5/month
- $6-$10/month
- $11-$15/month
- $16-$20/month
- $21-$25/month
- $26-$30/month
- $30-$50/month
- More than $50/month
- I don’t know

PART E – Demographics and Home Profile

E1. Are you a homeowner or a tenant?

- Homeowner
- Tenant
- Other, please specify _____

E2. How long have you lived in your current home?

Since _____ (Please specify the year that you moved-in. If you do not know, please write "I don't know".)

E3. How long do you plan to live in your current home?

Until _____ (Please provide your best estimate of the year. If you do not know, please write "I don't know".)

E4. How many people live in your home?

E5. How many children under the age of 18 years old live in your home?

E6. In what year were you born?

E7. Please indicate your gender.

- Male
- Female

E8. In what part of Canada do you live? If you do not live in Canada, please select, 'Not in Canada' in the first dropdown box.

First dropdown box options:

- Canada
- Not in Canada

Second dropdown box options:

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland
- Northwest Territories
- Nova Scotia

- Nunavut
- Ontario
- P.E.I.
- Quebec
- Saskatchewan
- Yukon Territory

City _____

E9. What is the size of your home? If your home has a finished basement, please include this. (Please select one of the responses listed below.)

- Less than 1000 square feet
- 1000 – 1499 square feet
- 1500 – 1999 square feet
- 2000 – 2499 square feet
- 2500 – 2999 square feet
- 3000 – 3499 square feet
- More than 3500 square feet
- I don't know

E10. What type of home do you currently live in? (Please select one of the responses listed below.)

- Apartment
- Row housing
- Semi-detached one storey
- Semi-detached two or more storey
- Detached one storey
- Detached two or more storey
- Other, please specify _____

E11. What is the main source of energy used for heating your home?

- Natural Gas
- Electricity
- Oil
- Wood
- Other, please specify _____

E12. From the list below, please identify which energy consuming devices you have in your home and how many of each that you currently use. (If an appliance is shared within a building – e.g., furnace or shared laundry machines – please leave it blank.)

Device	**Number of this type of device in your home?**
o Furnace	_____

- Air conditioner _____
- Clothes washer _____
- Clothes dryer _____
- Fridge _____
- Stove/Oven _____
- Dishwasher _____
- Microwave _____
- Stone alone freezer _____
- Television _____
- Personal computer _____
- Hot tub _____
- Pool pump _____
- Pool heater _____
- Heat recovery ventilator _____
- Space heater _____
- Dehumidifier _____
- Humidifier _____

E13. What was your total household income (before taxes) last year?

- Under $30,000
- $30,000 - $39,000
- $40,000 - $49,000
- $50,000 - $59,000
- $60,000 - $69,000
- $70,000 - $79,000
- $80,000 - $89,000
- $90,000 - $99,999
- $100,000 - $109,999
- $110,000 - $119,999
- $120,000 - $129,999
- $130,000 - $139,999
- $140,000 - $149,999
- $150,000 and over
- I don’t know

E14. Are you currently:

- In school?
- Working?
- Retired?
- Homemaker?
- Unemployed?

E15. What is the highest earned certificate, diploma or degree of any individual in your household?

- No certificate, diploma or degree
- High school certificate or equivalent
- Apprenticeship or trades certificate or diploma
- College, CEGEP or other non-university certificate or diploma
- University certificate or diploma below bachelor level
- Bachelor's degree
- Degree in medicine, dentistry, veterinary medicine or optometry
- Master's degree
- Earned doctorate

E16. How many kilowatt-hours of electricity does your household use in a typical summer month (June to August)? (It is recommended that you refer to your electricity bill to help you respond to this question.)

- Under 300 kWh/month
- 300 – 599 kWh/month
- 600 – 899 kWh/month
- 900 – 1199 kWh/month
- 1200 – 1499 kWh/month
- 1500 – 1799 kWh/month
- 1800 kWh or more/month
- I don't know

E17. How many kilowatt-hours of electricity does your household use in a typical winter month (December to February)? (It is recommended that you refer to your electricity bill to help you respond to this question.)

- Under 300 kWh/month
- 300 – 599 kWh/month
- 600 – 899 kWh/month
- 900 – 1199 kWh/month
- 1200 – 1499 kWh/month
- 1500 – 1799 kWh/month
- 1800 kWh or more/month
- I don't know

E18. How many kilowatt-hours of electricity does your household use in a typical spring or fall month (March to May and September to November)? (It is recommended that you refer to your electricity bill to help you respond to this question.)

- Under 300 kWh/month
- 300 – 599 kWh/month
- 600 – 899 kWh/month

- 900 – 1199 kWh/month
- 1200 – 1499 kWh/month
- 1500 – 1799 kWh/month
- 1800 kWh or more/month
- I don’t know

PART F – Thank You
Thank you for your participation in this survey conducted by the Faculty of Environment at the University of Waterloo.

Before clicking 'Submit', please let us know how you learned about this survey.

- Received a letter/flyer in a public location
- Received a letter/flyer at my home
- Saw the ad on craigslist.com
- Saw the ad on kijiji.com
- Saw the ad in the local newspaper
- Other, please specify _____

If you would like to be eligible to win one of two $100 gift certificates, redeemable at a selection of major retailers of your choice, please continue to this link [LINK INSERTED HERE] to provide us with your contact information.

++++++++++++++++++++ (shown in a separate survey)

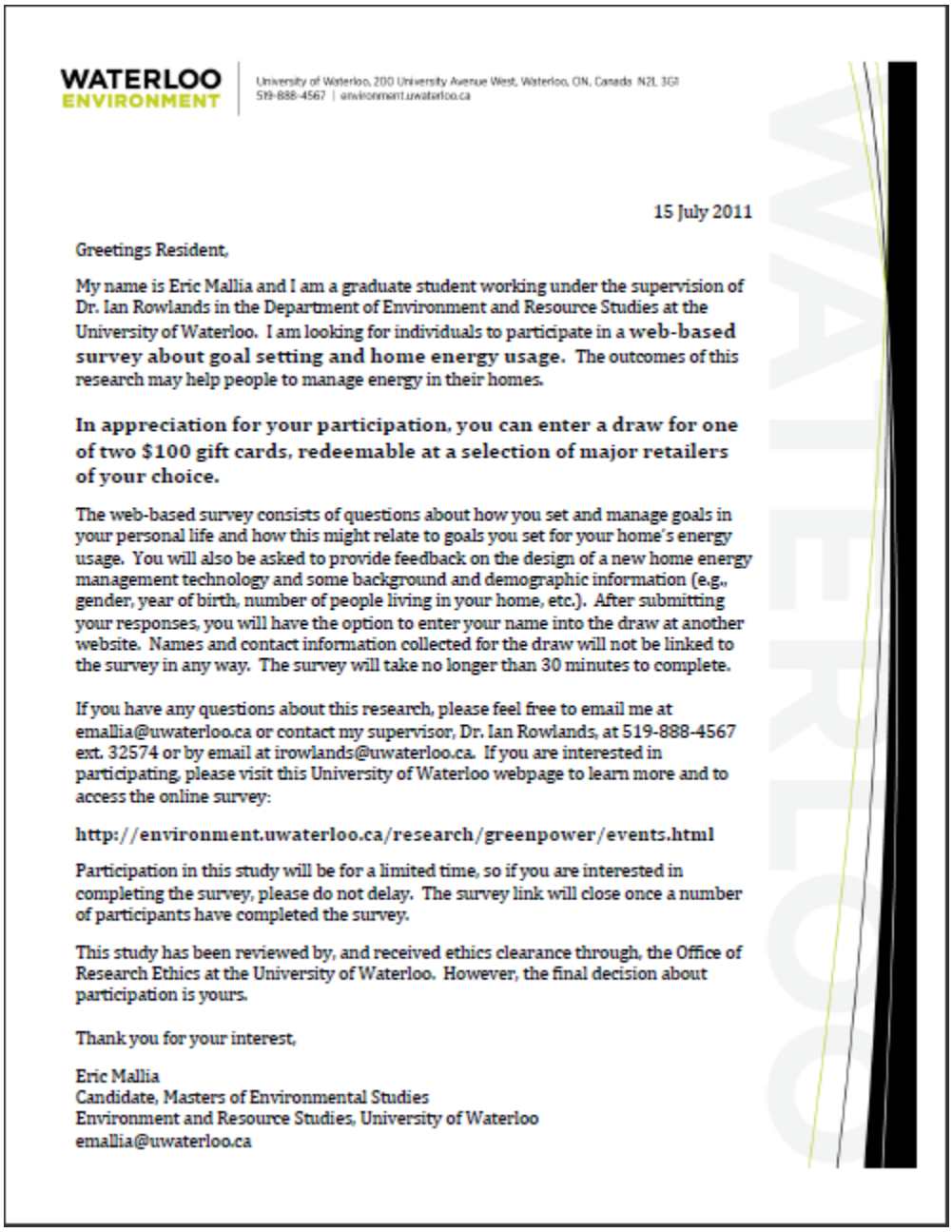
The information requested below is required in order to contact you, should you be the winner in the draw for the gift certificate.

First name: _____

Email address: _____

Thank you again for you interest and participation in this research.

Appendix B – A Copy of the Information Letter Distributed in Waterloo



WATERLOO ENVIRONMENT

University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada N2L 3G1
519-888-4567 | environment.uwaterloo.ca

15 July 2011

Greetings Resident,

My name is Eric Mallia and I am a graduate student working under the supervision of Dr. Ian Rowlands in the Department of Environment and Resource Studies at the University of Waterloo. I am looking for individuals to participate in a **web-based survey about goal setting and home energy usage.** The outcomes of this research may help people to manage energy in their homes.

In appreciation for your participation, you can enter a draw for one of two $100 gift cards, redeemable at a selection of major retailers of your choice.

The web-based survey consists of questions about how you set and manage goals in your personal life and how this might relate to goals you set for your home's energy usage. You will also be asked to provide feedback on the design of a new home energy management technology and some background and demographic information (e.g., gender, year of birth, number of people living in your home, etc.). After submitting your responses, you will have the option to enter your name into the draw at another website. Names and contact information collected for the draw will not be linked to the survey in any way. The survey will take no longer than 30 minutes to complete.

If you have any questions about this research, please feel free to email me at emallia@uwaterloo.ca or contact my supervisor, Dr. Ian Rowlands, at 519-888-4567 ext. 32574 or by email at irowlands@uwaterloo.ca. If you are interested in participating, please visit this University of Waterloo webpage to learn more and to access the online survey:

http://environment.uwaterloo.ca/research/greenpower/events.html

Participation in this study will be for a limited time, so if you are interested in completing the survey, please do not delay. The survey link will close once a number of participants have completed the survey.

This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours.

Thank you for your interest,

Eric Mallia
Candidate, Masters of Environmental Studies
Environment and Resource Studies, University of Waterloo
emallia@uwaterloo.ca

Appendix C – A Copy of the Advertisement in the Waterloo Chronicle

Appendix D – A Copy of the Text Used in the Online Classified Advertisements

Participants Needed for Web-Based Survey on Home Energy Usage

Researchers at the University of Waterloo's Department of Environment and Resource Studies are looking for volunteers to take part in a web-based survey about goal setting and home energy usage.

In appreciation of your time, you can enter a draw to receive one of two $100 gift cards redeemable at a selection of major retailers of your choice (e.g., home stores, DIY stores, restaurants, sports stores, book stores, electronic stores, and more).

The web-based survey will take approximately 30 minutes to complete. If you are interested in participating, additional information about this research and access to the web-based survey is provided at this University of Waterloo webpage:

http://environment.uwaterloo.ca/research/greenpower/events.html

This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo.

Appendix E – Copy of the Text on the University Website Explaining the Study and Providing Access to the Survey

Home Energy Goal-Setting

Thank you for your interest in participating in this research.

This research consists of a survey that is intended to help explore the potential benefits and/or drawbacks of goal setting in home energy use and how this may help in devising home energy management technology.

The survey has several sections that will help our research team understand homeowners' attitudes and behaviours regarding setting and managing personal life goals and how this might relate to goal setting for home energy usage.

The survey also asks for feedback on the design of a new piece of home energy management technology that uses goal-setting strategies for energy management.

The survey also asks for some background and demographic information (e.g., gender, year of birth, number of people living in your home, etc.). The only requirement is that respondents of the survey be at least 18 years of age. It is intended that this survey will take no longer than 30 minutes to complete.

After completing the survey**, you can enter a draw for one of two $100 gift cards to a selection of major retailers of your choice.**

Your odds of winning the draw are based on the number of individuals who participate in the study. We expect that approximately 50 individuals will take part in the study. After submitting your responses, you will be asked if you would like to enter your name into the draw at another website. Names and contact information collected for the draw will not be linked to the study data in any way, and this identifying information will be stored separately then destroyed after the draw has been made. The amount received is taxable. It is your responsibility to report the amount received for income tax purposes. Participation in this study will be for a limited time, so if you are interested in completing the survey, please do not delay. The survey link may close once a number of participants have completed the survey.

If you have any questions about this survey or this research more broadly, please feel free to contact the researcher, Eric Mallia, by email at the University of Waterloo at: emallia@uwaterloo.ca or Dr. Ian Rowlands at 519-888-4567 ext. 32574 or by email at: irowland@uwaterloo.ca.

We assure you that this study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo. If you have any comments or concerns resulting from your participation in this study, please feel free to contact Dr. Susan Sykes, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or by email at sskyes@uwaterloo.ca.

Click the link here to proceed to the survey:

http://app.fluidsurveys.com/s/uwenergystudy/

Thank you for your interest in this research.

Appendix F – Categorisation of Written Responses to Open-Ended Survey Questions

Question A3.1 – Rewards of Achieving Personal Financial Goals

Original Comment	**Category**	**Type of Motivation**
refunds form feds, roi	Government incentives	Extrinsic
We can utilize the $ for travel, renos and personal interest purchases. Financial security is a plus for this goal.	Increase spending power	Extrinsic
shopping	Increase spending power	Extrinsic
holidays, home improvement projects	Increase spending power	Extrinsic
able to purchase something we really want or trip we really would like to take	Increase spending power	Extrinsic
funds for vacations	Increase spending power	Extrinsic
money earned from coop	Increase spending power	Extrinsic
Early retirement, vacations	Increase spending power	Extrinsic
Spend extra money on my hobbies	Increase spending power	Extrinsic
a growing portfolio, money for travel and leisure activities	Increase spending power	Extrinsic
completed renovations	Increase spending power	Extrinsic
The financial goals are so I can get something I want (trip, car, dog, wedding).	Increase spending power	Extrinsic
money saved-rrsp	Increased savings	Extrinsic
seeing saved money accumulate in Quicken financial software	Increased savings	Extrinsic
watching your money grow for retirement	Increased savings	Extrinsic
save money	Increased savings	Extrinsic
Save money on spending with credit cards	Increased savings	Extrinsic
increased savings	Increased savings	Extrinsic
Lower administration fees	Increased savings	Extrinsic

saving money	Increased savings	Extrinsic
no debt, purchasing ability	Reduce debt and interest payments; Increase spending power	Extrinsic
purchasing power, financial security	Increase spending power; Financial freedom/security/less stress	Extrinsic and Intrinsic
purchasing ability, peace of mind	Increase spending power; Financial freedom/security/less stress	Extrinsic and Intrinsic
money saved, increased purchasing ability, increased financial security	Increase spending power; Increased savings; Financial freedom/security/less stress	Extrinsic and Intrinsic
money saved, reduced debt, increased spending power	Increase spending power; Increased savings; Reduce debt and interest payments	Extrinsic and Intrinsic
Feeling of satisfaction; ability to save money; financial flexibility.	Personal Satisfaction; Increased savings; Financial freedom/security/less stress	Extrinsic and Intrinsic
reduced financial worry, pride, home paid off sooner	Personal Satisfaction; Financial freedom/security/less stress	Intrinsic
financial freedom	Financial freedom/security/less stress	Intrinsic
less stress about money	Financial freedom/security/less stress	Intrinsic
peace of mind	Financial freedom/security/less stress	Intrinsic
money stability	Financial freedom/security/less stress	Intrinsic
lower stress levels when it comes to finances	Financial freedom/security/less stress	Intrinsic
peace of mind	Financial freedom/security/less stress	Intrinsic
mortgage paid, retirement early	Financial freedom/security/less stress	Intrinsic
financial stability	Financial freedom/security/less stress	Intrinsic
personal relief	Financial freedom/security/less stress	Intrinsic

