Evaluating Tailored Feedback for Re-Engaging Residential Smart Grid Users: A Case Study in Milton, Ontario

by

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Author's Declaration

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

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Abstract

A rapidly changing climate, predominantly caused by carbon-intensive human activities, has stimulated policies and programs to reduce greenhouse gas emissions (GHG's). One area in which GHG reductions are being made is in the electricity sector. In the province of Ontario, the shutting down of all coal fired plants in 2014 and the adding of clean energy sources have contributed to this shift away from GHG emitting fuel sources. In addition to this, the widespread adoption of smart meters, time-of-use pricing, and the fostering of a 'conservation culture' have been put forth to promote reductions in total and peak consumption through widespread access to electricity information. Reducing electricity consumption and shifting consumption to off-peak hours is important because it helps avoid investment in the up-keep of electricity systems, increases energy security, and decreases emissions produced from carbon-intensive sources used during times of peak demand.

Electricity reporting studies have sought to provide detailed feedback in the hopes of enhancing awareness and further reducing electricity consumption. While many studies have conducted research on the effectiveness of short term feedback, this study focuses on a case study of 26 households whom have been engaged in electricity interventions over a three-year period. Previous research on this case study, found that household engagement dropped off after the first few months. Therefore, this research seeks to understand the effectiveness of feedback to re-engage long-term smart grid users.

Throughout the course of a 30-week study period, households were provided with disaggregated appliance feedback and aggregate household feedback on electricity use on a weekly basis to encourage users to reduce overall consumption or to peak shift to hours of the day with a lower electricity demand. Household consumption from the monitoring period is compared to the baseline period to determine whether households made behavioural changes and reduced total or on-peak consumption. Those who achieved the greatest savings relative to the baseline period in each given month were awarded with a certificate and a public announcement of their success was delivered to all other households partaking in the study.

The weekly feedback reports categorized households into quintiles based on their electricity use relative to others in the study, listing them as 'very efficient', 'low consumers', 'average', or 'high consumers', or quintile 1, 2, 3, 4/5, respectively. From this, it was determined whether higher consuming households became motivated to match the consumption of the very efficient consumers.

To further encourage conservative energy practices, tips were sent out with the weekly reports to those households belonging to quintiles 3, 4, and 5, to encourage households to moderate specific appliances and reduce consumption to match that of the efficient households. Total consumption in kWh and on-peak share of the week following and month following were compared to the week and month prior to

the tip. The average change the week following a tip for the AC, laundry and media centre were 0.5, 3.5, and 2.4 kWh/week, respectively, and a 0.2% increase, and reduction of 1.4%, and 2.2% in on-peak share, respectively.

Based on the results of this inquiry, households at the aggregate level reduced consumption. This is attributed to the provision of feedback, the use of tips, and outside factors. On average households made reductions in total electricity consumption by **10.4%** before and after the intervention, over the course of 30 weeks (not normalized for temperature). A further seasonal analysis demonstrates a decrease of **4.5%** for the 12 week summer period, and a reduction of **11.5%** for the 18 week fall/winter period.

An analysis of quintiles found a change in use by higher consuming residential quintiles towards the lowest consuming quintile.

Following the presentation of a tip, households made reductions to particular appliances in total use (AC, washer/dryer, and media centre), and peak share (washer/dryer, dishwasher, and media centre) for both the week and month analysis. On average, there is a 1.6 kWh/week reduction in the week following a tip, and a 0.4 kWh/month reduction in the month following. For the peak share, there is an average 2.6% reduction the week following a tip, while the month following there is an average 0.4% increase.

Comparing this study to others in which households are newly selected for the particular study, in which there are average savings of 12.3%, this study has an average savings of 10.4%. Despite the assertion that electricity monitoring devices eventually become 'backgrounded' in households, (Hargreaves *et al.*, 2013), participants were still able to make reductions in electricity consumption (in terms of total or peak share) throughout the 30 week study period, resulting in similar reductions to those found in other studies in which participants are newly engaged with feedback interventions.

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CDD	Cooling Degree Days
EHMS	Energy Hub Management System
GHG	Greenhouse Gas
HDD	Heating Degree Days
TOU	Time-of-use

Chapter 1: Introduction

With energy demand on the rise as a result of population expansion and growing trends in consumption, questions have arisen about how to sustainably meet the demand. Two main concerns have been identified: the finite supply of fossil fuels, and the pollution generated from using such fuels (Kulkarni, Welch, & Harnett, 2011). According to the Intergovernmental Panel on Climate Change (IPCC, 2007), approximately 27 gigatonnes of carbon dioxide equivalent (CO2e) are released annually. Of that, electrical generation accounts for 10 gigatonnes, or 37% of global emissions. In response, policies have been established to decrease emissions associated with fossil fuel sources and enhance energy efficiency standards (Stern, 2007). This involves not only diverting from the use of fossil fuels, but also reducing the overall demand for energy. Although renewable energy sources can be seen as an alternative means to meet energy demand; there are new issues introduced, such as their integration into the power system (Gungor et al., 2010).

One solution proposed to address some of these challenges is the smart grid. The smart grid is a system which enables the integration of renewable generation sources, facilitates smart home energy features that encourage conservative energy use, records consumption data, and helps utilities identify and fix outages more readily (Choi et al. 2011). The province of Ontario was an early adopter of smart meters and has been recognized as a leader in smart grid technology (Ministry of Energy, 2013a). Working in unison with time-of-use (TOU) pricing, a demand management pricing scheme in which hours of the day are categorized by on-peak, mid-peak or off-peak; smart meters encourage users to consider how and when they use electricity (Ministry of Energy, 2013a). Uniting these two initiatives, residents are able to moderate their electricity consumption by using consumption information and save money by using the TOU pricing.