Being debt free, security, Freedom	Financial freedom/security/less stress; Reduce debt and interest payments	Intrinsic
Meet or exceed targets	Meet or exceed targets	Intrinsic
Personal Satisfaction	Personal Satisfaction	Intrinsic
satisfaction	Personal Satisfaction	Intrinsic
personal satisfaction	Personal Satisfaction	Intrinsic
to feel good about helping someone less fortunate	Personal Satisfaction	Intrinsic
satisfaction	Personal Satisfaction	Intrinsic
None. Just the satisfaction of achievement	Personal Satisfaction	Intrinsic
none	none or blank	none or blank
none just motivation	none or blank	none or blank
	none or blank	none or blank
None	none or blank	none or blank
	none or blank	none or blank
	none or blank	none or blank
	none or blank	none or blank
none	none or blank	none or blank
	none or blank	none or blank
	none or blank	none or blank
	none or blank	none or blank

Question A3.2 – Rewards of Achieving Nutritional/Dieting Goals

Original Comment	Category	Type of Motivation
Great annual check ups	Great annual check ups	Extrinsic
treat myself once week	Indulge after goal achievement	Extrinsic
less risk of illness	Less risk of illness	Extrinsic
massage	Massage	Extrinsic
better health	Better health	Extrinsic
general fitness (I have had an angioplasty and attend a cardiac fitness gym)	Better health	Extrinsic
Healthier	Better health	Extrinsic
Better health results.	Better health	Extrinsic
more energy, health	Better health	Extrinsic
better health	Better health	Extrinsic
Health	Better health	Extrinsic

better health	Better health	Extrinsic
better health and body shape	better health; Desirable body figure/features	Extrinsic
New clothing, being able to participate in new/more activities	New clothing; increase participation in activities	Extrinsic
weight loss	Desirable body figure/features	Extrinsic
weight control	Desirable body figure/features	Extrinsic
weight loss, better health	Desirable body figure/features; Better health	Extrinsic
increased energy, better health (less sick), lose weight	Desirable body figure/features; Better health	Extrinsic
higher energy, physically more appealing	Desirable body figure/features; Better health	Extrinsic
Being healthy, managing my weight, less need for meds	Desirable body figure/features; Better health; Less need for medication	Extrinsic
looking good and feeling great	Desirable body figure/features; Feel healthier/good/satisfied	Extrinsic and Intrinsic
health and self-esteem	Feel healthier/good/satisfied; Better health	Extrinsic and Intrinsic
better health, feeling good	Feel healthier/good/satisfied; Better health	Extrinsic and Intrinsic
feel healthier, better skin, less water retention	Feel healthier/good/satisfied; Desirable body figure/features	Extrinsic and Intrinsic
feel healthier	Feel healthier/good/satisfied	Intrinsic
healthy enjoyment of retirement	Feel healthier/good/satisfied	Intrinsic
feel healthier	Feel healthier/good/satisfied	Intrinsic

feel power over combating diseases	Feel healthier/good/satisfied	Intrinsic
feeling healthier	Feel healthier/good/satisfied	Intrinsic
feel healthier, more energetic	Feel healthier/good/satisfied	Intrinsic
feel good, reduce signs of aging	Feel healthier/good/satisfied	Intrinsic
increased self esteem,	Feel healthier/good/satisfied	Intrinsic
feeling good about my self	Feel healthier/good/satisfied	Intrinsic
satisfaction	Feel healthier/good/satisfied	Intrinsic
feel better about myself	Feel healthier/good/satisfied	Intrinsic
feeling better	Feel healthier/good/satisfied	Intrinsic
none	none or blank	none or blank
none just motivation	none or blank	none or blank
	none or blank	none or blank
	none or blank	none or blank
N	none or blank	none or blank

Question A3.3 – Rewards of Achieving Fitness Goals

Original Comment	Category	Type of Motivation
fitness	Better health	Extrinsic
better fitness level	Better health	Extrinsic
less risk of illness	Less risk of illness/mobility issues	Extrinsic
staves off stiffness and mobility problems	Less risk of illness/mobility issues	Extrinsic
general fitness (I have had an angioplasty and attend a cardiac fitness gym)	Better health	Extrinsic
weight loss, better health	Desirable body figure/features; Better health	Extrinsic
stronger body	Better health	Extrinsic
endurance	Better health	Extrinsic

increased energy and social connections	Better health; More social connections	Extrinsic
health & wellbeing, compliments/vanity	Desirable body figure/features; Better health	Extrinsic
Keep more mobile as we age.	Less risk of illness/mobility issues	Extrinsic
competitive during events	Better health	Extrinsic
better health, personal "best" goals	Better health	Extrinsic
better health	Better health	Extrinsic
I usually buy myself something.	Indulge after goal achievement	Extrinsic
better health	Better health	Extrinsic
Better sex life	Better sex life	Extrinsic
better health	Better health	Extrinsic
increased energy, lose weight	Desirable body figure/features; Better health	Extrinsic
higher energy, physically more appealing	Desirable body figure/features; Better health	Extrinsic
look and feel younger	Desirable body figure/features; Feel good/satisfied/healthier	Extrinsic and intrinsic
feeling more energetic, satisfaction of knowing I have done something good for myself, clothes fit better	Feel good/satisfied/healthier; Clothes fit better	Extrinsic and intrinsic
looking good and feeling great	Desirable body figure/features; Feel good/satisfied/healthier	Extrinsic and intrinsic
vigour and feel good	Feel good/satisfied/healthier; Better health	Extrinsic and intrinsic
maintain healthy weight and healthy heart, lower stress and feel great	Desirable body figure/features; Feel good/satisfied/healthier; Less stress	Extrinsic and intrinsic
better health, feeling good	Better health; Feel good/satisfied/healthier	Extrinsic and intrinsic
stress reduction, better health, managing my weight	Less stress; Better health; desirable body figure/features	Extrinsic and intrinsic
feel healthier	Feel good/satisfied/healthier	Intrinsic
I feel good and it promotes personal health.	Feel good/satisfied/healthier	Intrinsic
confidence	Increased confidence/self-esteem	Intrinsic

just feeling good	Feel good/satisfied/healthier	Intrinsic
personal satisfaction	Feel good/satisfied/healthier	Intrinsic
Feeling better - positive self esteem	Increased confidence/self-esteem	Intrinsic
feeling good about my self	Increased confidence/self-esteem	Intrinsic
Satisfaction with how I feel.	Feel good/satisfied/healthier	Intrinsic
satisfaction	Feel good/satisfied/healthier	Intrinsic
feel better about myself; notion that I am healthier	Feel good/satisfied/healthier	Intrinsic
feeling better	Feel good/satisfied/healthier	Intrinsic
none	None or blank	None or blank
none just motivation	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
N	None or blank	None or blank
	None or blank	None or blank

Question A3.4 – Rewards of Achieving Educational/Career Goals

Original Comment	Category	Type of Motivation
These goals support my career as a teacher.	Career advancement	Extrinsic
better future career	Career advancement	Extrinsic
Bigger salary increases, better performance evaluations	Increased salary/income	Extrinsic
Improvements in Operating Income of my Company	Increased salary/income	Extrinsic
more salary, new challenges	Increased salary/income	Extrinsic
Status, better salary	Increased salary/income	Extrinsic
money to achieve personal financial goals	Increased salary/income	Extrinsic
better future, scholarships, honours	Increased salary/income	Extrinsic
bonus and/or increased salary	Increased salary/income	Extrinsic
Improve career	Career advancement	Extrinsic
Promotions	Career advancement	Extrinsic
better job	Career advancement	Extrinsic
increased pay/bonus	Increased salary/income	Extrinsic

personal satisfaction, better chance at promotion	Personal satisfaction/sense of achievement; career advancement	Extrinsic and intrinsic
increased pay, sense of achievement	Increased salary/income; Personal satisfaction/senses of achievement	Extrinsic and intrinsic
Feelings of satisfaction; new employment opportunities.	Personal satisfaction/sense of achievement; career advancement	Extrinsic and intrinsic
stimulates my mind	Thought stimulation	Intrinsic
personal satisfaction - I am semi-retired, but am working on a second PhD	Personal satisfaction/sense of achievement	Intrinsic
wisdom	More wisdom/knowledge/skills	Intrinsic
personal satisfaction	Personal satisfaction/sense of achievement	Intrinsic
personal satisfaction	Personal satisfaction/sense of achievement	Intrinsic
maintain a work/life balance and enjoy my career while keeping stress low	Less stress/work lie balance	Intrinsic
personal satisfaction	Personal satisfaction/sense of achievement	Intrinsic
Feeling of success	Personal satisfaction/sense of achievement	Intrinsic
better teaching	More wisdom/knowledge/skills	Intrinsic
personal fulfillment	Personal satisfaction/sense of achievement	Intrinsic
personal satisfaction	Personal satisfaction/sense of achievement	Intrinsic
sense of accomplishment	Personal satisfaction/sense of achievement	Intrinsic
none... the reward if the knowledge or experience you gain	More wisdom/knowledge/skills	Intrinsic
affirmation from employer and colleagues	Recognition from colleagues	Intrinsic
accomplishment feelings, ability to converse with others, knowledge, more marketable	Personal satisfaction/sense of achievement; More wisdom/knowledge/skills	Intrinsic
financial independence and self respect	Self respect	Intrinsic
feel more in control; better job satisfaction	Sense of control	Intrinsic

Financial freedom	Less stress/work lie balance	Intrinsic
none	None or blank	None or blank
none just motivation	None or blank	None or blank
	None or blank	None or blank
none	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
None	None or blank	None or blank

Question A3.5 – Rewards of Achieving 'Other' Goals

Goal Type	Original Comment	Category	Type of Motivation
Sports	fitness and health	Better health	Extrinsic
Music	feeds my spirit	Feeds my spirit	Intrinsic
Housework	feel better as a home owner	Personal satisfaction	Intrinsic
Housework	less stress when chores accomplished	Less stress	Intrinsic
Travel	can do cycling, walking and canoeing trips	Enjoy outdoor activities	Intrinsic
Music		None or blank	None or blank
Retirement	security	Security	Intrinsic
Housework	pleasure and satisfaction	Personal satisfaction	Intrinsic
Housework	none	None or blank	None or blank
Personal growth	better family life, increased happiness, fulfillment	Personal satisfaction	Intrinsic
Energy	refunds from feds, roi, cash savings	Government incentives	Extrinsic
Personal growth	personal growth, feelings of achievement	Personal satisfaction	Intrinsic

Question A4.1 – Negative Consequences of Not Achieving Personal Financial Goals

Original Comment	Category	Type of Motivation
We are not able to make the purchases or have the security in retirement that would be our hope and wish.	Decreased spending power	Extrinsic
pay more money in interest, can't contribute as much to rrsp	Higher interest payments on debt	Extrinsic

decreased income and increasing cost of living are most prominent	Decreased spending power	Extrinsic
decreased expenditure	Decreased spending power	Extrinsic
less extra money for hobbies	Decreased spending power	Extrinsic
lower std of living	Decreased spending power	Extrinsic
no line of credit	Decreased spending power	Extrinsic
Not enough spending money	Decreased spending power	Extrinsic
Less purchasing power	Decreased spending power	Extrinsic
financial debt	Higher interest payments on debt	Extrinsic
The need to pay attention to mortgage/loan rates.	Need to pay attention to finances more closely	Extrinsic
debt, being poor	Higher interest payments on debt	Extrinsic
can't travel	Can't travel as much or as well	Extrinsic
I can't get what I want...	Decreased spending power	Extrinsic
less money to spend	Decreased spending power	Extrinsic
Less exotic vacations	Can't travel as much or as well	Extrinsic
do not receive the types of things that I would like in life(i.e. type of car)	Decreased spending power	Extrinsic
same or increased interest payments/debt	Higher interest payments on debt	Extrinsic
Lack of financial freedom, having to watch every penny	Loss of financial freedom/control; Need to pay attention to finances more closely	Extrinsic and Intrinsic
stress	Increased stress	Intrinsic
feelings of guilt or failure	Negative feelings	Intrinsic
financial worries	Increased stress	Intrinsic
more stress about bills	Increased stress	Intrinsic
having to worry about cash flow, not being able to do things I want to do	Increased stress; Loss of financial freedom/control	Intrinsic
Need to do more planning for retirement - more work	Loss of financial freedom/control	Intrinsic
worry	Increased stress	Intrinsic
less success	Negative feelings	Intrinsic
disappointment	Negative feelings	Intrinsic
disappointment	Negative feelings	Intrinsic
increased stress	Increased stress	Intrinsic
loss of independence	Loss of financial	Intrinsic

	freedom/control	
stress with unpaid bills	Increased stress	Intrinsic
STRESS!!!, reduced financial resources, lack of financial security, unable to obtain experiences saved for (family vacations, bucket list achievements)	Increased stress	Intrinsic
retirement later	Loss of financial freedom/control	Intrinsic
dissatisfaction	Negative feelings	Intrinsic
stress over lack of money	Increased stress	Intrinsic
stress	Increased stress	Intrinsic
Worry	Increased stress	Intrinsic
Losing assets, losing control of my future	Loss of financial freedom/control	Intrinsic
none	None or blank	None or blank
no negative consequences will get up and try again	None or blank	None or blank
usually achieve financial goals	None or blank	None or blank
none, income and savings are adequate to cushion any but the severest problem	None or blank	None or blank
none	None or blank	None or blank
	None or blank	None or blank
hasn't happened so cannot comment	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
none	None or blank	None or blank
	None or blank	None or blank
None	None or blank	None or blank

Question A4.2 – Negative Consequences of Not Achieving Nutritional/Dieting Goals

Original Comment	Category	Type of Motivation
health impacted	Decreased health	Extrinsic
rising cost of food especially glutton-free, local produce and organics	Pay more for food/medication	Extrinsic
risk of illness, loss of mobility	Risk of illness/loss of mobility	Extrinsic
illness, early death	Decreased health	Extrinsic
cannot fit in clothes nicely	Need new clothes	Extrinsic
increased risk of diseases such as heart disease/ stroke; osteoporosis/ cancer etc	Risk of illness/loss of mobility	Extrinsic
weight gain, general poor health that leads to other risks like diabetes, heart attack	Less desirable body figure/features; Decreased health	Extrinsic
weight gain, illness, going on medication to manage health issues	Less desirable body figure/features; Decreased health; Pay more for food/medication	Extrinsic
poor health, change clothes	Decreased health; Need new clothes	Extrinsic
Negative annual check ups	Negative annual check ups	Extrinsic
difficulty fitting into clothes	Need new clothes	Extrinsic
poor health	Decreased health	Extrinsic
Poor health, poor self-image	Negative feelings; Decreased health	Extrinsic and intrinsic
sluggish, expanded waistline	Less desirable body figure/features; Feeling sluggish/less healthy	Extrinsic and intrinsic
feel fatigued, being over my comfortable weight	Less desirable body figure/features; Feeling sluggish/less healthy	Extrinsic and intrinsic
increased weight, feeling lethargic	Less desirable body figure/features; Feeling sluggish/less healthy	Extrinsic and intrinsic
tired, weight increase, spend more on food/dining out	Less desirable body figure/features; Feeling sluggish/less healthy; Pay more for food/medication	Extrinsic and intrinsic
Poor health and physical well-being, poor self-esteem	Negative feelings; Decreased health	Extrinsic and intrinsic
sluggishness	Feeling sluggish/less healthy	Intrinsic
feelings of guilt or failure	Negative feelings	Intrinsic

low self-esteem	Negative feelings	Intrinsic
not feeling my best	Feeling sluggish/less healthy	Intrinsic
guilt, feel bad	Negative feelings	Intrinsic
feeling bloated	Feeling sluggish/less healthy	Intrinsic
feel sluggish	Feeling sluggish/less healthy	Intrinsic
frustration	Negative feelings	Intrinsic
feeling bad about my self	Negative feelings	Intrinsic
dissatisfaction	Negative feelings	Intrinsic
Lesser self esteem	Negative feelings	Intrinsic
body doesn't feel as good	Feeling sluggish/less healthy	Intrinsic
feeling poor/lethargic	Feeling sluggish/less healthy	Intrinsic
less energy, not feeling healthy, not as appealing	Feeling sluggish/less healthy	Intrinsic
none	None or blank	None or blank
no negative consequences will get up and try again	None or blank	None or blank
	None or blank	None or blank
hasn't happened so cannot comment	None or blank	None or blank
none	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
N	None or blank	None or blank