Conserving electricity produces 'winners' in multiple respects. For instance, when consumers lower their consumption, they also lower their electricity bill and can decrease their carbon footprint. With regards to the electricity infrastructure, conservation and peak shifting reduce or avoid further investment in electricity systems as the required peak system capacity is reduced. Companies or utilities benefit from the positive public image or tax breaks for contributing to a reduction in greenhouse gas emissions (Faruqui et al., 2010). That being said, many jurisdictions have set forth initiatives in which conservation is a priority. This is the case for Ontario.

Coinciding with the smart grid initiative, the provincial government has sought to foster a 'conservation culture' which encourages individuals to use energy resources more efficiently and effectively (Ontario Power Authority [OPA], 2013). Enabling transparency with electricity use and time-of-use pricing, residents are able to better understand how they can conserve electricity and reduce their demand during peak hours. In Ontario, peak consumption is also more carbon intensive as natural gas fired plants are brought online to supplement the nuclear, hydro, wind and solar supplies. By reducing consumption during the peak hours, there is a lessened dependence on fossil fuel sources for electricity production; making conservation an important strategy for reducing greenhouse gas (GHG) emissions and reaching climate targets.

Although it is generally understood by the Canadian population that consumption behaviours must be altered in order to reverse the predicted outcomes of climate change (Ostry & Woollard, 2000), there continues to be limited participation in conservation efforts. As a result, this research seeks to understand how to foster more conservative electricity behaviours within households through the use of feedback. While there is an abundance of research on the short term effects of feedback on electricity consumption, less is known regarding the effect of feedback on households whom have been engaged in electricity interventions over the long term (3-4 years). Previous research on this case study, found that household engagement dropped off after the first few months. Therefore, this study focuses on 26 households with an Energy Hub Management System (EHMS) installed in their homes, to better understand how customized, comparative feedback may be used as a re-engagement tactic to change electricity consumption patterns.

Utilizing social norms to establish a rating for households has long been used to carry out behaviour based research (Allcott, 2011; Chen et al., 2011; Jain et al., 2013; Schultz et al., 2007; Stern, 1992). Social norms have been found to impact individual consumption behaviours, and because of this, have been used as a method for encouraging high electricity consuming individuals to reduce their consumption to match that of the norm. The social comparison technique, originally proposed by Festinger (1954), allows individuals to compare themselves to others and to improve their behaviours in order to align themselves with others. Therefore, for this study, participants were provided with information about other households to see whether they would moderate high consumption behaviour to move toward that of the lowest cohort of consumers.

To set the context for this research, the processes that inform decision-making and influence personal consumption, as well as the various forms of feedback, are reviewed. By understanding these processes, a feedback instrument can be designed to effectively re-engage households and lead to more conservative energy behaviours. The results of this initial inquiry then inform the detailed case study where weekly electricity reports were electronically delivered to each of the participating households. This research then examines the changes in consumption following customized, comparative feedback as a re-engagement technique for households that have had access to TOU pricing and smart grid tools for an extended period (multiple years). This research also furthers our understanding of consumption responses following customized feedback that compares individual households to average and lowest consumption quintile norms.

The primary research objective is to evaluate the impact of customized, comparative feedback in households who are long term users of smart grid tools, on electricity consumption levels and peak shifting. This is addressed through four research questions:

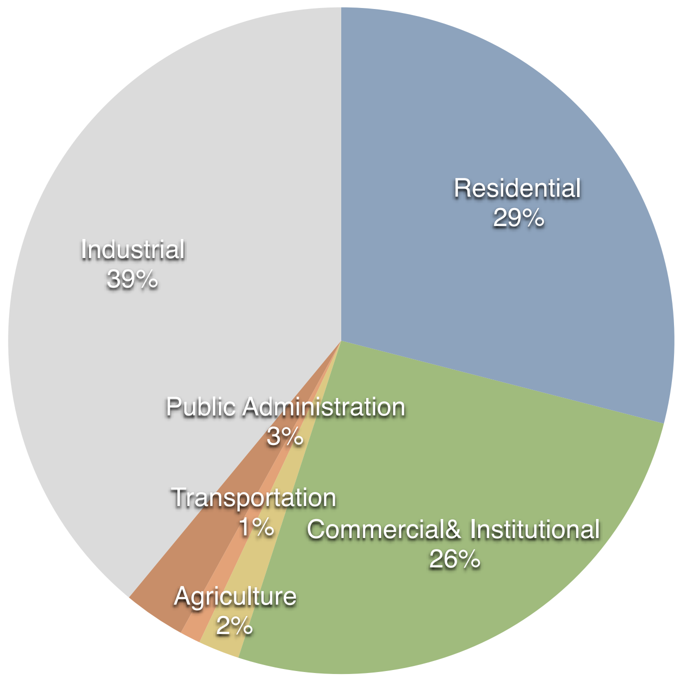
1. When provided with feedback, how do households respond/alter their consumption from the previous (baseline) year?
2. Does the eliciting of social norms result in a shift in household consumption levels towards the most efficient cohort of consumers or towards average consumers?
3. When provided with an appliance-specific tip, did households reduce the total or on-peak consumption of the appliance?
4. How do the results of this study, using households whom have been engaged in electricity interventions over multiple years, compare to other studies, in which households have been introduced to short term electricity interventions?

In the following sections a summary of residential electricity use is provided, along with a description of the Energy Hub Management System used in this study to access household consumption information.

1.1 Residential Electricity Use

Within Canada, electricity use has grown at a rate of 1.2% per year since 1990 (NRCan, 2009), Currently, 55% of electricity demand comes from the residential and commercial-institutional sectors, as shown in Figure 1.1.1, providing an opportunity to make an impact with conservation programs designed for these high consuming sectors (NRCan, 2009).