Question A4.3 – Negative Consequences of Not Achieving Fitness Goals

Original Comment	Category	Type of Motivation
weight gain, loss of mobility, flexibility	Less desirable body figure/features; Decreased health	Extrinsic
illness, early death	Decreased health	Extrinsic
sickness	Decreased health	Extrinsic
poor health	Decreased health	Extrinsic
less able to ski/golf/hike etc	Risk of illness/loss of mobility	Extrinsic
not aging well	Risk of illness/loss of mobility	Extrinsic
lower quality of life/health	Decreased health	Extrinsic
Perhaps a feeling of displeasure in the short term and health issues in the future.	Negative feelings; Risk of illness/loss of mobility	Extrinsic and intrinsic

feel and look older ; less flexible	Feeling sluggish/less healthy; Decreased health	Extrinsic and intrinsic
feeling lethargic, tight clothing, makes it harder to exercise the next time too	Feeling sluggish/less healthy; Need new clothes; Decreased motivation	Extrinsic and intrinsic
increased stress levels, poor heart health	Increased stress; Decreased health	Extrinsic and intrinsic
clothes tight, lack of energy, lack of motivation	Need new clothes; Feeling sluggish/less healthy; decreased motivation	Extrinsic and intrinsic
I feel bad, don't fit in clothes, not as productive in team sports	Need new clothes; Negative feelings	Extrinsic and intrinsic
feeling lethargic, increased weight, less sex drive	Feeling sluggish/less healthy; Less desirable body figure/features; Decreased sex drive	Extrinsic and intrinsic
tired, weight increase	Feeling sluggish/less healthy; Less desirable body figure/features	Extrinsic and intrinsic
less energy, not feeling healthy, not as appealing	Feeling sluggish/less healthy; Less desirable body figure/features	Extrinsic and intrinsic
decreased motivation and flexibility	Decreased motivation	Intrinsic
fatigue	Feeling sluggish/less healthy	Intrinsic
low self-esteem	Negative feelings	Intrinsic
self discipline sometimes lacking	Decreased motivation	Intrinsic
guilt	Negative feelings	Intrinsic
feeling lazy	Feeling sluggish/less healthy	Intrinsic
not as much energy	Feeling sluggish/less healthy	Intrinsic
guilt	Negative feelings	Intrinsic
feeling bad about my self	Negative feelings	Intrinsic
no enjoyment in competition	Negative feelings	Intrinsic
feeling crappy, lack of energy	Feeling sluggish/less healthy	Intrinsic
Aches and pains.	Feeling sluggish/less healthy	Intrinsic
dissatisfaction	Negative feelings	Intrinsic
tired	Feeling sluggish/less healthy	Intrinsic
Loss of energy	Feeling sluggish/less healthy	Intrinsic
I get out of breath faster	Feeling sluggish/less healthy	Intrinsic
not able to cope with life as well	Feeling sluggish/less healthy	Intrinsic
feeling poor/lethargic	Feeling sluggish/less healthy	Intrinsic
none	None or blank	None or blank

no negative consequences will get up and try again	None or blank	None or blank
	None or blank	None or blank
hasn't happened so cannot comment	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
None	None or blank	None or blank
N	None or blank	None or blank
	None or blank	None or blank

Question A4.4 – Negative Consequences of Not Achieving Educational/Career Goals

Original Comment	Category	Type of Motivation
Stress in Long Term Health of Business	Loss of income/money	Extrinsic
lost income	Loss of income/money	Extrinsic
Lose money	Loss of income/money	Extrinsic
poor student responses	Poor work performance	Extrinsic
no job, waste of paying so much tuition	Loss of income/money	Extrinsic
don't progress	Lack of career advancement	Extrinsic
lack of promotions	Lack of career advancement	Extrinsic
missed opportunities	Lack of career advancement	Extrinsic
lack of career advancement, sense of failure	Lack of career advancement; Negative feelings	Extrinsic and intrinsic
become disinterested in life	Become disinterested in life/depressed	Intrinsic
dissatisfaction with self; sense of failure	Negative feelings	Intrinsic
mental stress	Increased stress	Intrinsic
guilt	Negative feelings	Intrinsic
depression	Become disinterested in life/depressed	Intrinsic
Poor self-image	Negative feelings	Intrinsic
disappointment	Negative feelings	Intrinsic
not liking my job, increased stress levels	Negative feelings; Increased stress	Intrinsic

loss of self esteem	Negative feelings	Intrinsic
Stress	Increased stress	Intrinsic
feeling of stagnation	Negative feelings	Intrinsic
mild depression	Become disinterested in life/depressed	Intrinsic
disappointing self and family members	Negative feelings	Intrinsic
stress, anxiety, less marketable	Increased stress	Intrinsic
possibility of unenjoyable jobs	Negative feelings	Intrinsic
Lesser job satisfaction	Negative feelings	Intrinsic
Losing control of my future	Loss sense of control	Intrinsic
disappointment, not intellectually stimulated	Negative feelings	Intrinsic
none	None or blank	None or blank
none	None or blank	None or blank
no negative consequences will get up and try again	None or blank	None or blank
None	None or blank	None or blank
	None or blank	None or blank
hasn't happened so cannot comment	None or blank	None or blank
none	None or blank	None or blank
none	None or blank	None or blank
	None or blank	None or blank
	None or blank	None or blank
none (I have other work)	None or blank	None or blank
	None or blank	None or blank
none	None or blank	None or blank
None	None or blank	None or blank

Question A4.5 – Negative Consequences of Not Achieving 'Other' Goals

Goal Type	Original Comment	Category	Type of Motivation
sports	injuries	Injuries	Extrinsic
Music	become uninspired	Loss of inspiration	Intrinsic
Housework	none	None or blank	None or blank
Housework	chore overload, stress	Increased stress	Intrinsic
Travel	mainly financial	Financial consequences	Extrinsic
Music		None or blank	None or blank
Retirement	hasn't happened so cannot comment	None or blank	None or blank

Housework	less beauty and fewer veggies	Loss of produce in the garden; Less aesthetic appeal	Extrinsic and intrinsic
Housework	feeling guilty	Negative feelings	Intrinsic
Personal improvement	STRESS, feelings of missing out on family life/children's milestones	Increased stress	Intrinsic
Energy	poor application of capital/risk	Poor application of capital	Extrinsic
Personal improvement	negative feelings about self	Negative feelings	Intrinsic

Question A18 – Reasons Why Goal-Setting Works or Does Not Work

Question A18	Original Comment	Category
Yes	I am a goal oriented person	I am goal oriented
Yes	I am the only one involved and so commitments to the goal and he effort, energy and time which I spend on the endeavour depends only on myself	I am goal oriented
Yes	I'm goal oriented.	I am goal oriented
Yes	I set reasonable goals, and I am able to be flexible when needed. I can bounce back when I don`t meet a goal, and I have self-discipline to get back on track.	I am goal oriented
Yes	I have to goal-set my finances if I want to be able to pay tuition.	I am goal oriented
Yes	I wouldn't achieve the goals otherwise	I am goal oriented
Yes	It is part of my journey; If something doesn't work, it challenges me to look at why that may be the case, and either change the approach or re-evaluate the goal based on changing circumstances.	It helps me measure progress/accomplishments
Yes	it lets me know if I'm staying on track	It helps me measure progress/accomplishments
Yes	reference points to gauge progress and recognize completion	It helps me measure progress/accomplishments
Yes	I can keep track of progress and I feel like I have accomplished something	It helps me measure progress/accomplishments
Yes	it keeps my life organized and less stressful	It helps me stay organised
Yes	If written down it helps me to keep on track	It helps me stay organised
Yes	proactive, planning, stay on task	It helps me stay organised

Yes	keeps me organized	It helps me stay organised
Yes	it keeps me on track and in the groove	It helps me stay organised
Yes	it helps me to stay on track	It helps me stay organised
Yes	I can stay organized and gain a measure of accomplishment	It helps me stay organised; It helps me measure progress/accomplishments
Yes	it is integrated into my life style	It is integrated into my lifestyle
Yes	it prompts me to make progress	It prompts me to make progress
Yes	at my age (60+) the future is scary without assurance of good health and a liveable income	It provides a sense of control/reassurance
Yes	It gives me a sense of control over my own life.	It provides a sense of control/reassurance
Yes	I have a purpose and a deadline to meet.	It provides a sense of purpose/focus
Yes	I have a focus.	It provides a sense of purpose/focus
Yes	it gives me a direction in my life	It provides a sense of purpose/focus
Yes	it gives me something to aim for	It provides a sense of purpose/focus
Yes	it keeps me focused on what I want to achieve and when	It provides a sense of purpose/focus
Yes	It provides something to work towards achieving.	It provides a sense of purpose/focus
Yes	It makes me more productive	It provides a sense of purpose/focus
Yes	keeps me focused	It provides a sense of purpose/focus
Yes	It gives me direction in my life.	It provides a sense of purpose/focus
Yes	it provides me with a target, something to work towards	It provides a sense of purpose/focus
Yes	clearly identifies a target from me to concentrate on	It provides a sense of purpose/focus
Yes	it is something I want to accomplish	It provides a sense of purpose/focus
Yes	it gives me something to work towards	It provides a sense of purpose/focus
Yes	it helps me clearly articulate for myself what I want to do	It provides a sense of purpose/focus
Yes	sometimes, if focused on possible positive results	It provides a sense of purpose/focus
Yes	it keeps me focussed	It provides a sense of purpose/focus
Yes	it gives me a definitive "thing" to work towards	It provides a sense of purpose/focus
Yes	It gives me something to work toward and helps me focus	It provides a sense of purpose/focus
Yes		No explanation given
Yes		No explanation given
Yes	it works for me	No explanation given
Yes		No explanation given

Yes	It enables clear decisions and helps to measure progress.	Provides a guide for decision-making/prioritising
Yes	Provides a guide towards developing strategies	Provides a guide for decision-making/prioritising
Yes	it prioritizes time	Provides a guide for decision-making/prioritising
Yes	When targets are met the result is a great sense of positive satisfaction	Seeing progress/results is satisfying
Yes	gratification from results	Seeing progress/results is satisfying
Yes	progress towards the goal keeps me motivated	Seeing progress/results is satisfying
Yes	putting it down on paper or on a spreadsheet keeps me motivated to continue	Seeing progress/results is satisfying
Yes	I don't like the feeling of not finishing a task so it's a self-motivation tool	Seeing progress/results is satisfying
Yes	it keeps me motivated	Seeing progress/results is satisfying
Yes	something to look forward to - to try and achieve	Seeing progress/results is satisfying
Yes	I will follow through and enjoy looking back to see the results	Seeing progress/results is satisfying
Yes	I need to get the "sense of achievement" on a regular basis	Seeing progress/results is satisfying
No	I tend to go with the flow	Rather go with the flow
No	I don't normally set specific goals	Rather go with the flow
No	too busy	Too busy
No	External issues arise and conflict with goals that have been set. Cannot stay committed.	Too busy
No		No explanation given
No	I give up too easily sometimes and get discouraged if I don't meet a goal	Get discouraged
No	I get overwhelmed	Get overwhelmed
No	Yes and no... No because it seems year after year I set the same fitness goals (though I generally don't get worse)... I do generally meet my financial and educational goals though.	No progress was achieved

Question C2 – Reasons Why Respondents Were Interested or Non Interested in Home Energy Goal-Setting

Original Comment	Interested?	Category
I would love to be able to purchase the most energy efficient appliances, but my budget does not allow me that option	Yes	Alternative to purchasing efficient appliances

Although I am interested in keeping the cost of my electrical usage at a minimum, it does not preoccupy my focus from leading my life in the way I desire. For example, if I am hot, I will turn on my air conditioner and set it at a comfortable temperature for me. I may take an interest in how to keep my system cost down to run my air conditioner but not at the expense of actually changing the thermostat setting. Therefore, setting a goal is unrealistic for home energy usage for me. It is more about being aware of the costs and a trade off type analysis on whether to change a system to take advantage of lower operating costs.	Yes	Interested in becoming more energy aware
I'd be curious to see what routines we could change within our house to save energy. Curious as to how it compares to a similar household.	Yes	Interested in becoming more energy aware
At this point, my goal is more about getting aware of appliance-wise energy profiles (how much energy, when). Once that's clear, goal-setting would follow.	Yes	Interested in becoming more energy aware
Very interested in seeing breakdown of usage, but concerned about added time commitment to an already busy work/life schedule.	Yes	Interested in becoming more energy aware; Concerned about time-commitment and difficulty to use
Getting to see the actual number or some kind of data would be nice and interesting. It is also a good way to confirm that the ways that I try to reduce energy consumptions is actually working.	Yes	Interested in becoming more energy aware; Looking to reduce environmental impact
Costs are only going up, to enjoy our existing home comfort level (A/C, heat, etc) need to know more about what each item consumes and when. Take advantage of any time of use rates. TOU not currently billed in my area.	Yes	Interested in becoming more energy aware; To help manage rising costs of energy
I would like to know in visual format how much energy is used by various appliances, heating/cooling, water because I don't set aside the time to examine details of usage on the bills. I would respond to an interactive option. I think in this way I would have real-time response to energy	Yes	Interested in becoming more energy aware; Tool to help teach kids/others about energy management

consumption, and have a tool (vs. nagging) to advocate to others in the household.		
I would like to consider better option or alternatives to save energy at my home and play my part of global warming.	Yes	Looking to reduce environmental impact
We have actively put in place, during our recent renovations, items to support our energy footprint on the earth. Our interest and commitment during the reno time demonstrates our interest in setting goals to reduce my environmental impact.	Yes	Looking to reduce environmental impact
I am committed to using energy as efficiently as possible and lowering our homes environmental footprint.	Yes	Looking to reduce environmental impact
If there are ways that I am not aware of to save more energy, I would like to know.	Yes	Looking to reduce environmental impact
I am interested as an environmentally responsible citizen	Yes	Looking to reduce environmental impact
I'm just generally interested in reducing use of energy and conservation.	Yes	Looking to reduce environmental impact
I would be very interested if budget allowed to reduce my house's environmental impact.	Yes	Looking to reduce environmental impact
I believe that we need to reduce our overall use of energy as a society in order to achieve sustainability as a culture. Our current growth in energy use will reach an unsustainable tipping point.	Yes	Looking to reduce environmental impact
Environmental concerns, saving energy and I have the time	Yes	Looking to reduce environmental impact; I have the time
It would be helpful to know what/how much is being used where and use that information to make cut-backs in energy use where available.	Yes	Looking to reduce environmental impact; Interested in becoming more energy aware
I would be interested in keeping track and trying to save energy used in our home.	Yes	Looking to reduce environmental impact; Interested in becoming more energy aware
It is responsible and part of being a good citizen. It also tells me whether changes are needed or investments are needed.	Yes	Looking to reduce environmental impact; Interested in becoming more energy aware

We rent, and all utilities are included, so we don't know how much energy/water/gas we use... I want to reduce our use, but it is hard to see any progress when you don't know the baseline.	Yes	Looking to reduce environmental impact; Interested in becoming more energy aware
It is something that is always talked about but i actually do not know a lot of the facts. I think that we should take more of an interest in how much energy we are using and how to reduce that energy or to consume less of it.	Yes	Looking to reduce environmental impact; Interested in becoming more energy aware
I would be interested in setting goals for saving energy. I would be particularly in understanding the impacts of the energy I use. At this time the cost of energy is not a particularly large part of our family budget, but I would like to conserve energy because I think the extraction or production of energy is an important issue facing society. I also believe energy will become increasingly expensive.	Yes	Looking to reduce environmental impact; To help manage rising costs of energy
Would like to reduce the amount of energy we use. Set an example for the kids on being conservative	Yes	Looking to reduce environmental impact; Tool to help teach kids/others about energy management
I would like to reduce our footprint, and our bill. We moved to a smaller house a few years ago in an effort to reduce. I am having trouble motivating my almost adult children to shut off lights and be aware of both the expense, and the environmental impact	Yes	Looking to reduce environmental impact; Tool to help teach kids/others about energy management
What I really want is to reduce my energy bills!	Yes	Looking to save money
I confess that my interest in achieving energy goals is to save money	Yes	Looking to save money
To save MONEY!	Yes	Looking to save money
My interest is in saving money	Yes	Looking to save money
I am always interested in saving money and definitely would like to be able to see exactly what each appliance etc. is costing me to use and also try to help the environment at the same time.	Yes	Looking to save money; Interested in becoming more energy aware; Looking to reduce environmental impact
Save money and reduce environmental impact.	Yes	Looking to save money; Looking to reduce environmental impact