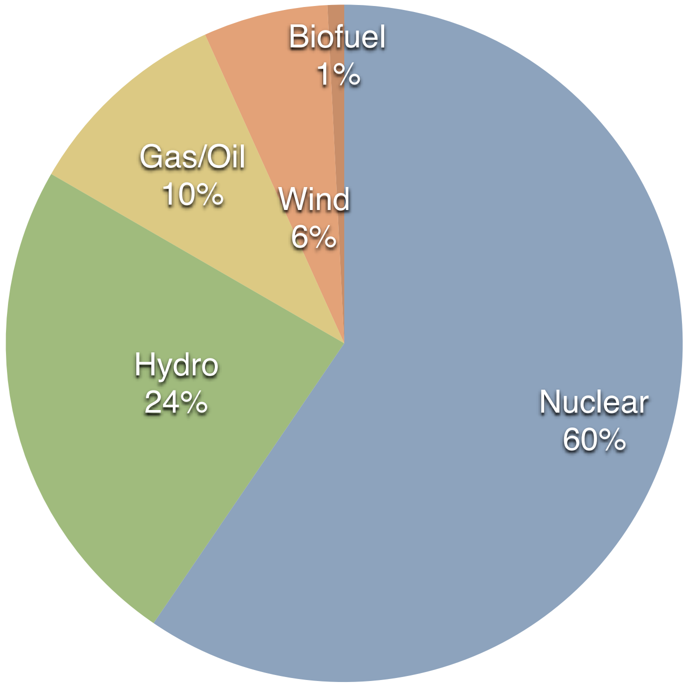
Figure 1.1.1 Electricity Demand by Sector in Canada (2012)



Source: Statistics Canada, Catalogue no 57-003-X, Report on Energy Supply and Demand in Canada, 2012 Preliminary. Table 1-1.

On top of this, the demand for electricity during peak hours is growing faster than total electricity use, a demand which is heightened during summer cooling or winter heating months (Rowlands, 2008). In Ontario, the electricity supply is made up of nuclear (60%) and hydro (24%) for baseload, with natural gas powered plants primarily operating during peak hours (10%), Figure 1.1.2. These peaking plants provide an opportunity to reduce GHG emissions by steering consumption away from these peak hours.

Figure 1.1.2: Ontario Electricity Supply Mix (2015)



Source: IESO (2015) Ontario Current Supply Mix Retrieved from http://www.ieso.ca/Pages/Power-Data/Supply.aspx on August 29, 2015

Leading up to 2003, the province of Ontario experienced many problems with its electricity system: a declining supply caused by the waning state of energy infrastructure, a reliance on polluting energy sources, such as coal, and a lack of long-term planning (Ministry of Energy, 2013b). To alleviate these issues, the province set forth multiple initiatives to increase and stabilize supply, by upgrading transmission lines and adding clean energy sources, as well as focusing on reducing emissions from generation by shutting down coal fired plants by 2014. To help lessen the demand for electricity, the province also re-established conservation programs in 2005, to encourage all sectors to reduce their energy consumption and use energy more efficiently. In addition to this, the province began long term energy planning, with the creation of the Integrated Power System Plan (IPSP) in 2007, which helped delineate realistic targets to manage the province's energy system (Ministry of Energy, 2013b).

An updated version of this plan, the Long Term Energy Plan (2013), has set forth five major goals: cost effectiveness, reliability, clean energy, community engagement, and conservation and demand management (Ministry of Energy, 2013b). In accordance with these principles, the province plans to reduce future electricity demand growth through the expansion of conservation programs and improved energy efficiency standards. Smart grids, peak saver (plus), on-bill financing, dynamic pricing, and retrofit programs are all examples of how this is being accomplished (Ministry of Energy b, 2013). A kilowatt-hour (kWh) conserved is now considered equivalent to a kWh generated: in 2012 conservation accounted for 7.6 Tera-Watt hours (TWh), or 5% of the supply mix (OPA, 2013). By 2030, conservation is expected to account for up to 27.7 TWh, approximately 14% of the supply mix (OPA, 2013).

Through the expansion of the smart meter and other demand management initiatives throughout the province, it is hoped that a reduction in overall electricity demand will be attained, and conservation goals designated by the Long Term Energy Plan (2013), reached.

1.2 The Energy Hub Management System

The Energy Hub Management System (EHMS) is a tool which combines data from the smart meter, circuit meters, system factors and a customized computer model to relay electricity information to households via a web-site (Shulist, 2013). The system can display household or appliance level consumption data to allow for greater transparency with energy reporting. For the purpose of this research, the system is used to record both appliance and household level data to determine whether the prompting of feedback elicits changes in behaviour. The 26 households partaking in the study each have an EHMS installed in their home and have access to an online portal to ascertain their consumption on a 5 minute, hourly or daily basis.

1.3 Thesis Outline

The following chapters of this thesis will provide background, methods, and outcomes of the research undertaken. Chapter two begins with a review of the relevant literature, and provides a background for understanding the decision-making processes, and energy feedback reporting. This opens the discussion on the types of feedback that will prove most successful, and how to encourage conservative energy use through the application of key ideas from books, reports and online journal articles. Chapter three will then present how the project will be undertaken, i.e. the research methods. The key processes and actions undertaken in the research are summarized. Data sources, such as surveys and electronically recorded consumption data, will provide qualitative and quantitative data for analysis and interpretation. Chapter four presents the results including the results from surveys, the weather normalization results, the general change in consumption following feedback, the comparison amongst quintiles, the response to tips, the results of the monthly certificate, and the comparison to other studies. In this chapter, the results are compared and analyzed. Finally, Chapter 5 presents the conclusions of the thesis, identifies limitations to the research and makes recommendations for research to be undertaken in the future.

Chapter 2: Literature Review

In order to gain an understanding of residential energy consumption and the basis for conserving energy within this sector, a literature review examining the three broad concepts of energy based decision-making, best practices for feedback, and the various ways to measure consumption were undertaken. This literature was retrieved primarily through the use of Google Scholar and Scholar's Portal to collect peer reviewed journal articles and book excerpts. The purpose of this literature is to provide a background covering previous research on the various factors influencing residential energy decision-making. The literature identifies the preferred features of feedback systems, to increase the potential for consumption changes following feedback. The three models of decision making will be reviewed: the microeconomic model, the behavioural economic model, and the social and environmental psychology model. Consumers' attitudes towards feedback can demonstrate the ways in which individuals will be most receptive to receiving energy consumption data, thus prompting them to change their energy behaviours and distinguishing feedback best practices. Therefore, it is important to understand various factors of feedback that may enhance or hinder responses to feedback. Changes in consumption can then be measured in a variety of ways, which encapsulate the amount of electricity used, the associated cost or savings, or the associated carbon emissions. For instance, a shift in energy use from peak hours can lead to a decrease in fossil fuel use; however, it may not reduce total electricity use. These measurements are then summarized to outline the effect that presentation of data may have on the interpretation of feedback. These topics, build a foundation for the reasoning behind this research and demonstrate how the analysis of household consumption changes can further the understanding of fostering conservative electricity practices.

2.1 Models of Decision Making

Many authors have sought to understand consumer decision making processes with regards to energy use. Multiple models have been developed that incorporate a variety of components, from economic means to socio-cognitive processes. Models are typically used to explain household energy use because, in Western countries, while consumers may be concerned with energy use (Abrahamse, 2007); they often do not consume according to their concern, i.e. household energy use increased (Steg, 2008). In part, this problem is caused by many consumers having a lack of understanding regarding where and how energy is used in their home (Steg, 2008). Due to this, people make choices based on a variety of factors, which are then used to explain decision-making and energy consumption, as presented below.

2.1.1 Microeconomic Model

The first school of thought to explain energy decision-making is based on the rational-actor theory. This model is derived from the microeconomic theory of "utility maximization and consumer rationality" (Gyamfi et al., 2013, p.73). This perspective assumes that consumers are aware and understanding of their surrounding environment, and from this, are able to calculate preferences based on efficiency and personal benefits, which are primarily driven by individualistic and economic means (Simon, 1955). It does not account for non-rational behaviour, as it is modeled upon how people should act, rather than how they necessarily do act (Simon, 1959). Therefore, the basis of this theory is founded on an individual's ability to act predictably.

Authors such as Evans (2011) support this theory and suggest that through the economic downturn there has been a return to frugality or 'sustainable consumption', resulting in more cautious consumers. This frugal behaviour has led to the sparing use of money, as well as resources, such as energy (Evans, 2011). With the limited supply of economic resources, consumer attitudes have reflected those of the rational economic model by reducing their consumption in order to maximize their economic means. Consumers, therefore, rationalize their behaviour based on financial means. Yan and Lifang's (2011) study corroborate this idea, by suggesting that as quality of life, measured by income within households increases, greater energy consumption occurs; whereas, when quality of life decreases, people will modify their behaviour accordingly, and reduce their consumption.

Although this theory is corroborated by some studies, there are many issues concerning its overarching validity in the case of energy use. Firstly, it assumes people have all the information necessary to make logical decisions, which is commonly not the case. An example of this is that many homeowners are unaware of which appliances in their home consume the most energy, or how the source of energy may change based on quantities of consumption (Steg, 2008). Due to the lack of understanding of energy use in many households, attempts to conserve energy based on the rationale that it would save them money, may not be sufficient to do so. This theory also assumes rationality of the individual and self-serving tendencies (Simon, 1959). Many individuals do not act according to this single rationale, as they are motivated by outside factors, creating inconsistencies in habits, and occasionally sacrifice self-gratification for the benefit of others (Lutzenhiser, 1993). Overall, although the model fails to accurately predict individual behaviours, it is useful to capture societal trends at the aggregate level (Wilson & Dowlatabadi, 2007).

The effectiveness of the rational economic theory as a motivator for conservation is strongly related to the pricing of energy. The nominal price of electricity in Canada may hinder the desired outcomes of conservation. For instance, Gillingham & Palmer (2014), have found that the low cost of energy lessens the effect of conservation efforts since the low prices create an "energy efficiency gap", in which despite having an abundance of energy saving devices available, such technologies are not universally adopted (Gillingham & Palmer, 2014). Despite economic motivation playing a role in energy consumption, the literature suggests that there are other factors which may be more significant in the decision-making process, as the model is too simplistic to fully represent how and why individuals consume energy.

2.1.2 Behavioural-Economic Model

To fill in some of the gaps from the previous model, a second model utilizing a more integrated approach to energy consumption through the inclusion of psychological aspects was created. While the rational economic model suggests individuals are fully informed when making decisions, the behavioural model acknowledges this is not always the case. Instead, consumers have a bounded rationality that is based on their individual experience and information (Sen, 1977). Therefore, their decision heuristics are personally founded techniques to solve problems, which may produce a less than optimal outcome due to limited cognitive abilities (Camerer *et al*., 2011; Mullainathan & Thaler, 2000). These decisions are largely framed by outside sources, called the framing effect, which can steer how a choice may be perceived (Allcott & Mullainathan, 2010). Framing is largely dependent upon processes, including: anchoring and status quo (Wilson & Dowlatabadi, 2007). Anchoring refers to using the most simplistic and accessible information found, and not seeking out further information which may contradict their current understanding. Status quo is what is considered normal within a given context or location. These understandings are also time dependent, as people typically make decisions based on short term priorities or concerns (Wilson & Dowlatabadi, 2007). People then make a decision based on whether the information speaks to their personal beliefs (Allcott & Mullainathan, 2010). Therefore, decision-making under this model is constrained by rationality on the individual level.