To save money first and reduce environmental impact second.	Yes	Looking to save money; Looking to reduce environmental impact
Dual primary reasons: 1.Doing my part in conserving and energy for a better environment for my children and grandchildren. 2. Being able to financially manage the rising cost of energy in my remaining years.	Yes	Looking to save money; Looking to reduce environmental impact
Well it would help reduce the cost of energy and have a more long term positive impact on the environment for my children's lives	Yes	Looking to save money; Looking to reduce environmental impact
reduce my energy bills, reduce the impact on the earth damage because of my neglect	Yes	Looking to save money; Looking to reduce environmental impact
My main concern would be saving money but reducing my environmental impact is also a factor	Yes	Looking to save money; Looking to reduce environmental impact
If I can help the environment by reducing my energy costs with a resulting national and therefore global impact then I think it's vital that we do this for a sustainable future. Maintaining a home in the first world is expensive as so much of our energy use is not related to direct sunlight. If we could heat our homes, cook our food using cheap or zero impact alternatives then we should.	Yes	Looking to save money; Looking to reduce environmental impact
I'd be interested, to reduce environmental impact and financial impact. It would be good if we had a sense of what changes would make the most impact.	Yes	Looking to save money; Looking to reduce environmental impact
I am interested in saving money and in making a positive impact on the environment. After we made several energy improvements to our home I was amazed how much we began to save annually, on gas and electricity. I use the amount of money we spend each month as a proxy for the amount of energy we use.	Yes	Looking to save money; Looking to reduce environmental impact
I'm very environmentally conscious and active in sustainability initiatives. And it's great to save money too!	Yes	Looking to save money; Looking to reduce environmental impact
Reducing consumption -- both as a cost-saving measure and to decrease environmental impact.	Yes	Looking to save money; Looking to reduce environmental impact

I would like to reduce the amount of energy used and have the same comfort level but pay less in monthly utility bills.	Yes	Looking to save money; Looking to reduce environmental impact
It's important financially and environmentally. It's a challenge!	Yes	Looking to save money; Looking to reduce environmental impact
if the system helped me save money (and energy) it might be advantageous	Yes	Looking to save money; Looking to reduce environmental impact
Due to the benefit to me, my family and society	Yes	Looking to save money; Looking to reduce environmental impact
First and foremost is the environmental impact. We have had the Home EcoEnergy program through our home and have done the majority of modifications required to lower our impact...although not as significant a change as we hoped. Secondly, would be the cost.	Yes	Looking to save money; Looking to reduce environmental impact
It would be great to find ways to save money. In addition, I hate waste, so would welcome finding ways to save energy.	Yes	Looking to save money; Looking to reduce environmental impact
I am interested as long as the feedback or tools are not complicated, time-consuming, or difficult to decipher.	No	Concerned about time-commitment and difficulty to use
I am just concerned with the space since I live in a very small space and the price of the set up is also a concerned.	No	Concerned about the costs of the system
We live fairly simply and aren't generally wasteful, so this just isn't a priority for us.	No	Already do what I can
I already do everything possible and necessary: keep track of consumption, minimize usage, practise the use of alternatives and conservation (e.g., use high efficiency washing machine, use clothesline, rarely use clothes dryer, use cold water detergent, keep water temperature relatively low), keep informed, keep records. I don't think a management system would provide much extra benefit	No	Already do what I can
I am very busy I don’t have much time to spend on energy goals. Also there is not much I can do to reduce the cost. We do all we can right now.	No	Concerned about time-commitment and difficulty to use; Already do what I can

We have already done as much as I feel we can to reduce our energy usage. I'm not interested in further reducing energy usage because any further reduction impacts our quality of life. I DETEST time of use billing. It is anti-traditional family because it penalizes a stay-at-home parent for doing tasks while the rest of the family is out of the home. The pressure is to push energy usage (i.e. doing laundry, cooking meals) into time that was previously reserved for family time (evenings and weekends). What a surprise - we're also not saving any money. Just another bafflegab way for politicians to stick it to tax-payers and rate-payers. I bet you can't tell that I'm angry???	No	Already do what I can
We use what we believe we need. We try where possible to be conscious of our usage, and also purchase energy efficient appliances. We believe we're doing our part.	No	Already do what I can
I don't buy into your premise re "environmental impact."	No	Don't agree with the premise "environmental impact"
Goals would have to be long term and set at the time of a major purchase (i.e. a/c unit) or set during a construction cycle (i.e. insulation). Setting a goal that simple reduced the interior comfort level, or impacted like style would not be acceptable. Nor would setting a goal that masked itself as energy related goal (i.e. window replacement) when indeed it is mostly a cosmetic application of capital. Setting of only achievable goals, no matter the term, would be the only goals that could, or would, be supported and the only ones that would be in interest to achieve or even plan for.	No	Already do what I can
I try not to waste energy but I still view it as uncontrollable. We use what we use and I am satisfied that it is a reasonable amount. Goal setting n this situation seems a waste of time and effort.	No	Seems like a waste of time
cost of the program	No	Concerned about the costs of the system

We do not have any incandescent light bulbs in our house.	?	

Question C11 – Explanations for Preferred Timeframe When Managing Home Energy Goals

Original comment	Timeline Selected	Category
energy billing comes in monthly three month snap shots looks at short trends	3 months only	To align with the bills
	3 months only	No comment given
Energy use depends on the season of the year so I try to set goals for the various seasons.	3 months only	Because energy usage is seasonal
Not too much and not too little	3 months only	Not too much, not too little
Heating and cooling is the main thing for which I have left to cut my energy usage since my other usage is so low anyway. This sort of thing is best done on a longer-term basis.	3 months only	Because energy usage is seasonal
I think a 3 month period is a good average to take into account fluctuating weather conditions and times when we are gone (vacation).	3 months only	Because energy usage is seasonal
It would allow enough time for us to adjust, see the repercussions, and modify as needed. Month 1: what is our usage decrease, Month 2: have we significantly decreased our usage? Month 3: Make modifications to decrease further.	3 months only	Allows enough time to adjust
Our bills come every two months, so a similar time frame would be useful.	3 months only	To align with the bills
We are use energy on a daily basis therefore it seems to be the reasonable things to do to learn to minimize it on a daily basis.	Daily only	Use energy on a daily basis, thus seems reasonable to track on a daily basis
We are retired and our energy consumption is essentially the same for each day of the week therefore it would make sense to manage our energy related goals on a daily basis.	Daily only	Energy usage is similar each day for us, therefore would be interested in daily monitoring

we put the washer/ dryer/ dishwasher after 7pm.	Daily only	We pay attention to time-of-use schedules
Energy is used daily, it should be managed daily.	Daily only	Use energy on a daily basis, thus seems reasonable to track on a daily basis
One month is realistic time and positive approach to set a goal.	Monthly only	Realistic amount of time given other priorities
A month is a manageable time frame given other family concerns. It is a period of time where you can plan for changes and it gives you an applicable time to make the necessary changes.	Monthly only	Realistic amount of time given other priorities
	Monthly only	No comment given
Because bills come once a month and it would be easier to see seasonally.	Monthly only	To align with the bills
Because then I could compare my monthly bills/costs.	Monthly only	To align with the bills
I get monthly bills so that would make the most sense	Monthly only	To align with the bills
To iron out small-scale disturbances like visits of large numbers of people	Monthly only	To 'iron out' rare occurrences
We are billed monthly for hydro use water and gas. It would be better to use a monthly evaluation to look at the overall use as an average. Some days or weeks might be different because of who was at home and what else was happening.	Monthly only	To align with the bills
I think a month would allow for the planning of weekly tasks like laundry and also the timing of daily energy consuming tasks based on seasonal peaks in energy consumption.	Monthly only	Allows for periodic planning
would look at bill received to compare usage for month, compare usage versus peak and non peak hrs	Monthly only	To align with the bills
It roughly coincides with my billing for electrical us which is bi-monthly	Monthly only	To align with the bills
Most bills are shown by monthly usage.	Monthly only	To align with the bills
gives a fairly broad time period to track energy use	Monthly only	Allows for periodic planning

We look at consumption each month and compare it to same time last year. I think we can factor in the seasons too and set goals based on weather, daylight etc.	Monthly only	Already manage energy on monthly basis
Because energy bills usually come monthly	Monthly only	To align with the bills
	Monthly only	No comment given
	Monthly only	No comment given
	Monthly only	No comment given
Easy to monitor based on monthly billing	Monthly only	To align with the bills
per month or 3 months would make sense as it would coordinate with bills.	Monthly only	To align with the bills
I think this is an ongoing concern, to save energy as well as money, so therefore it would be a goal indefinitely.	More than 1 year only	Would be an ongoing indefinite goal timeframe
I would like to see the short term effects as well as the big picture of energy usage and expenditure in my home.	Multiple	Short periods keep it 'top of mind'; Yearly to see long-term results
Going by day is too short to see any actual result because consumption each day could fluctuate.	Multiple	Short periods, like daily and weekly, would take too much effort
I'd select day to compare Monday's to Monday's for example, since every day of the week involves different tasks. For the week overall because sometimes tasks fall on different days in a week. Month to month to determine how our energy use this January stacks up against last January (e.g.), every 3 months to compare seasons and every year to get a sense of annual improvement.	Multiple	Daily to compare Mondays to Mondays
Everyday choices (peak-times, amount of lights/heating used etc.) are the basis to energy goals; use less everyday and then see how you did each month.	Multiple	Daily to help manage time-of-use schedules

Time of day electricity usage rates mean planning daily but you need to set longer timeframe goals like monthly and year over year too	Multiple	Daily to help manage time-of-use schedules
Energy consumption is seasonal, hence month-wise tracking. At the same time, I'd like to track consumption on an annual basis.	Multiple	Longer to account for seasonal effects
	Multiple	No comment given
Frequent enough to be helpful but not too frequent to become tedious.	Multiple	Short periods are easier to manage and develop patterns
easier to manage it becomes a pattern quicker	Multiple	Short periods keep it 'top of mind'
I think a variety of timeframes are important- immediate(daily)- makes it easier to change for tomorrow, longer term- gives targets to work towards(e.g. save money for a more energy efficient appliance etc.)	Multiple	Short periods keep it 'top of mind'
I think you need big picture goals (annual) short term measures (3 month), periodic assessment (monthly to compare seasonal shift year over year) and daily to ensure that it is "always on your mind".	Multiple	Short periods keep it 'top of mind'; Yearly to see long-term results
Daily or weekly would take too much effort and I don't think would be feasible. In addition, there would be considerable fluctuation and I don't think the information would be useful to me in managing the goals.	Multiple	Short periods, like daily and weekly, would take too much effort
I can't bother daily so weekly would be a good tool to review consumption for the week. Monthly would be a good check to see if goals are realistic.	Multiple	Short periods are easier to manage and develop patters
Relates to energy billing periods and annual consumption patterns and annual DD and hrs of sunlight measure. Thus using this time frame makes tracking easier.	Multiple	To align with the bills; Longer to account for seasonal effects
Monthly to coincide with the bill (can instantly view progress). Yearly to take into account seasonality	Multiple	To align with the bills; Longer to account for seasonal effects

Week and Month: This would help me monitor my family's energy use throughout the month, and would help me work toward lowering the cost of a utility bill (which arrives either monthly or bi-monthly). Year: It is nice to be able to reflect on energy expenses at the end of a year. After we made energy improvements to our home, I didn't realize the savings we were experiencing each month; I needed to see the annual costs in order to really appreciate how much of a difference we made.	Multiple	To align with the bills; Yearly to see long-term results
some chores are done weekly, bill for power, water and gas are received monthly; over 3 months one can find a monthly average in case one item was over- or under-expended in one month of the 3 months	Multiple	To align with the bills; Yearly to see long-term results; some activities are done weekly
I want everyone in my home to know what, when and how to use energy at the lowest cost.	Multiple	To help educate everyone in the home
should be able to see a difference	Multiple	To see differences over time
I don't plan on setting an energy usage goal at all - I continually look at sources of power use and question - is this an efficient way to operate.	Not applicable	Try to be efficient without the need to set goals
time periods and seasons differ for different needs	Not applicable	Goals would vary given time of year
	Not applicable	No comment given
n/a	Not applicable	No comment given
So that it could align with my hydro bill timing.	Other (every 2 months)	To align with the bills
A week seems like a good unit. there are weekly effects such as when I work from home, laundry, etc.	Weekly only	There are weekly effects such as working from home and laundry
Seems like a manageable timeframe to assess and react.	Weekly only	Seems like a logical timeframe to assess and react

Because our usage would vary between weekdays and weekends, so averaging it out over the week makes the most sense. Daily is too often, and any more than weekly doesn't give you time to react if your currently using too much to make adjustments.	Weekly only	Because usage varies between weekdays and weekends, so averaging it out over the week is preferred. Daily is too often and more than week doesn't allow time to make adjustments if needed
Shorter time frame to recall what I was doing during that period to contribute towards the consumption. Any longer and I would lose the specific details that I could improve on	Weekly only	Any longer and I would lose the specific details of what I was doing
It provides you with tangible and immediate information; frequent feedback is effective in learning or unlearning poor habits.	Weekly only	Any longer and I would lose the specific details of what I was doing
	Weekly only	No comment given
It's a great time frame for me to get efficient results :)	Yearly only	Need the long time to achieve the goal
We are a family of four and we would have to re-configure much of our daily activities to achieve a realistic goal of 30%.	Yearly only	Need the long time to achieve the goal
I do not like the very structured and detailed agenda of a short timeframe	Yearly only	I do not like the very structured and detailed agenda of a short timeframe

Question C12 – Rewards Expected by Householders for Achieving Home Energy Goals

Original Comment	Category	Type of Motivation
I would expect to see reduced bills. I would also hope/expect to see government rebate cheques for meeting my goals. I would also expect to see more incentive programs and discounts on energy-saving appliances etc.	Reductions in energy costs; Government/utility incentive/rebates	Extrinsic
Tax incentive to make higher cost purchases related to energy efficiency. Token drop in energy costs from the utility.	Reductions in energy costs; Government/utility incentive/rebates	Extrinsic
monetary	Reductions in energy costs	Extrinsic

It will be a reduction on my utility bill and if applicable incentive from our government.	Reductions in energy costs; Government/utility incentive/rebates	Extrinsic
Saving money.	Reductions in energy costs	Extrinsic
The reward for me would be $$ saved on my bills. (Gov't rebates would be a nice incentive too though!)	Reductions in energy costs; Government/utility incentive/rebates	Extrinsic
I would save money!	Reductions in energy costs	Extrinsic
I don't know of any rewards available from others. If I save money with energy savings, I could do something special with it or save it for an expected month of high expenses, such as birthdays, x-mas, holiday.	Reductions in energy costs	Extrinsic
$	Reductions in energy costs	Extrinsic
I would just be happy to save money. I don't need/want any outside rewards.	Reductions in energy costs	Extrinsic
perhaps a lower rate if I achieved and maintained so much usage in off peak hours	Reductions in energy costs	Extrinsic
save money	Reductions in energy costs	Extrinsic
Lower energy bills!	Reductions in energy costs	Extrinsic
Financial savings	Reductions in energy costs	Extrinsic
Monetary from either utilities or government. Or both!	Government/utility incentive/rebates	Extrinsic
Use the least amount of energy to save money.	Reductions in energy costs	Extrinsic
lower cost	Reductions in energy costs	Extrinsic
Money savings	Reductions in energy costs	Extrinsic
Lower utility cost, rebates	Reductions in energy costs; Government/utility incentive/rebates	Extrinsic
CASH saved. Don't involve me with any government incentive programs. I'm SO SICK of the paperwork involved and the extra government workers that increase my taxes. Really - we CAN'T afford it any more - there is nothing left to trim.	Reductions in energy costs	Extrinsic
No reward expected, as it would translated to a monetary savings.	Reductions in energy costs	Extrinsic
A decrease in energy costs.	Reductions in energy costs	Extrinsic

I don`t expect any reward from others, other than the reduced electricity rates that currently exist. The reward that would occur in the form of savings on my energy bills would suffice.	Reductions in energy costs	Extrinsic
I would expect to see monetary savings.	Reductions in energy costs	Extrinsic
monetary, savings on bill (if I paid a bill)	Reductions in energy costs	Extrinsic
Income tax rebate	Government/utility incentive/rebates	Extrinsic
I would always take a monetary reward!	Reductions in energy costs	Extrinsic
Saving money, discounted rates if you drop below a certain (realistic) level.	Reductions in energy costs	Extrinsic
Monetary - spend less on energy	Reductions in energy costs	Extrinsic
money and global warming	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
A personal awareness of our decreased impact on the environment and of course $.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
monetary and lowering the environmental effects	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Monetary and a sense of satisfaction for reducing our imprint on the environment.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
a manageable electric bill for sure and just to know that I am helping to preserve the environment	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Money would be saved and the environment improved if multiplied	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Satisfaction, feel better socially (smaller footprint), educate my children and save money.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Money savings and lower the damage to the planet earth :(	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic

feel good about lowering our energy usage i.e. lower monthly costs	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
financial and environmental	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Decreased environmental impact. It would be nice if the government would provide financial incentives for people that consume little energy. Having more money in our bank account for using less energy is nice too, so I guess financial rewards are good.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Reward would be saving energy costs & the environment. No additional monetary reward needed!	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Bill savings and knowing that I am polluting less.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Monetary - spend less money Personal satisfaction from having a small energy footprint	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
a more sustainable society, lower energy costs at home	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Decrease in bills, satisfaction that I'm doing my part environmentally.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Lower costs, satisfaction from saving money	Reductions in energy costs; Satisfaction from goal attainment	Extrinsic and intrinsic
Yay! Less impact on the environment. Less money spent.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Personal satisfaction that I was helping the environment and lower energy costs for the home.	Reductions in energy costs; Satisfaction from reducing environmental impact	Extrinsic and intrinsic
Satisfaction	Satisfaction from goal attainment	Intrinsic

It would be motivating to receive a monetary incentive but with a large number of people in one house just seeing if we as a family could achieve these goals would be motivating as well.	Satisfaction from goal attainment	Intrinsic
For me intrinsic rewards are better: I would feel good about doing good for myself and society.	Satisfaction from goal attainment; Satisfaction from reducing environmental impact	Intrinsic
Personal satisfaction.	Satisfaction from goal attainment	Intrinsic
The satisfaction of attaining my goal	Satisfaction from goal attainment	Intrinsic
Feel good about the changes and still maintain level of comfort. Can share info with others to prompt more changes in the community.	Satisfaction from goal attainment; Chance to share with others in the neighbourhood	Intrinsic
None.	None or blank	None or blank
Monetary rewards would be great, but somewhat counterproductive as we're trying to save money as a country on our energy consumption.	None or blank	None or blank
Not expecting any reward.	None or blank	None or blank
n/a	None or blank	None or blank
already answered in first section	None or blank	None or blank
None	None or blank	None or blank

Question C13 - Negative Consequence Expected by Householders for Not Achieving Home Energy Goals

Original Comment	Category (multiple permissible)	Type of Motivation
Loss of reduction in energy costs.	Increase energy costs/lack of financial savings	Extrinsic
It would cost more money.	Increase energy costs/lack of financial savings	Extrinsic
it is all about the effort, and not meeting reasonable goals will certainly cost more money	Increase energy costs/lack of financial savings	Extrinsic
lose money	Increase energy costs/lack of financial savings	Extrinsic

Same/Higher energy bills	Increase energy costs/lack of financial savings	Extrinsic
We are on fixed income and in the coming years we will need as much money as we can save or use to live at the same life style.	Increase energy costs/lack of financial savings	Extrinsic
higher bills	Increase energy costs/lack of financial savings	Extrinsic
higher utility cost	Increase energy costs/lack of financial savings	Extrinsic
We lose our house. We are really struggling. We have no idea how we are going to pay our heating bill this winter (much less how we are going to buy groceries next week). I'm so sick of freezing in the winter, I'm so sick of melting in the summer because we can't afford the bill to run an air conditioner. Instead we have "energy efficient" fans that blow the hot air around. Oh goody...	Lose our house	Extrinsic
I would not expect any consequences other than my own lack of savings on my energy bills.	Increase energy costs/lack of financial savings	Extrinsic
I have done renovations and spent more to make the house more efficient but I wonder if there really has been any savings with regard to my utility bills. I don't mind spending more on insulation even though the return on my investment is probably 15 years in utility bill savings.....it would be nice to notice my utility bill decrease, which I don't. I also realize there are a lot of climate factors so it's very hard to judge.	Increase energy costs/lack of financial savings	Extrinsic
costs of upgrading appliances..., inconvenience of changing habits	Increase energy costs/lack of financial savings	Extrinsic
Increased billing costs by utility companies	Increase energy costs/lack of financial savings	Extrinsic
Depends- if it would be a province wide thing, then I would expect there to be negative consequences, such as a bit of a higher bill. If it is	Increase energy costs/lack of financial savings	Extrinsic

voluntary, then no consequence.		
higher energy cost	Increase energy costs/lack of financial savings	Extrinsic
Pay more for electricity.	Increase energy costs/lack of financial savings	Extrinsic
financial and environmental	Increase energy costs/lack of financial savings; Environmental/social consequences	Extrinsic and intrinsic
We'd be spending more money on energy and it's not good for the environment.	Increase energy costs/lack of financial savings; Environmental/social consequences	Extrinsic and intrinsic
Wasted money. Also aware of wasted energy.	Increase energy costs/lack of financial savings; Environmental/social consequences	Extrinsic and intrinsic
Disappointment and not saving money & the environment.	Negative feelings; Environmental/social consequences; Increase energy costs/lack of financial savings	Extrinsic and intrinsic
Impact the environment (in a bad way) more, more money spent on energy	Increase energy costs/lack of financial savings; Environmental/social consequences	Extrinsic and intrinsic
higher dollar costs and associated social costs	Increase energy costs/lack of financial savings; Environmental/social consequences	Extrinsic and intrinsic
Disappointment and higher energy costs than otherwise.	Negative feelings; Increase energy costs/lack of financial savings	Extrinsic and intrinsic
My bills would probably remain the same or increase. I would be disappointed because of the impact this would have on the environment as well. I may get discouraged if I could not afford to implement some of the energy saving incentives due to the lack of government rebate cheques, incentive programs, and	Negative feelings	Intrinsic

discounts on energy-saving appliances.		
guilt	Negative feelings	Intrinsic
Somewhat depressed and frustrated :-(	Negative feelings	Intrinsic
Perhaps we would be disappointed that we could not achieve the goals. I would not want to see us financially penalized	Negative feelings	Intrinsic
The feeling of failing, getting discouraged and not wanting to try anymore, frustration with other family members who are not cooperating with achieving the goals.	Negative feelings; friction in the household	Intrinsic
I would be disappointed.	Negative feelings	Intrinsic
:(	Negative feelings	Intrinsic
I feel I am responsible for the amount of energy used and when and how it is used	Negative feelings	Intrinsic
None but the awareness that we were using world resources unnecessarily (assuming the goal was realistic).	Environmental/social consequences	Intrinsic
Feel lousy; might cause friction in the household/relationship-I am thinking of the film "No-Impact Man" in making the previous statement.	Negative feelings	Intrinsic
Higher bills, feeling irresponsible.	Negative feelings; Increase energy costs/lack of financial savings	Intrinsic
Frustration (especially if we modified and it did nothing).	Negative feelings	Intrinsic
none	None or blank	None or blank
none	None or blank	None or blank
none	None or blank	None or blank
I believe that it will just stay as it is right now.	None or blank	None or blank
None	None or blank	None or blank
None	None or blank	None or blank

Relatively little negative consequences.	None or blank	None or blank
No negative consequence	None or blank	None or blank
None.	None or blank	None or blank
None	None or blank	None or blank
I don't expect anything much to be affected.	None or blank	None or blank
None	None or blank	None or blank
n/a	None or blank	None or blank
No negative consequence, if one did their best to achieve their goals it says something to try. One may have set a goal that was unattainable.	None or blank	None or blank
None other than perhaps some minor inconvenience in not being to do things like laundry on a spur of the moment	None or blank	None or blank
Actions may not be easy or fit in our lifestyle, or even just not feasible.	None or blank	None or blank
None	None or blank	None or blank

Question C16 - Reasons for Preferred Method to Receive Home Energy Goal-Setting Information

C16	Original Comment	Type of Reason (multiple permissible)
In-home display	because if I could see it right there in front of me I would be more inclined to watch my energy consumption every day	Stays visible/top of mind; Good for daily monitoring
In-home display	It is visual and readily accessible	Easily accessible
In-home display	Available continuously	Available continuously
In-home display	front and center for everyone to see and consider on an on-going basis	Visible for everyone in the home to see
In-home display	immediate feed back	Available continuously
In-home display	I think we already do a really good job conserving energy. If we could see what we are using in real time, it would help us conserve even more and develop better habits - like reminding us to switch off appliances that use phantom power or if we forget to turn off lights. It would also help us to manage the time of use rates.	Available continuously; Help to manage TOU pricing

In-home display	It's niftier. Also, everyone could see it so it would be a non-intrusive yet real-time visual reminder. (Out of sight, out of mind...). It takes some of the load off me to remind/nag.	It's niftier; Visible for everyone in the home to see; Stays visible/top of mind
In-home display	It is immediate and constantly visible; it also avoids being on the computer and using paper.	Easily accessible; Avoids being on computer and/or using paper
In-home display	Ease of use - it doesn`t tie me to my computer; it doesn`t involve the expense of mail; it doesn`t clutter up my email inbox.	Easily accessible; Avoids being on computer and/or using paper; Doesn't clutter my email inbox
In-home display	You're using the energy in your house, so it's the easiest place to see it. Pretty self-explanatory.	Easily accessible
In-home display	It's easy to quickly check informally. Everyone will see it as they pass by.	Easily accessible; Visible for everyone in the home to see
In-home display	it would be the easiest to see at all times...	Easily accessible
In-home display	Track daily progress and get immediate feedback	Good for daily monitoring
In-home display	immediate way to check	Available continuously
In-home display	It is the easiest, quickest, most accessible way to check. Ironically, it's the most environmentally hurtful!	Easily accessible
In-home display	Easily visible without the additional hassle Of logging n. Always available	Easily accessible; Available continuously
Web account	Likely more interactive and have more information available more quickly.	More interactive
Web account		No reason given
Web account	Easy to access from anywhere.	Easily accessible; Accessible anytime/anywhere
Web account	Perceive it as most efficient way to track usage.	Easily accessible
Web account	convenient - able to access and study anytime, printable if necessary	Easily accessible; Accessible anytime/anywhere; printable/downloadable
Web account	easily accessed and less likely to be broken by a child unlike the in home display	Easily accessible; Less likely to be 'broken by kids'
Web account	I could access this at my convenience and see trends and compare with my own history (and maybe some information on the average energy use patterns of others in my community)	Accessible anytime/anywhere

Web account	Most likely allows for more in depth analysis	More information and analysis can be presented
Web account	This could be done more frequently and would provide more up to the minute information.	More information and analysis can be presented
Web account	Easy access whenever/wherever I want it	Easily accessible; Accessible anytime/anywhere
Web account	easiest	Easily accessible
Web account	check my computer frequently for messages and if another mail strike were to occur that would not be possible to receive updates	Uses computer often
Web account	I have control over the tracking. I can check my progress at my convenience and act on it as I wish. It is the simplest method for me.	Easily accessible; Accessible anytime/anywhere
Web account	Self-monitoring and readily available information when needed. Don't have to wait for it to come to you.	Accessible anytime/anywhere
Web account	I am usually online. It is nice to be able to keep track from anywhere.	Uses computer often; Accessible anytime/anywhere
Web account	Easy to access at home, but not blatantly for friends and family to see.	Easily accessible; Information is kept private
Web account	No need for paper, I don't need to monitor it daily.	No need for paper
Web account	Most mobile	Accessible anytime/anywhere
Web account	I'm very comfortable with computers. Additionally, if online, I would expect data to be downloadable into applications of my own choice for further analysis.	Printable/downloadable; Uses computer often
Web account	can be accessed at all times and cannot be lost	Accessible anytime/anywhere; Less likely to be lost
Web account	easy to access... no need for paper copies... no need for a physical device at home	Easily accessible; No need for paper
Web account	Any family member could access and monitor, expect information to be timely.	Easily accessible
Web account	It is the least intrusive and I can access it whenever I wish.	Accessible anytime/anywhere
Utility bill	It breaks it down for me in the format I am used to.	Familiar with billing information/format
Utility bill	It would be closely related material.	Relates to other information on the bill
Utility bill	I like to see the results on paper.	Prefer looking at this on paper

Utility bill	I don’t like getting that info from email and don’t want something on my counter. Would prefer to read it.	Prefer looking at this on paper
Utility bill	When I receive something in the mail, I open it and read it right away. Not always the case with email or an online account.	Prompts me to look at it
Utility bill	Convenience, doesn't rely on me remember to check (like an online form I'd have to go to), but doesn't incur any additional energy costs (such as manufacturing of a counter-top or wall-mounted display or additional paper mail)	Prompts me to look at it
Utility bill	it is the way I am use to	Familiar with billing information/format
Utility bill	I don't need more than this	Don't need more than the bill
Utility bill	This shows usage and cost. We get this now.	Familiar with billing information/format
Utility bill	You will always have to see your progress every month (or every 2 months) because you always have to pay your bills	Prompts me to look at it
Utility bill	I prefer being able to analyze data on paper and monthly utility bills would be the most convenient way to gather information on energy use.	Prefer looking at this on paper
Utility bill	Could easily track the increase or decrease by the amount spent	Don't need more than the bill
Utility bill	Makes the most sense- also an in home display would work to.	Makes the most sense
Utility bill	I already use the utility bill for tracking	Familiar with billing information/format
Utility bill	corrected consumption vs. time/billing period	Relates to other information on the bill
Info sheet by mail	convenience	Convenient
Info by email	I verified my email on a daily basis and I believe that it will avoid paper waste since my utility is not able to go paperless, although I tried.	Reduce paper use
Info by email	Electronic media is the most common way to keep tract and keep record of data.	Common way to track data
Info by email	because I really on it	Often use email
Info by email	Easy to filter and manage.	Easy to manage

Other	I like writing things down in my own handwriting in a notebook with my own annotations. It's quiet and you can add personal ideas or how you felt at that moment - it's a bit like a diary.	Would like to keep track by writing in a diary and adding my own ideas

Question D1a – What Householders Liked About the Selecting a Home Energy Goal Screen

Original Comment	Category (multiple permissible)
How much you can customize everything	Ability to customise goals
2 values (dollar and percentage)	Actual and percentage values shown
n/a since I stated that I don't need the management system	Not applicable
None of it	Nothing
nothing	Nothing
Options to change unit of measurement. Usage compared to total household %	Option to change to/use different units; The breakdown by appliance
The option to change the unit to see progress, and change goals by either $$ value or %.	Option to change to/use different units; Actual and percentage values shown
Ability to choose/change unit of measure (kWh, $, g of CO2)	Option to change to/use different units
the ability to change the units ; the goal	Option to change to/use different units; Ability to customise goals
the dollar value associated with it	Option to change to/use different units
flexibility of kWh $ and CO2 automatic % calculation	Option to change to/use different units; Actual and percentage values shown
display, allocations in $ and percentage	Option to change to/use different units
simple and easy to read	Simple and easy to read format
the column and row set up	Simple and easy to read format
The way it is set up but not sure how to come up with amount allocated and % of total household.	Simple and easy to read format
Very clear and easy to read. I would want to know how the default values would be determined. I know someone can see how much my bill was, but how will they know how much of it was for drying clothes? I also like how you can change the units.	Simple and easy to read format; Option to change to/use different units
I like the format very much, it is clear and simple	Simple and easy to read format
looks clear and straight forward	Simple and easy to read format
Presentation	Simple and easy to read format