The bounded rationality of the participants is evident in Steg's (2008) study. The sampled subjects relayed confusion regarding the energy requirement of appliances, believing that the larger appliances consumed greater amounts of energy. Through greater education, individuals become aware of where and how they consumed energy in order to reduce their usage in areas where they could achieve the greatest savings. Education can also teach homeowners how to operate appliances optimally, thus allowing for savings without greatly modifying behaviour (Wood & Newborough, 2006). Through increased awareness, people were able to make more informed decisions regarding energy use.

Despite the rationale that with increased knowledge, consumers may be able to act more conservatively, this does not always occur. In a study conducted by Geppert & Stamminger (2010), households were given energy saving tips and informed of the expected financial compensation when following these tips. Despite receiving knowledge on ways to conserve energy, the majority of consumers did not follow the recommendations. It was found that outside factors, such as lifestyle, may have hindered their ability to partake in energy saving behaviours, thus proving that decision-making is complex at the individual level.

Expanding individual knowledge can increase conservation awareness and understanding, however, there are limitations to the extent to which consumers will incorporate these ideas into their behaviour. When conservation conflicts with the comfort or convenience of the homeowner, it is less likely to occur (Yan & Lifang, 2011; Steg, 2008). This can refer to practices such as reducing heating during the winter months or air conditioning during the summer months, which may reduce consumers' comfort in their homes. This also involves conservation efforts that involve greater behavioural changes, such as doing laundry during 'off-peak' hours, as the timing may not fit into the individual's schedule. Therefore, conservation that requires significant adjustment to the consumers' lifestyle or comfort may prove to be more difficult to achieve.

2.1.3 Social and Environmental Psychology

Another model used to understand decision-making processes is based on social and environmental psychology. This model recognizes many factors contributing to energy behaviours, ranging from personal benefits, to social norms and environmental knowledge. In order to foster pro-environmental beliefs, the model focuses upon "changing people's knowledge, perceptions, motivation, cognitions and norms" (Steg, 2008, p. 4450). The idea of changing such behaviours is based upon the theory of planned behaviour in which decisions made by individuals are highly related to attitudes and social norms that shape intentions and behaviors (Ajzen, 1991). Therefore, if you can change attitudes towards an activity or the social norm, individuals will more readily alter behaviour accordingly.

In the following sections pro-environmental attitudes, consumer habits, and social norm concepts will be discussed to further understand the complex decision-making process relating to social and environmental psychology.

2.1.3.1 Attitudes

Many researchers have attempted to understand the ways in which attitudes are formed and the ways they affect environmental behaviour (Ajzen, 1991; Bamberg & Möser, 2007; Barr & Gilg, 2006; Clark *et al*., 2003). Based on the findings in the literature, there are two presiding factors: self-interest and pro-social motives. According to Bamberg & Möser (2007), attitude, perceived behavioural control, and social norms impact the extent to which an individual will act environmentally. These are founded in an individual's moral/social norms, and their guilt and attribution. To foster moral norms, an individual must have an awareness of environmental issues, and from this, attribute these as negative behaviours, thus creating feelings of guilt if they commit such behaviours. Therefore, the individual will strive to avoid penalties and rather seek out rewards (Ajzen, 1991).

Another interpretation by Kaiser *et al*. (1999), suggests that there are three main elements which determine environmental behaviour. First, environmental knowledge determines what the individual knows or understands about the environment. Second, environmental values, meaning how the individual views the environment and its perceived usefulness and, third, ecological behaviour intention, meaning an individual's intention to act to benefit the environment. These three elements in combination may infringe or enhance an individual's ability to act environmentally.

In Barr & Gilg's (2006) study, the ways in which environmental attitudes are formed, and how behaviours reflect the adoption of 'green' activities are discussed. According to their study, certain personality traits reflect greater environmental concern. These traits include: less desire for wealth and more cumulative attitudes attributed to positive environmental behaviour. On the other hand those who see humans as dominant to nature, were less supportive of pro-environment behaviours.

Although attitudes towards environmental concern may be present, they are also flexible. Greater knowledge of environmental issues or concerns, or effects of consumption decisions, can lead people to alter their behaviour to more conservative actions (Steg, 2008; Hall, 2011). Information alone may not result in a significant change, however, engaging individuals on a personal level can improve conservation capacity (Barr & Gilg, 2006).

Additionally, many theories promote increasing individual knowledge to enhance environmental practices, however, many individuals have a strong contradiction between their beliefs and performance, described as cognitive dissonance (Festinger, 1962). Although people may, when questioned, state that they use energy sparingly, in reality, they may not act as conservatively as they claim. For example, in Costanzo *et al*. (1986), it was found that people who claimed conservation was the best strategy for changing the future of energy were no more likely to perform energy conserving actions than those who did not make such claims. Therefore, fostering renewed perspectives and behaviors can be difficult, particularly when the individual has low self-efficacy, in which they do not believe in their ability to complete tasks or reach goals (Festinger, 1962). However, perspectives towards energy can be changed through the expansion of access to information, demonstrating connections between outcomes and personal efforts, and by providing social encouragement (Bandura, 1986).