The information is presented in a clear, uncluttered format.	Simple and easy to read format
White space, drop downs. ability to flip between co2 and kwh	Simple and easy to read format; Option to change to/use different units
the simplicity	Simple and easy to read format
Comparison with previous year, clean interface	Simple and easy to read format; Comparison to previous year
The simplicity. Having each appliance separately.	Simple and easy to read format; The breakdown by appliance
That it is easy to read.	Simple and easy to read format
I do like the format. It is pretty specific.	Simple and easy to read format; The breakdown by appliance
The presentation- looks good. easy and simple	Simple and easy to read format
good way to see it,	Simple and easy to read format
You can change values small percentages/dollar amounts. Easy to read.	Simple and easy to read format; Option to change to/use different units
Layout	Simple and easy to read format
Being able to change from kWh to $ to g of CO2 and the table design	Simple and easy to read format; Option to change to/use different units
The way it breaks down the main power users in the home, and what you would hope to be the amount and percentage you could expect to spend on each per month.	The breakdown by appliance; Actual and percentage values shown
The key appliances are included.	The breakdown by appliance
shows me biggest usage	The breakdown by appliance
The list of appliances.	The breakdown by appliance
all but dishwasher and I have a outside clothes line so dry cost would be lower	The breakdown by appliance
I am not able to change the amounts. If I were, I would allocate zero for the dryer and include a freezer.	The breakdown by appliance
that it breaks it down to small details	The breakdown by appliance
that each appliance is listed	The breakdown by appliance
how each appliance shows usage	The breakdown by appliance
tracking by appliance so we can target our goals and make better choices	The breakdown by appliance
Breakdown	The breakdown by appliance
the break down for each appliance	The breakdown by appliance
The list of appliances and the interchangeable units. It is clear.	The breakdown by appliance; Option to change to/use different units
That energy use is broken down by appliance.	The breakdown by appliance

the level of granularity (i.e. at appliance level)	The breakdown by appliance
seeing energy use broken down by appliance being able to switch between units of use	The breakdown by appliance; Option to change to/use different units
Appliances broken down individually	The breakdown by appliance
very inclusive	The concept/idea overall
the idea of it	The concept/idea overall
I like it overall	The concept/idea overall

Question D1b – What Householders Did Not Like About the Selecting a Home Energy Goal Screen

Original Comment	Category (multiple permissible)
It is not clear how you would determine the percentage or dollar amounts for a specific month. It is also not clear what happens if you say you want to spend $7 on the clothes washer, but you end up spending $8. Is it simply reflected as a negative value in the percentage column, or does one get penalized?	Don't know how the initial values would be calculated; What happens if goal is not met?
How do I figure the amount?	Don't know how the initial values would be calculated
I would first have to establish a record of cost to use each appliance monthly to estimate if I could reduce the cost. I don't like dealing in percentages.	Don't know how the initial values would be calculated; The percentage column
We need to allocate by ourselves which is hard to do	Don't know how the initial values would be calculated
would initially have difficulty coming up with individual goals for each appliance	Don't know how the initial values would be calculated
Not knowing what the benchmark is for a starting point	Don't know how the initial values would be calculated
can't figure out how to change the amounts	Don't know how to change the amounts
Lack Of colour	Lack of colour
Because there's not enough detail of energy/cost savings.	Missing actual savings
How you can't see what you did the previous year (you only know it's a 10% decrease from 2010)	Missing actual savings
maybe it should also say the amount decrease from may 2010, not only the percentage, especially for the kWh and g of CO2	Missing actual savings
Little background information e.g. average	Missing normative comparisons to help

amounts for a household of four	establish goal
Lack of visual representation. No comparison to previous data	Missing visuals; Missing actual savings
You need to cover personal electronics. There are a lot in people's houses.	No lighting or small electronics
that there is no category for electronics- if a person is a heavy electronic user, it would be good to know how much for that category	No lighting or small electronics
No option to include other appliances like a chest freezer. Can't compare other items like lighting or electronics.	No option to exclude/include other appliances; No lighting or small electronics
The dishwasher. Never use mine	No option to exclude/include other appliances
To me it's useless - appliances are tools - all we need to know is that operating them has an impact but we do not need to set a goal to run a refrigerator or a stove - this is absurd. The screen needs to be split up between things you can affect directly easily and background appliances that you cannot affect at all or very easily. You can for example affect the usage of a pool pump by turning it on or off or adding timers or using more energy efficient models. You barely can affect the operation of a refrigerator without spoiling food.	No option to exclude/include other appliances
Can I add specific appliance. Or does everything else go into Other (i.e., PC, TV, etc).	No option to exclude/include other appliances
It doesn't show how much has been used so far in the month	Not clear what actual current usage/progress is
I don't understand how it provides information on progress rewards the goal	Not clear what actual current usage/progress is
that there is no info on how you are progressing toward the goal or data on actual usage	Not clear what actual current usage/progress is
nothing	Nothing
Granularity - I don't care to track usage of each appliance in the house.	The breakdown by appliance
The amount of horizontal space between columns. Hard to link them up to the appliances.	The layout/format
The other figure takes up the largest %. This item could be more specific in terms of details i.e. freezer	The 'Other' category is too large

more detail on other when highest cost per time of day	The 'Other' category is too large; Need to understand time-of-use implications
I need to know how much time of use is represented by the measurements given because that is how I would track my use. The component Other represents a lot of usage and is not well defined.	The 'Other' category is too large; Need to understand time-of-use implications
so few appliances included	The 'Other' category is too large
The absence of other electronic devices that require energy also, such as a computer and all the ones that are "phantom" appliances. What about all the light bulbs?	The 'Other' category is too large; No lighting or small electronics
That the other category is so big. Screens (TV, computers) suck up an enormous amount of energy but aren't broken down.	The 'Other' category is too large; No lighting or small electronics
I'd like to know what other is... I guess lights and computer and TV. I'd like to see a column for actually usage and suggestions to obtain these reductions. Even the numbers of hours that each appliance is used to justify the expense.	The 'Other' category is too large; Would like to see energy saving tips; Would like to see hours of usage
Would like items ranked from highest to least Other at 23.70 and 39% needs further break down	The 'Other' category is too large; Would prefer to rank appliances by usage
I'd like to assign more than one "Other" and label it - such as Computer, Freezer, second refrigerator	The 'Other' category is too large; No option to exclude/include other appliances
"Other" would be nice to be broken down into a person's personal things (computer, water softener, etc.) % of total household may be hard for some people to understand.	The 'Other' category is too large; The word choice for '% of Total Household'
The fact that "other" is so large a proportion of the total in the example	The 'Other' category is too large
The %.	The percentage column
The %. It's interesting, but does not necessarily help with my goals.	The percentage column
the words: appliances % of total household	The word choice for '% of Total Household'
the % of total household because I don`t have a context for thinking of my expenses in this way, i.e., I don`t already think of how much I should expect each of the appliances to contribute to the overall household expenses, so I don`t know what number to enter here.	The word choice for '% of Total Household'; Don't know how the initial values would be calculated

I'd have to set another goal and constantly monitor % achievement. Failure to achieve means I have to follow up with more nagging because I live with a family rather on my own.	Too much work/effort
Too much work. Just give me accurate information about what is using the most energy and I will work to reduce usage.	Too much work/effort
too micro managed with no real benefit vs. time to manage	Too much work/effort

Question D1c – What Householders Found Clear About the Selecting a Home Energy Goal Screen

Original Comment	Category (multiple permissible)
all	Everything
everything	Everything
All of it	Everything
everything	Everything
everything	Everything
all	Everything
The target goals and the adjustments that could be made.	Goals are clearly stated; How to make adjustments
the goals and how it changed from last year this time	Goals are clearly stated
Like a budget for energy the goals are stated clearly.	Goals are clearly stated
the goals and reductions	Goals are clearly stated; The values
very easy to use	How to make adjustments
ability to adjust allocation	How to make adjustments
the percentage reduction and the cost savings	Percentages and actual amounts
the appliance breakdown	The breakdown by appliance
The breakdown and ability to target reductions.	The breakdown by appliance; Goals are clearly stated
biggest usage	The breakdown by appliance
how much each appliance/factor contributes to the total	The breakdown by appliance
the $ symbol, other, stove, refrigerator, dish washer clothes washer clothes dryer	The breakdown by appliance
the types of appliances	The breakdown by appliance
Breakdown	The breakdown by appliance
The percentages and amounts allocated	The breakdown by appliance

Where I'm starting and the percentage of my home energy use that is consumed by each appliance.	The breakdown by appliance; The values
Amount allocated and percentage of household usage.	The breakdown by appliance; Percentages and actual amounts
That the overall household energy expenses are divided among the appliances.	The breakdown by appliance
The concept and the table	The concept/idea overall
the readings	The values
It is clear to understand	The values
easy to read	The values
What is being monitored	What is being monitored
All but "other"	All but “other”
most of it	Most of it

Question D1d – What Householders Found Confusing About the Selecting a Home Energy Goal Screen

Original Comment	Category (multiple permissible)
The adjustments for both amount and %. Do they automatically adjust? How can you increase %? Maybe just the amount should be adjustable.	Do percentages automatically adjust?
how you determine what each appliance would use, and whether a person is already saving as much energy as can be expected from that household. Is there a way for the reader/homeowner to be acknowledged for a job well done? Also, should there not be some place where the number of occupants of a particular house is registered. A family of 6 would spend more on energy than a single person. How would this be acknowledged?	Don't know how the initial values are calculated
see the response for "I like"	Don't know how the initial values are calculated
How the percentages are calculated	Don't know how the initial values are calculated
How I'd know which of my appliances use how much of our total energy consumption.	Don't know how the initial values are calculated
How do I know, at the beginning, the appropriate breakdown and percentages?	Don't know how the initial values are calculated
I don't think I would know a dollar amount to assign to each appliance	Don't know how the initial values are calculated

How do I find the current kWh or $ allotments for my appliances?	Don't know how the initial values are calculated
How will we know how much to allocate for each appliance? How will we know if the allocation is realistic? It only works if you correctly allocate the appliances.	Don't know how the initial values are calculated
Without some baseline measurements, I wouldn`t know what is realistic. If I am already running my appliances on on-peak hours, then there isn`t a lot of room to move, so I would need to know what a reasonable goal looks like for me.	Don't know how the initial values are calculated
When you allocate $15.00 for clothes dryer how many loads of clothes is that? etc.	How much money = one cycle of appliance usage
most of it	Most of it
It's challenging to say only having a screen shot to look at, and not being able to play around with the numbers.	Need to see how this fits into the system
might have a better grasp of how this screen fits into the bigger picture once I have seen more	Need to see how this fits into the system
The category other- not sure what is included in that category.	Not sure what is in the 'Other' category
none	Nothing
Nothing	Nothing
Nothing	Nothing
none	Nothing
it is all clear	Nothing
I get it. It is very straight forward. Not anything I don't already know, but if you are an energy efficiency newbie you might get excited.	Nothing
none	Nothing
none	Nothing
It would be clear what unit you are working with if the unit was displayed alongside the amount. E.g. Instead of the dollar sign being outside the box have it displayed in the box as $15. Likewise 15kWh	The $ unit
It took me a moment to realize that the usage was expressed in $ so I didn't understand what I was looking at initially.	The $ unit
house hold % is confusing/amount allocated	The term '% of Household'
Amount allocated. Allocated to what? To saving? To current rate to future goal?	The term 'Amount Allocated'

What does amount allocated mean?	The term 'Amount Allocated'
Not likely that I can adjust my fridge usage unless I buy a different one. But good to know how much power it uses.	Why is the fridge included?

Question D2a – What Householders Liked About the Performance Indicator

Original Comment	Category (multiple permissible)
all of it	Everything
The whole thing.	Everything
This is the only screen that I think would be really useful... you guys should look at making an iphone app! - That would be cool, push notifications when you reach a certain amount of energy use...	It's cool - make it into a mobile application
Granularity - showing only total usage, not appliance break down.	Less granularity is good
it shows how well I am doing	Shows progress/tracking
the tracking system	Shows progress/tracking
the ability to compare goal and actual achievement	Shows progress/tracking
That it is easy to discern that you are on track without much effort.	Shows progress/tracking
clearly shows progress or lack of it	Shows progress/tracking
Right there in front of you - always aware	Shows progress/tracking
visual representation, immediate feedback on how you're doing in relation to achieving goal	Shows progress/tracking
the continuous tracking	Shows progress/tracking
The ease of being able to keep an ongoing look at one's energy use.	Shows progress/tracking
This one is WAY better. I definitely like that you are keeping tabs on your progress.	Shows progress/tracking
the comparison (actual vs. goal)	Shows progress/tracking; Using actual costs
the idea of a check in to see if I'm on target for my goal	Shows progress/tracking
can see progress monthly at a glance like bar graph as well as percentage like the use of green, yellow and red "seal"	Shows progress/tracking; The horizontal bar graph comparison; Use of colours
gives expected and actual, timely information	Shows progress/tracking; The horizontal bar graph comparison
the clarity	Simple/clear/user-friendly presentation
figures and facts	Simple/clear/user-friendly presentation

The simplicity of this model.	Simple/clear/user-friendly presentation
Very clear.	Simple/clear/user-friendly presentation
The visual summary. Quite clear in terms of tracking.	Simple/clear/user-friendly presentation
Once again, it is legible and comprehensible.	Simple/clear/user-friendly presentation
How it looks user friendly.	Simple/clear/user-friendly presentation
very clear	Simple/clear/user-friendly presentation
really like this one because it is very clear, what you've used and what is remaining	Simple/clear/user-friendly presentation; Shows progress/tracking; Shows remaining
It is clear	Simple/clear/user-friendly presentation
how simple it is to read,	Simple/clear/user-friendly presentation
clear concise easy to understand	Simple/clear/user-friendly presentation
Easy to read.	Simple/clear/user-friendly presentation
Very clearly mapped out as to what has been used and what is still available. Like this one.	Simple/clear/user-friendly presentation; Using actual costs; Shows remaining
simplicity	Simple/clear/user-friendly presentation
the simplicity	Simple/clear/user-friendly presentation
quick visual reference tool that is easy to understand	Simple/clear/user-friendly presentation
this is very clear,	Simple/clear/user-friendly presentation
the simplicity, colours	Simple/clear/user-friendly presentation; Use of colours/symbols
How this screen expresses the amounts in relation to my goal. I like how the bottom line is clearly visible and I like that I can quickly see if I am on target, too high, or too low. Since I gauge my energy consumption by the total amount of my bills, this would be easy to use right away. I realize that an energy bill amount has other costs, and that ultimately it would be better to use kwh but until I get a handle on that measurement system, this would be easier.	Simple/clear/user-friendly presentation; Shows progress/tracking; The horizontal bar graph comparison
The expected and actual display, the goal is clear the actual cost and remaining is clear as well. Maybe monitoring daily is better. I could decide to change habits based on my remaining expenditures	Simple/clear/user-friendly presentation; The horizontal bar graph comparison; Shows remaining
clear and simple	Simple/clear/user-friendly presentation
Clear, concise, colourful	Simple/clear/user-friendly presentation; Use of colours/symbols
looks good	Simple/clear/user-friendly presentation
the concept	The concept/idea - in general

Interface	The concept/idea - in general
the bar graph and colours.	The horizontal bar graph comparison; Use of colours/symbols
the graph and the colour coded tracking information	The horizontal bar graph comparison; Use of colours/symbols
Multi colors. The bar graphs for the tracking. I'm assuming the I in circle would be a tool tip with a definition shown when you hover over	The horizontal bar graph comparison; Use of colours/symbols
The remaining $ and the tracking bars	The horizontal bar graph comparison; Shows remaining
Happy green checkmark. A good choice psychologically - green means go, check mark means correct.	Use of colours/symbols
green check mark	Use of colours/symbols
how I am managing usage consumption	Using actual costs
Having actual cost.	Using actual costs
That an actual is shown	Using actual costs
Actual and remaining. How are you tracking	Using actual costs; Shows remaining

Question D2b – What Householders Did Not Like About the Performance Indicator

Original Comment	Category (multiple permissible)
The lack of ability to switch from $ to energy units.	Can't change units
Still need a base to start from. Again do not like dealing in percentage. When dealing in terms of money rates change. Need consumption figures.	Don't like percentages
don’t know where the savings r being generated	Lack of appliance granularity
not as specific as the previous screen	Lack of appliance granularity
fact this comparison is not available for individual usage types (e.g. dishwasher, drier etc)	Lack of appliance granularity
Not having a further breakdown of where costs are out of line if I am not achieving the goal. Not related to environmental impacts.	Lack of appliance granularity; Not related to environmental impacts
This because there's not enough detail.	Lack of appliance granularity
The monthly summary - if this was in addition to a breakdown similar to the screen previously shown I might find it more useful. If you just get a "goal not achieved" it doesn't really give you any direction as to	Lack of appliance granularity

where you are falling short.	
Where are my costs increasing the most? Should I cut back on using my dryer so much or maybe my stove is cutting into my budget too much.	Lack of appliance granularity
No break down as to "actual Cost"	Lack of appliance granularity
the granularity - need it at the appliance level	Lack of appliance granularity
miss seeing it broken down by appliance	Lack of appliance granularity
If not on track, would like to know why, more details. More details by unit would be helpful in case one is being over used, but overall are doing well.	Lack of appliance granularity
The fact that it appears I can only see the total. It would be useful to be able to drill down and see where things are going off kilter and where I am doing really well.	Lack of appliance granularity
The lack of tips that would help make better choices. For example, when an appliance operates during peak hours, an alarm or notice should appear that suggest a better use or asks if it is necessary to use the appliance at this time	Missing energy savings tips
No comparison to previous year's usage.	Missing historical comparison
No comparison to previous month's data. Missing things like, how many days left in the month? How much average usage per day? What are the big energy suckers?	Missing historical comparison; Doesn't' have daily breakdown
irrelevant if you don't know where one can start	Missing historical comparison
That it does not divide up your based fixed operations compared to your variable operations	No breakdown of base-load and variable load
Can't think of anything.	Nothing
nothing	Nothing
Nothing	Nothing
none	Nothing
nothing	Nothing
None	Nothing
That there is no white space between "tracking?" and symbol. That things aren't lined up on the left. "Legend" should be inside the legend.	The formatting