2.1.3.2 Habits

Energy conservation and the ways in which individuals choose to reduce their consumption are highly dependent upon habits. Since many individual's routines are highly regimented, it can sometimes prove difficult to alter these processes. This is particularly evident when saving energy means inputting large sums of money, effort, or inconveniences (Steg, 2008). The difficulty with habits is that they are hard to break. Once an individual has a set routine, it may prove challenging to alter that behaviour to save energy. Matthies's (2005) model of routinized or habitual behaviour and conscious decisions summarizes these challenges. According to Matthies, habitual behaviour refers to actions that are taken without a conscious effort, that are typically performed on a regular basis. In order to establish new habits, a consumer must make a conscious effort to alter their current behaviour. This can prove difficult, as previously mentioned, due to the lack of thought put into routine actions. In order to change the behaviour, the individual must have the strong desire to change.

In addition to the habitualized routines undertaken by individuals, there are some activities that are time-specific. For instance, in Goulden *et al*.'s (2014) study, participants described their inability to change certain tasks to off-peak hours, such as showering at 7:00am before work, or cooking dinner for their family. Pierce, Schiano, & Paulos (2010), support this theory, suggesting that due to the increase of digital devices, there is a lack of acknowledgement of daily tasks, and thus energy use. Instead, it is micro-level systems, such as the thermostat, and macro-level systems, such as HVAC standards, that most strongly contribute to everyday energy use. As a result, studies have focused upon how to alter consumer habits, particularly those that are routinized. Fischer (2008) states that in order for new? habits to be formed, there must be a long term strategy to do so. For instance, when delivering feedback reports, reporting should occur over a longer term, in order for the household to habitualize their conservative behaviours, and thus continue to follow these regimes after the feedback has concluded.

2.1.3.3 Social Norms

The relationship between social norms and behaviour has been extensively researched (Allcott, 2011; Chen et al., 2011; Jain et al., 2013; Schultz et al., 2007; Stern, 1992). It has been found that social norms not only stimulate action, but also directly steer action within individuals (Schultz et al., 2007). According to Guagnano, Stern, & Dietz (1995), social influences formulate the foundation of values, shape beliefs, behavioural intentions, and resultant behaviour. When an individual feels that their behavior does not match that of the social norm, they have feelings of guilt, and fear of social exclusion, prompting them to act within the norm (Bamberg & Möser, 2007).

Applying this rational, Festinger's (1954) theory of social comparison demonstrates that juxtaposition of household feedback data can further constitute positive energy behaviours, as homeowners can recognize consumption, compare themselves to similar households, and enhance energy saving behaviours via the status quo. Vermeir & Verbeke's (2008), study suggests that perceived social influences, effectiveness, attitudes, and availability contribute to personal decision-making with regards to consumption. Normative feedback allows for households to see how they compare to like households, thus, urging households who consume more, to reduce their consumption. According to Schultz et al. (2007), being outside of the norm is to be deviant and therefore has a negative connotation, driving houses to conserve.

The framework for this study was designed based on the model of social norms. Through directly comparing consumption between households, it enables the participants to compare themselves to others, in order to determine where their consumption falls amongst a group of their peers. It is through the dissemination of peer information, that it is hoped participants will moderate their energy use to match that of the conservative users (categorized by quintiles).

2.2 Best Practices for Feedback

It is evident in the literature that the majority of consumers have a lack of understanding when it comes to household energy consumption (Darby, 2006; Wallenborn et al., 2011; Wood & Newborough, 2003). Understanding energy use is particularly difficult due to the many appliances and variability of schedules and what is considered 'normal' consumption, making it difficult for households to discern when and how much energy is being used (Goulden *et al*., 2014; Wallenborn et al., 2011; Wood & Newborough, 2003). Coupled with energy use being invisible, people are largely unaware of how much energy is required for different appliances, or how they can reduce their usage (Darby, 2006; Wallenborn *et al*., 2011). Based on these findings, the use of feedback has been suggested as a solution to this lack of understanding and knowledge, and has been analyzed in a variety of studies to measure the positive outcomes of feedback. Feedback provides learning and reinforcement, resulting in a modification of resource-using behaviour (Lutzenhiser, 1993). The way in which feedback is presented may enhance or reduce the effectiveness of the information. In the following sections, various methods for reporting feedback are discussed in order to identify the optimal feedback process. This includes feedback scheduling, customized vs. generic feedback, and display features.

2.2.1 Feedback Schedule

There are many studies that have monitored energy consumption following feedback. These studies have exemplified the different timing, in terms of hourly vs. daily vs. monthly feedback to understand how to best induce a change in consumption. The timing for interaction can greatly affect individual response to the information provided, specifically relating to electricity use. For instance, Lutzenhiser (1993), suggests that antecedent strategies, those that provide prompts prior to an act, are less effective than consequent strategies, in which feedback is provided following an act. Consequent strategies are suggested to be more successful because they enable consumers to make connections between their actions and the outcome of such action. For instance, after completing a load of laundry, the feedback would tell the household how much electricity was used for that end use, allowing consumers to understand how their actions lead to different results. Furthering this, feedback is more effective when the information is provided directly after an action is taken rather than following a significant time period. This relays a more direct message between actions and the resulting electricity usage. The integration of computerized electricity use information has made more data available to individuals at their own discretion. This is called direct feedback, which is provided immediately at the time of use (Grønhøj & Thøgersen, 2011), in contrast to indirect feedback, which is provided later. Despite claims suggesting the ideal timeline for feedback scheduling, the results remain unclear for summarized feedback, and whether it is most effective through computerized feedback where individuals can access information based on their own schedule (Fischer, 2008). The smart meter is one device which provides information on a consistent basis, demonstrating exactly how much electricity is used at any specific time. Householders then have the ability to access feedback from the smart meter via the web portal at any convenient time. Overall, feedback that is provided regularly and following actions helps elicit the greatest understanding of electricity consumption, and resultantly produces more successful feedback.

2.2.2 Customized vs. Generic Feedback

When considering the content of the feedback, there is much debate regarding the explicitness of the information to promote the greatest response among consumers. According to Steg (2008), tailored information leads to greater behavioural change when compared with generic information aimed for a larger public. Therefore, to enhance conservation efforts, personalized details of one's consumption and how to attain reduced consumption is most effective. Furthering this, Lutzenhiser (1993) also suggests that humanizing the results through the use of images and community based role models may enhance conservation within households. Role models that have social significance play the greatest factor in feedback effectiveness, largely due to the sparked sense of competition amongst households when compared with each other (Fischer, 2008). A comparison of a household's previous and current data can also ignite a sense of competition with one's self to attain a better score than the previous year, with many studies finding that comparisons were an important part of the presentation of feedback (Bonino *et al.*, 2012, Karjalainen, 2011; Wilhite et al. 1999).

Therefore, the more specific the information with regards to comparisons or content, the greater the effectiveness the feedback will have on consumers. The provision of specific information makes the feedback much more realistic and therefore, more encouraging to consumers so that they may act to achieve their savings goals.

2.2.3 Feedback Features

When considering the aesthetic value of the feedback, there are certain display features which may be more conducive to viewers, and thus, more effective. According to Darby (2010), there are three main factors to consider when designing a method of feedback. Firstly, it must catch the eye of the consumer. This can mean the use of colour, imagery, or even the use of bold face fonts on important lettering. Secondly, the information must establish a connection between the individual's behaviour and their impact on energy consumption, i.e. show them how and where they are saving energy through their actions. This provides the consumer with a more realistic vision of their usage and how through their actions they are effectively changing their consumption. Thirdly, there must be information describing what the benefits of the energy saving behavior are. This may include cost reduction, emission reduction, or other information appealing or relevant to the consumer.

A second interpretation, based on Fischer's (2008) literature review of effective feedback suggests that projects with successful results from feedback yield seven criteria. Firstly, feedback should have an appliance specific breakdown. Corroborated by Darby (2010) and studies including Wilhite et al. (1999), and Bonino et al. (2012), disaggregated feedback is a helpful tool for homeowners, as it provides additional information regarding the exact devices where electricity is consumed and where reductions are being made through their behavioural change. The specificity of this reporting provides greater understanding to households and the ability to discern areas where they can conserve electricity. Secondly, feedback should include historical or normative comparisons. Historical comparisons allow residents to compare their consumption based on the previous year, to see how they consumption has changed. Normative comparisons provide homeowners a comparative analysis of their usage compared to similar households, thus engaging a sense of competition and desire to achieve the greatest results. Thirdly, there should be interactive elements which allow the user to select from different options for viewing their consumption data. This allows the customer accessibility to the data in whichever format is most comprehensible based on their own understanding. Fourthly, feedback should be frequent. This can be interpreted in many different ways, but essentially, it means to consistently provide data in order to allow households the ability to interpret their results and attempt to make changes accordingly. Along with frequent feedback, it should also be long-term feedback. This allows for habit formation over a longer term, which will likely persist following the dissolution of feedback. Feedback should also be based on actual consumption rather than previous periods or estimates. Finally, information should be presented in a clear and effective manner. For instance, labels should be clear and explanatory, and textual information should be supported with graphics. Through the use of these criteria, it is expected that feedback will have the greatest chance of success.

In another context, Gastafson & Baylor (1989) assert that energy management systems can induce energy savings with the inclusion of three conditions. Firstly, the pricing of the electricity must be communicated directly to households, allowing discernment of price reduction resulting from conservation. Secondly, there must be a tradeoff between the electricity cost and comfort level; hence, encouraging conservation whilst maintaining householders' ability to remain comfortable (i.e. allowing for heating and cooling when necessary). Finally, the energy management system should be reliable, and have a support staff to ensure the success and ease of the program.

Lutzenhiser (1993) also claims that incentives are required to enhance the effectiveness of feedback. When individuals are given a motivation to achieve a goal, they are more likely to seek to attain the target. Many studies corroborate this idea (e.g. Abrahamse et al., 2007; Becker, 1978; Bonino et al., 2012; McCalley & Midden, 2002), suggesting that an electricity conservation goal should accompany feedback in order to improve effectiveness. This is due to the goal providing direction that the household can work towards, and allows for assessment of how well they are doing with regards to that goal and how they can improve (McCally et al., 2011).

In collaboration with such goals, compensation or a reward are required to motivate households to achieve their goals. According to Winnett & Nietzel's (1975) study, monetary prizes for the greatest reductions in energy use produced a savings of 23%. In Seaver & Patterson's (1976) study, another form of reinforcement was used, a certificate. Based on that study, greater savings were attained when households were awarded with the certificate saying that they had reduced their electricity from the baseline period more than those who did not. Therefore, it can be suggested that supplementary to feedback, rewards can be used to further promote conservative efforts in terms of monetary compensation or rewards.

Aside from the features of the feedback, the format of the feedback is also important to achieve results (Brown et al., 2009). According to Smith & Mosier (1986) consistency between wording and labels are important for viewing purposes. Visuals and graphics need to be clear, distinguishable, and easy to interpret. Essentially, the overall appearance of the feedback should be clear, consistent, and aesthetically appealing. Khorrami (2014) suggests that the format of the feedback, such as word choice, and measurement units will determine how the consumer reflects on their usage.

Based on the reviewed studies, there are critical features which must be incorporated into feedback in order for it to be effective. In order to determine these features, the key feedback measures that repeatedly came up in the literature were summarized below. These seven critical features of feedback include:

1. Normative and/or Historic Comparison;
2. Consequent and Direct;
3. Tailored and (Appliance) Specific;
4. Multiple measures of consumption;
5. Persistent and Consistent;
6. Reinforcement;
7. Clarity and Attractiveness.