Legend takes up a LOT of space. Perhaps use a tool tip when you hover over the check mark.	The formatting
Too much work. Just give me accurate information about what is using the most energy and I will work to reduce usage.	Too much work
see other comments	Too much work
Don't really need the color categories.	Use of colours/symbols
The confusing language. Value of the goal, $60.00 is clear. "Actual Cost" is confusing. Is this Actual Savings to Date? If so, use Savings language. e.g. "Savings to Date". If the goal is to reduce usage then it is a savings and not a "Cost". Remaining might be better framed as "Remaining Goal" or "Outstanding Goal or Target." Likewise, "Expected" is not clear. Is this expected goal target to date or expected savings to date? I think it would be clearer if it were "Expected savings to date" and "Actual savings to date."	Wording 'Actual Cost'; Wording 'Remaining'; Wording 'Expected'
The remaining part?	Wording 'Remaining'
"remaining"-really not necessary	Wording 'Remaining'

Question D2c – What Householders Found Clear About the Performance Indicator

Original Comment	Category (multiple permissible)
exactly how much that damn beer fridge is costing	Actual usage
Exactly what is being tracked and how much used	Actual usage
all	Everything
everything	Everything
this is very clear,	Everything
Everything	Everything
everything	Everything
everything	Everything
everything	Everything
yes	Everything
all	Everything
yes	Everything
I think I understand it well.	Everything
Understood	Everything

how the system works	How the system works
most of it	Most of it
most	Most of it
savings	Progress/tracking
Progress bar	Progress/tracking
where things stand at that point in time so adjustments could be made	Progress/tracking
how I am doing with respect to my goals	Progress/tracking
the chart	Progress/tracking
the tracking graphic	Progress/tracking
Goal setting and tracking	Progress/tracking
That this relates my actual usage (expressed in terms of expense) to my goal.	Progress/tracking
Expected and Actual	Progress/tracking
The general concept. Terminology and presentation need work.	The general concept
The goal set, the actual cost and how I am stacking up to last year.	The goal set for this month; Actual usage; Progress/tracking
my goal, actual cost and remaining cost to stay within budget	The goal set for this month; Actual usage; Remaining
the legend	The legend
the readings	The values
This indicator	This indicator

Question D2d – What Householders Found Confusing About the Performance Indicator

Original Comment	Category (multiple permissible)
Are the targets set from previous use in that home? If the homeowner changes (moves), how do the targets reflect that?	Are the goals based on historical usage?
The placement of the status symbol - e.g. the green check mark for using less than expected. It would be clearer if it was below the per cent boxes and labelled, "Progress to date:"	Placement of symbol - should be below bars
where savings r coming from	What are the appliances' contributions?
nothing	Nothing
nothing	Nothing
Does this presume knowledge of reduction?	What are the appliances' contributions?
Nothing	Nothing
60 or less...	$60 or less is confusing

hard to know what is contributing to my usage so far	What are the appliances' contributions?
how will you be able to target where you can have the greatest impact and reduce the most	What are the appliances' contributions?
Actual cost... of what? Current cost of electricity consumed?	The term 'Actual Cost'
Nothing	Nothing
none	Nothing
it is all clear	Nothing
The "remaining" line doesn't really add much for me. It's just visual clutter.	Concept of 'Remaining'
The "actual cost" seems to refer to a cumulative amount this far in the month (vs. the actual cost today), but it could be mis-read as meaning actual cost today, since today's date is given at the bottom of the screen. This could be made more clear by stating "actual cost to date" (or "today's costs" if that's what is meant)	The term 'Actual Cost'; Does 'Today's Date' indicate this represents today's usage or usage to date?
How much of the month is left.	How much of the month is left?
Which appliance is cutting into my budget the most and where I need to make changes to meet my goals?	What are the appliances' contributions?
I am not informed as to my "actual cost" utility break down	Breakdown by utility is missing
nothing	Nothing
none	Nothing
none	Nothing
none-very simple	Nothing
None	Nothing
I think I understand it well and it is clear to me.	Nothing

Question D3a – What Householders Liked About the Appliance-Specific Feedback Screenshot

Original Comment	Category (multiple permissible)
clarity and easiness	Clear layout/format
Clear and understandable.	Clear layout/format
The way the chart is set out.	Clear layout/format
Very clear easy to understand	Clear layout/format

I like this presentation very much	Clear layout/format
It is clear and easy to understand	Clear layout/format
easy to read and interpret...love it	Clear layout/format
this is very clear,	Clear layout/format
looks good	Clear layout/format
full layout-can see at a glance	Clear layout/format
all of the features; just add light bulb use	Everything
Everything! Great info provided.	Everything
the idea	The general idea/concept
the graphics and the detail	The granularity and detail
This indicator as it is very specific.	The granularity and detail
The breakdown of appliances	The granularity and detail
more specific info	The granularity and detail
That you listed all the appliances and the way it is set up.	The granularity and detail; Clear layout/format
the breakdown of usage	The granularity and detail
The specifics.	The granularity and detail
How I know which appliance is costing me the most or causing me to go over the target. It would help me to change my habits for the rest of the month. I also like how I don't have to wait until the end of the month for feedback.	The granularity and detail; The tracking progress and instant feedback
even better because now I can see exactly what appliances I need to cut back on to achieve my goal	The granularity and detail
nice to see the detail about what is the "culprit" of the electricity consumption...definitely would allow for adjustment of what we were doing with detailed info	The granularity and detail
That I can see where the goal is not being met so I can alter use in that area, if possible.	The granularity and detail; The tracking progress and instant feedback
this view and level of detail	The granularity and detail
shows me which appliance is not energy efficient, like the tracking feature	The granularity and detail; The tracking progress and instant feedback
The tracking graphic. More details per appliance and the usage %	The granularity and detail; The tracking progress and instant feedback
This one because there's more detail and I like the % allocation to show a saving of sorts.	The granularity and detail; The tracking progress and instant feedback
The accuracy of it.	The granularity and detail
how it is broken down by appliance	The granularity and detail
The level of detail. Exactly what I need to	The granularity and detail

know.	
breakdown & visual representation of progress in relation to goal	The granularity and detail; Clear layout/format; The tracking progress and instant feedback
That information is broken down by appliance so you can see where you're falling short.	The granularity and detail
Breaking out each appliance. How each appliance directly contributes. Cost for each.	The granularity and detail
How this allows me to pinpoint where I am using the most energy. I like that I can easily view the "tracking" symbols.	The granularity and detail; The symbols
that you can pinpoint which appliance you need to be more concerned about	The granularity and detail
This is showing what is actually using the energy.	The granularity and detail
specific to each appliance, allocated and actual and percentage display	The granularity and detail
Finding out what is not tracking and change whatever possible to meet the target.	The granularity and detail
Pin points where usage is occurring. Gives a "tracking" grade	The granularity and detail; The tracking progress and instant feedback
the granularity	The granularity and detail
helps to know exactly how my energy use is tracking towards target on each appliance	The granularity and detail
The table is excellent and the drill down is great.	The granularity and detail
The symbols in the last column and the comparison of allocated and actual costs	The symbols
That the costs that are not tracking are bolded. Highlight in red or yellow would be even better.	The symbols
Colours	The symbols
I like the tracking and the allocated money in dollars.	The tracking progress and instant feedback; Allocation in actual amounts
this analysis and tracking indicators very much	The tracking progress and instant feedback
It's nice to know this but how do you track it?	The tracking progress and instant feedback
interface, actually % of allocation used, allocated vs. actual cost	The tracking progress and instant feedback
Tracking again...easy to see. Actual cost. Little symbols beside appliance. You could even take out the words and put some real pictures.	The tracking progress and instant feedback; Clear layout/format; The symbols

Question D3b – What Householders Did Not Like About the Appliance-Specific Feedback Screenshot

Original Comment	Category (multiple permissible)
The method of displaying data. I'd like the last 2 columns (% of allocation, Tracking) to be replaced by a horizontal bar graph that shows "budgeted" and "actual"	Data visualisation - add horizontal bars for '% of allocation' and 'tracking'
Would like to see tracking over time - as in a bar chart - for one unit. Otherwise I'd need to check progress every day.	Does not provide daily breakdown
comparison to previous month's data	Historical comparison is missing
You may spend more than the information is worth.	Is information worth the cost to get it?
The fact that the expected amount is not shown and the total is not shown in this table.	Missing the expected amount in table; Total household goal is missing
other than the tracking icon, more colour is needed	Needs more colour
need more appliances	Not enough granularity
no electronics section	Not enough granularity
Can't think of anything.	Nothing
no suggestions	Nothing
nothing	Nothing
nothing	Nothing
none	Nothing
The little picture icons beside the names of the appliances. The %.	The little appliance images
Ambiguous icons for appliances that add no value, granularity of goals (don't want to set per-appliance goals)	The little appliance images; Too much information/granularity
The order of the columns (I think the % of Allocation Used should be the 2nd column, because it's easier to see for some reason)	The order of the columns
The other category is still a worry to me. I would like to see it break down the items into smaller sub groups (i.e. freezer).	The 'other' category is not broken down more
What is "other"?	The 'other' category is not broken down more
The 'other' would need to be specified	The 'other' category is not broken down more
"Other" - how granular can this list be broken down to?	The 'other' category is not broken down more

that "other" is such a big "mush" category - what if you provided a customizable category or two instead so that people could customize their energy reduction to areas where they feel they fall short (i.e. heating, air conditioning, outdoor lighting, phantom load).	The 'other' category is not broken down more
"Other" at 43% of usage needs further break down	The 'other' category is not broken down more
The symbols. Doesn't relate to the appliance and is not useful in any way.	The symbols/tracking column
don't need the tracking column...the percentage is clear	The symbols/tracking column
Percentage of allocation means nothing	The use of percentages
time period costs	Time period costs
Too much information. I might like this initially but to see this every month would be overload	Too much information/granularity
Lots of info	Too much information/granularity
Again don't think money is good method of determining usage as rates change.	Would prefer alternative unit
only reporting in dollars without other options	Would prefer alternative unit
The potential to become so obsessed with energy consumption for an appliance that might not be the most efficient, but would be costly to replace. Also, there is no option to switch to energy units (vs. $ amount). If I want to be become more literate in this area, I will need to be able to start seeing the units (e.g., kwh).	Would prefer alternative unit
That the screen doesn't show the current date, the total cost of the energy used or the goal to be achieved.	Current date is missing
The allocation of energy costs.	Too much information/granularity
too micro managed with no real benefit vs. time to manage	Too much work/effort
would like lines going down to separate it	Missing vertical lines between columns

Question D3c – What Householders Found Clear About the Appliance-Specific Feedback Screenshot

Original Comment	Category (multiple permissible)
savings	Actual usage/costs
usage	Actual usage/costs
allocated, actual cost, % of goal	Actual usage/costs; The goals

Actual cost	Actual usage/costs
everything	Everything
everything	Everything
all of it	Everything
Everything	Everything
everything	Everything
everything	Everything
What is shown here?	Everything
everything	Everything
all	Everything
yes	Everything
It all.	Everything
most of it	Most of it
most	Most of it
What is going well and areas that need more work.	Progress/tracking
progress with relation to goal	Progress/tracking
Where my energy efficiency goals are on target, where I'm in trouble and where I've blown it.	Progress/tracking
Progress vs. goals	Progress/tracking
the concept	The concept
the numbers and readings	The layout and presentation
quite clear	The layout and presentation
this is very clear,	The layout and presentation
the symbols	Use of colour/symbols
This indicator	Use of colour/symbols
tracking graphic	Use of colour/symbols; Progress/tracking
tracking and allocation	Use of colour/symbols; Progress/tracking

Question D3d – What Householders Found Confusing About the Appliance-Specific Feedback Screenshot

Original Comment	Category (multiple permissible)
Can I change my goals at any time of the month? Can I add a device? Computer or TV?	Can the appliance list change?; Can goals change part way through the month?
How will each appliance be tracked? Is there a device installed in each home? Does the homeowner pay for this tracking device?	How appliances will be monitored/allocations set

Where usage per appliance could be calculated. I don't know what my house's breakdown of use is - how on earth could I set goals on each of these appliances without knowing this?	How appliances will be monitored/allocations set
How is it possible to run a refrigerator at 1/3 of an allocated energy usage - its either a bad plan or the person goes around unplugging his refrigerator	How appliances will be monitored/allocations set; How to adjust behaviour for a fridge
how to set the allotments	How appliances will be monitored/allocations set
How do they know how much appliance is used per month?	How appliances will be monitored/allocations set
Same comment as the first screen, how will you know if you have allocated correctly?	How appliances will be monitored/allocations set
How do you get usage from a single appliance? That's impressive!	How appliances will be monitored/allocations set
Allocation info and percents. Don't understand how this works	How appliances will be monitored/allocations set
the bigger picture of what you are trying to put together	How this adds up to a household goal
I'd love to know how you increased the efficiency of your refrigerator without buying a new one.	How to adjust behaviour for a fridge
nothing	Nothing
nothing	Nothing
nothing	Nothing
n/a well done	Nothing
Nothing	Nothing
none	Nothing
it is all clear	Nothing
none	Nothing
none	Nothing
other usage	Other usage
What is "other"?	Other usage
I don't feel the need of tracking column. I'd like to see lights specified...do those new bulbs really save anything?	Other usage
category other- what other could potentially include	Other usage
% of allocation used.	Term '% of Allocation Used'
Percentage of allocation used.	Term '% of Allocation Used'
% of allocation used	Term '% of Allocation Used'
What is the % allocated I expected to use at	Term '% of Allocation Used'

this point in the month.	
the headings	The headings - in general
Terms "allocated" "actual cost" ... could use better explaining	The headings - in general
Same comment as before - "actual cost" refers to "actual cost to date", not "actual cost" for the energy used on the date shown.	The headings - in general

Question D4a – What Householders Liked About the Daily Consumption Graph

Original Comment	Category (multiple permissible)
Measured day by day so you can see how you're doing each day not just cumulative.	Daily summary
The daily usage. the bar graphs	Daily summary; Graphical presentation
Day to day feedback.	Daily summary
that it's daily	Daily summary
Great!	Everything
Nice graph but a bit complex.	Graphical presentation
Also excellent - graphic presentation expands data on previous screen	Graphical presentation
graphical nature	Graphical presentation
this graph and example	Graphical presentation
How visual it is	Graphical presentation
easy to understand graph	Graphical presentation
if it were monthly over 24 months	Graphical presentation
Nothing	Nothing
don't	Nothing
anything	Nothing
I don't like	Nothing
nothing	Nothing
absolutely nothing about this graph, there is too much tension in it	Nothing
Common sense is the most important thing we can use to save energy and money. Tracking it on an average is in my opinion is not the thing to do.	Nothing
Not a whole lot!	Nothing
Nothing about this screen.	Nothing
not much	Nothing
Number of days below and above average	Number of days below/above average
Days above Days below	Number of days below/above average
The days above and below average and the daily average goal and actual $.	Number of days below/above average

Very specific	The detail/appliance granularity
The detail. The comprehensive overview.	The detail/appliance granularity
the amount of information	The detail/appliance granularity
This because there's a lot of detail and it looks like one could track one's use and try and do better.	The detail/appliance granularity
Daily average. Each appliance over time. Each appliance as percentage of overall.	The detail/appliance granularity; The red line/daily average goal
The daily usage goal and the daily actual average as well as the number of days below and above.	The red line/daily average goal
red line as daily average goal	The red line/daily average goal
the daily bars & the budgeted red line	The red line/daily average goal; Graphical presentation
Red line indicating goal. Day by day usage (although you could include days of week under that too so I could say...I use a lot more, or lot less on Wednesdays). Very dramatic to see huge amount of black (guessing it's other...but could be fridge).	The red line/daily average goal; Daily summary
Information presented on the right side of the graph. It is clear, concise and easy to understand. I like the daily average and comparison to goal avg.	The red line/daily average goal
colors	Use of colours

Question D4b – What Householders Did Not Like About the Daily Consumption Graph

Original Comment	Category (multiple permissible)
The colour coding on the right. The colours around the different appliances need to be bolder. It does not jump out at you that the clothes dryer has a purple box around it.	Colour around the appliance images is too thin
Daily usage is too small a unit and yields too much data. The black/other area is too dominant.	Daily feedback; The 'other' category is too dominant
Tracking each day. Weekly would be better.	Daily feedback
Daily summary is pointless. It's the average that matters.	Daily feedback
too micro managed on a daily pattern	Daily feedback
Everything	Everything
Anything.	Everything
everything	Everything

the crowded space; it is easier to have separate fields for each appliance as opposed to them all stacked together	Goal for each appliance is missing
I like to see each specific appliance with its own line. What's all the black?	Goal for each appliance is missing; The 'other' category is too dominant
It would be helpful to look at one appliance as well. Can be confusing if more appliances are added.	Goal for each appliance is missing
the charts	Graphical presentation
bar graph	Graphical presentation
just not a fan of graphs,	Graphical presentation
the daily detail and the bar graph almost too much to look at here	Graphical presentation; Daily feedback
The graph. Too confusing, you need to keep going back and forth to the legend to figure out what is what and why is there so much black? Other is still too vague a category. I would also want the day of the week beside the date so I could quickly see weekend vs. weekday use.	Graphical presentation; Less user-friendly/clear; The 'other' category is too dominant; Would like 'day of week' indicated; The use of colours in the vertical bars
Everyone who has every taken a basic Statistics course should know that the graph type used above is difficult to interpret.	Graphical presentation
Graph difficult to interpret	Graphical presentation
graph would take getting used to	Graphical presentation
The graph. It is dark. Too much black. Looks ominous. Cannot get a clear picture without studying the graph. A graph should give an instant picture	Graphical presentation; The 'other' category is too dominant; The appliance amounts are not precise
The two reds make it harder to see things. The graph is difficult to interpret. There is too much black for other, so most of the graph is not useful. There are too many things to look at.	Graphical presentation; The use of colours in the vertical bars; The 'other' category is too dominant
lack of split between fixed and variable usage appliances	Lack of split between base-load and variable
confusing	Less user-friendly/clear
A little bit more complex but I am sure that I could figure out. Not too sure why all those color.	Less user-friendly/clear; The use of colours in the vertical bars
Looks a little less user friendly.	Less user-friendly/clear
It is unclear to me and takes more time to figure out	Less user-friendly/clear
I find it difficult to see what is being measured and what the results are. I find the chart confusing	Less user-friendly/clear; The appliance amounts are not precise

Seems more complicated, you really have to look hard to make sense of it.	Less user-friendly/clear
It's too complicated. I'd need a colour code lookup all the time	Less user-friendly/clear; The use of colours in the vertical bars
Usefulness - real world applicability - what does this mean to me? Not easy to tell.	Less user-friendly/clear
it is harder to read compared to past models	Less user-friendly/clear
pretty much everything- very confusing at first glance, would want it a lot easier to understand with a quick glance, clearer legend	Less user-friendly/clear
I don't think it adds any new information over the previous screen, but it is harder to understand because I cannot see the colours in the right hand key very well (the coloured lines are too thin)	Less user-friendly/clear; Colour around the appliance images is too thin
none	Nothing
This particular method of relaying information. It can't see how it tells me how much (specifically) that I am spending on the dryer, the washer etc. per day.	The appliance amounts are not precise
hard to understand each appliance	The appliance amounts are not precise
the idea	The idea/concept
Too much black. Don't like bars piled on top of each other.	The 'other' category is too dominant; The use of colours in the vertical bars
Too much black. Bad color for the bar. Also unclear which color corresponds to which appliance. Symbols are useless, please drop them.	The 'other' category is too dominant; The use of colours in the vertical bars; Use of appliance images/icons
The colour choices. The appliance icons	The use of colours in the vertical bars; Use of appliance images/icons
The harsh colouring and the very bold icons. That it does not show how close you are to the monthly goal(accumulative)	The use of colours in the vertical bars; Use of appliance images/icons; Progress to monthly goal is missing
Breakdown of appliances, ambiguous icons for appliances, lack of day of the week on x-axis (knowing that it was a Saturday or Sunday without looking at a calendar is useful information).	Too much information; Use of appliance images/icons; Would like 'day of week' indicated
Too much information. My kids would never look at this	Too much information
too much to figure out, colour and what appliance it represents	Too much information; The use of colours in the vertical bars

The fact that there is too much information. The units along the vertical axis and the horizontal bars are too small.... I can't see reading and making use of all of that. This doesn't allow me to see my goal for each appliance.	Too much information; Labels on the graph/axis are too small
Pictures in this one. Would be better as solid colors so old eyes could see well. Maybe you could put a small picture in the graph on the part of the bar representing it? Hard for really small slices though.	Use of appliance images/icons; Colour around the appliance images is too thin

Question D4c – What Householders Found Clear About the Daily Consumption Graph

Original Comment	Category (multiple permissible)
above and below average	Above/below average
Daily actual average.	Daily actual average
the red line the bright colours	Daily actual average
Where the daily average goal is, and how much each appliance is contributing to the bars.	Daily actual average; Appliance-specific contributions
the dates at the bottom of each bar	Dates on the x-axis
everything	Everything/most of it
most	Everything/most of it
all	Everything/most of it
yes	Everything/most of it
Nothing	Nothing/very little
don't	Nothing/very little
nothing	Nothing/very little
Doesn't work for me for many reasons.	Nothing/very little
hard to understand	Nothing/very little
nothing	Nothing/very little
I'm sure if I spent more time looking at this, I'd be able to understand something. But at a quick glance (as I did with previous charts), I don't understand much	Nothing/very little
very little	Nothing/very little
not much at first glance	Nothing/very little
All the information presented in the right.	Nothing/very little
It.	Nothing/very little
The concept.	The concept
the intentions	The concept

the names	The labels
This indicator.	This indicator
When I am over or under my total goal for the day.	Tracking relative to daily goal
How much is used each day	Usage per day
Overall snap shot of my usage by day	Usage per day

Question D4d – What Householders Found Confusing About the Daily Consumption Graph

Original Comment	Category (multiple permissible)
all of it	Everything/Most of it
it all	Everything/Most of it
The whole lot :)	Everything/Most of it
Everything else. I wouldn't use this screen because it is too confusing.	Everything/Most of it
The bar chart concept the lines	Graphical presentation; The red line/daily average goal
Looks a little less user friendly.	Graphical presentation
the bars	Graphical presentation
Don't get this kind of a bar graph: what's included in the huge black portion - other?	Graphical presentation; What's in the 'Other' category?
The overall visual display is too busy.	Graphical presentation
a lot of info on graph but would take a while for me to separate it all out to understand-hard to do at a glance	Graphical presentation
I'm a scientist and used to reading this type of graph-but someone may have a hard time getting that the clothes dryer by itself is not $2.20 on May 2nd...they may think it is all added up...	Graphical presentation
The entire graph	Graphical presentation
n/a	Nothing
none	Nothing
none	Nothing
none	Nothing
energy usage is hard to decipher	Precise amounts are harder to see
it is hard to relate to the colour bars to understand how you are doing in that area in meeting the goal.	Precise amounts are harder to see; Hard to understand progress
The details by appliance. It would be better to have separate graphs available for each appliance instead.	Precise amounts are harder to see

What each colour in each bar graph represents. For example, what does the black at the bottom and the purple at the top of each bar graph represent?	The colours in the vertical bars
Too hard to see small bars of colour for little-used appliances.	The colours in the vertical bars
the use of the bars and the colours are putting me off	The colours in the vertical bars; Graphical presentation
the graph is too detailed	The colours in the vertical bars
The difference between the gray and black	The colours in the vertical bars
I don't like the bar graph with everything piled on top of each other.	The colours in the vertical bars; Graphical presentation
need to have a clearer legend	The legend
Numbers????	The numbers
So the red line is the daily average goal of all the appliances together?	The red line/daily average goal
how to set the averages	The red line/daily average goal
"other" needs further breakdown	What is in the 'Other' category?

Appendix G – Chi-Squared Goodness-of-Fit Tables

Table 33

% of males				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	49.00	49.00	0	0
Survey	38.00	49.00	-11	2.469387755
				2.469387755

Age				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	37.20	37.20	0	0
Survey	44.00	37.20	7	1.243010753
				1.243010753

% in same residence one year ago				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	84.20	84.20	0	0
Survey	86.90	84.20	3	0.086579572
				0.086579572

Income				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	$ 53,626.00	$ 53,626.00	0	0
Survey	$ 58,756.00	$ 53,626.00	5130	490.7488905
				490.7488905

% with post-secondary education				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	43.00	43.00	0	0
Survey	93.00	43.00	50	58.13953488
				58.13953488

% of population employed				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	63.20	63.20	0	0
Survey	61.00	63.20	-2	0.076582278
				0.076582278

% owner occupied dwellings				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	66.70	66.70	0	0
Survey	82.00	66.70	15	3.509595202
				3.509595202

# of home occupants				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	3.20	3.20	0	0
Survey	3.30	3.20	0	0.003125
				0.003125

Household size				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	1200.00	1200.00	0	0
Survey	1155.00	1200.00	-45	1.6875
				1.6875

kWh of electricity per month				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	800.00	800.00	0	0
Survey	750.00	800.00	-50	3.125
				3.125

Energy intensity				
Sample	**observed (a)**	**expected (b)**	**(a-b)**	**(a-b)^2/b**
Ontario	0.67	0.67	0	0
Survey	0.65	0.67	0	0.000418314
				0.000418314

Table 53

Strongly agree

Home Energy	Average	Difference	Chi-squared stat	Critical value	Significance?
41	28	12.6	5.590141	3.8415	yes
33	57	-23.8	9.972535	3.8415	yes
34	49	-15.2	4.695935	3.8415	yes
34	62	-27.6	12.36623	3.8415	yes
38	12	25.8	54.56066	3.8415	yes
22	31	-9	2.612903	3.8415	no

At least agree

Home Energy	Average	Difference	Chi-squared stat	Critical value	Significance?
71	71	0	0	3.8415	no
75	94	-19	3.840425532	3.8415	no
62	81	-19.4	4.623587224	3.8415	yes
82	93	-11.4	1.39143469	3.8415	no
77	30	47	73.63333333	3.8415	yes
49	59	-10.4	1.820875421	3.8415	no

At least somewhat agreed

Home Energy	Average	Difference	Chi-squared stat	Critical value	Significance?
95	85.6	9.4	1.032242991	3.8415	no
86	99	-13	1.707070707	3.8415	no
76	91.4	-15.4	2.594748359	3.8415	no
94	97.8	-3.8	0.147648262	3.8415	no
94	52	42	33.92307692	3.8415	yes
77	76	1	0.013157895	3.8415	no

Appendix H – Chi-Squared Contingency Tables

Table 35

C2 and C1	*financial*	*environmental*	*something else*	TOTAL
Strongly agree	15	20	1	36
Agree	4	12	5	21
Somewhat agree	5	4	7	16
TOTAL	24	36	13	73
chi-squared stat	15.582			
degrees of freedom	4			
p-value	0.0036			
chi-squared critical value	13.2767			

Table 46

E7 and C1	*male*	*female*	TOTAL
Strongly agree	8	14	22
Agree	8	12	20
Somewhat agree	5	9	14
Neither	1	1	2
Somewhat disagree	0	1	1
Disagree	1	1	2
Strongly disagree	23	38	61
chi-squared stat	0.948		
degrees of freedom	5		
p-value	0.9666		
chi-squared critical value	11.0705		

E15 and C1	*High school*	*Trade school*	*College*	*Uni. below bachelor*	*Bachelor*	*Medicine*	*Master*	*PhD*	TOTAL
Strongly agree	1	0	5	0	7	1	2	6	22
Agree	0	1	4	1	5	2	5	2	20
Somewhat agree	1	0	1	2	7	0	2	1	14
Neither	0	0	0	0	2	0	0	0	2
Somewhat disagree	0	0	0	1	0	0	0	0	1
Disagree	1	0	0	0	1	0	0	0	2
Strongly disagree	3	1	10	4	22	3	9	9	61

chi-squared stat	43.0509
degrees of freedom	35
p-value	0.1647
chi-squared critical value	49.802

Table 47

C18 and C1	*Yes*	*No*	TOTAL
Strongly agree	16	5	21
Agree	15	5	20
Somewhat agree	2	8	10
Neither	0	2	2
Somewhat disagree	0	1	1
Disagree	0	1	1
TOTAL	33	22	55

chi-squared stat	16.8353
degrees of freedom	5
p-value	0.0048
chi-squared critical value	11.0705

C19 and C1	*Yes*	*No*	TOTAL
Strongly agree	15	0	15
Agree	15	1	16
Somewhat agree	3	1	4
TOTAL	33	2	35
chi-squared stat	3.679		
degrees of freedom	2		
p-value	0.1589		
chi-squared critical value	5.9915		

Table 49

E7 and D4e	*male*	*female*	TOTAL
Strongly agree	4	7	11
Agree	3	5	8
Somewhat agree	5	3	8
Neither	4	4	8
Somewhat disagree	2	3	5
Disagree	2	6	8
Strongly disagree	3	9	12
TOTAL	23	37	60
chi-squared stat	3.9675		
degrees of freedom	6		
p-value	0.6811		
chi-squared critical value	12.5916		

E15 and D4e	*High school*	*Trade school*	*College*	*Uni. below bachelor*	*Bachelor*	*Medicine*	*Master*	*PhD*	TOTAL
Strongly agree	0	0	2	2	3	0	2	2	11
Agree	0	0	4	0	1	1	0	2	8
Somewhat agree	0	0	0	0	4	0	1	2	7
Neither	1	1	0	1	3	0	3	0	9
Somewhat disagree	1	0	2	0	1	0	0	1	5
Disagree	1	0	0	1	3	1	1	1	8
Strongly disagree	0	0	2	0	6	1	2	1	12
TOTAL	3	1	10	4	21	3	9	9	60

chi-squared stat	41.86
degrees of freedom	42
p-value	0.477
chi-squared critical value	58.12

C10 and D4e	*Day*	*Week*	*Month*	*3 month*	*Year*	*Year +*	*Other*	TOTAL
Strongly agree	1	3	7	3	1	0	0	15
Agree	1	2	4	2	3	0	1	13
Somewhat agree	1	1	5	1	1	0	0	9
Neither	2	2	4	2	2	1	0	13
Somewhat disagree	0	2	2	0	0	1	0	5
Disagree	2	1	4	3	1	0	0	11
Strongly disagree	3	2	8	2	4	0	0	19
TOTAL	10	13	34	13	12	2	1	85

chi-squared stat	26.7534
degrees of freedom	36
p-value	0.8686
chi-squared critical value	50.9985

C16 and D4e	*Display*	*Web Portal*	*Bill*	*Info Sheet*	*Email*	*Other*	TOTAL
Strongly agree	3	5	2	0	0	0	10
Agree	0	6	1	0	0	1	8
Somewhat agree	4	2	2	0	0	0	8
Neither	1	1	4	1	1	0	8
Somewhat disagree	1	0	3	0	1	0	5
Disagree	3	4	0	0	0	0	7
Strongly disagree	3	4	2	1	1	0	11
TOTAL	15	22	14	2	3	1	57

chi-squared stat	35.002
degrees of freedom	30
p-value	0.2426
chi-squared critical value	43.773

C17 and D4e	*Real-time*	*hourly*	*daily*	*weekly*	*monthly*	*other*	TOTAL
Strongly agree	4	0	3	2	4	0	13
Agree	6	0	1	2	4	1	14
Somewhat agree	5	0	1	2	3	0	11
Neither	2	0	1	0	6	0	9
Somewhat disagree	2	0	0	0	4	0	6
Disagree	4	0	2	3	3	0	12
Strongly disagree	7	1	2	2	4	0	16
TOTAL	30	1	10	11	28	1	81

chi-squared stat	21.6595
degrees of freedom	30
p-value	0.8661
chi-squared critical value	43.773