In collaboration with these features, energy feedback studies have been designed to guide households to more conservative and efficient uses of energy. Utilizing this information, the feedback in this study incorporated each of these measures.

2.3 Measures of Consumption

The type of data presented to households can have a profound effect on how they interpret the results, and how they use and conserve energy. When measuring or classifying the usage of energy, there are many different units, such as kilowatt hours, grams of carbon dioxide, or various consumption periods (on-peak, off-peak, mid-peak). For the purpose of displaying energy consumption to households, the more specific the information, the more readily households are able to discern the information provided (McCalley & Midden, 2002). Midden *et al*. (1983), suggest that concrete and significant units are important. This refers to particulars such as the time span or the money involved. Without these parameters, the feedback becomes irrelevant. Additionally, including different variables or units may be more appealing to specific demographics, dependent upon their motivations (Fischer, 2008). For instance, the individual looking to save money would be interested in the price difference, while those looking to reduce their impact on their environment would be more interested in the resulting carbon emissions. Therefore, having access to a variety of measures appeals to more actors.

2.3.1 Total Consumption

The total consumption of electricity is the accumulated consumption over a selected period of time. This information is commonly used to identify electricity consumption, as it demonstrates to households what their overall consumption is from all electricity consuming activities in the units of kilo-watt hours (kWh). From this, they are able to see how their consumption changes during different time periods, as well they are able to determine what is considered 'normal' based on their typical previous use.

2.3.2 Peak Consumption & Associated Emissions

On-peak consumption refers to the total usage of electricity during on-peak hours. In the province of Ontario, these hours vary based on the season or day of the week. For instance, during the winter months (November 1-April 30), the times of highest demand occur between 7am to 11am and 5 to 7pm; therefore, equating to on-peak hours, while in the summer these hours are from 11am to 5pm (Ministry of Energy, 2013a). Throughout these different periods of the day: on-peak, mid-peak, off-peak; there are different associated prices, with on-peak consumption costing the most per kWh. As of November 2014, off-peak costs 8.0 cents/kWh, mid-peak 12.2 cents/kWh, and on-peak 16.1 cents/kWh (Ontario Energy Board, 2015). Providing this information via feedback, households are able to reduce their electricity bill by changing their consumption to off-peak hours.

Providing the breakdown of peak hours is important to provide to households as it is the time of day in which a reduction in demand is most needed in order to reduce total capacity demands and carbon emissions. During these hours, natural gas is used to generate electricity in order to meet the high demand, thus creating a surge in GHG emissions. If households were to reduce their usage during this time period, then emissions produced by electricity generation could be significantly reduced. Furthermore, when peaking occurs, stress is put on generating facilities, leading to the need for the refurbishment of older facilities (Kohlenberg *et al.,* 1976). Therefore, to demonstrate to households a way to reduce their impact on the environment, the measure of on-peak consumption and on-peak share can prove beneficial. According to Midden et al. (1983), demonstrating units in terms of money saved, or emissions reduced play a large part of household cooperation, as they can more strongly interpret the benefits of using energy more sparingly.

2.4 Comparison to Other Studies

Unlike many studies, in which participants are newly selected for the study, this study examines households who have been engaged in electricity studies for multiple years (3-4 years). To compare the effectiveness of feedback on re-engaged households compared to newly engaged households, a review of

20 peer-reviewed articles with newly selected participants for the project are compared to the results of this study. This is completed by comparing the percent change following the interventions. The first 20 eligible articles on the Google Scholar search engine, identified with the keywords “electricity feedback” are used. To be included the study had to conduct primary research on feedback, i.e. not a literature review, and include a result giving the percent change in consumption following the intervention. The following table (2.4) outlines the examined articles, including the study name, author, year published, length of study, and the overall savings achieved following the intervention. While the methods used in the studies vary in the process or format of feedback provided, they all examine how the provision of detailed electricity information changes consumption.

Table 2.4: 20 Sampled Electricity Feedback Studies

	Study Name	Author	Year	Length of Study	# of Partici-pants	Savings (%)
1	Dormitory Residents reduce electricity consumption when exposed to real-time visual feedback and incentives	Peterson et al.	2007	2 Weeks	2 Dormitories	32%
2	Effects of Self-Monitoring and Feedback on Residential Electricity Consumption	Winett et al.	2013	1 Month	12	13%
3	Conservation Effect of Immediate Electricity Cost Feedback on Residential Consumption Behaviour	Dobson & Griffin	1992	60 Days	100	5%
4	Effects of monetary rebates, feedback, and information on residential electricity conservation	Winett et al.	1978	Summer	129	12%
5	Feedback on household electricity consumption: learning and social influence processes	Grønhøj & Thøgersen	2011	5 Months	20	8.1%
6	Feedback as a means of decreasing residential energy consumption	Seligman & Darley	1977	1 Month	29	10.5%
7	Joint effect of feedback and goal-setting on performance: A field study of residential energy conservation	Becker	1978	Several Weeks	80	13-25.1%
8	The effect of Feedback by Text Message (SMS) and email on household electricity consumption: Experimental evidence	Gleerup et al.	2010	1 Year	1452	3%
9	Real-time feedback and residential electricity consumption: British Columbia and Newfoundland and Labrador pilots	Mountain	2007	3.5 Years	-	2.7-18.1%
10	The impact of consumers’ feedback preferences on domestic electricity consumption	Vassileva et al.	2012	4 Years	2000	15%
11	The Dubuque electricity portal: evaluation of a city-scale residential electricity consumption feedback system	Erickson et al.	2013	20 Weeks	765	3.7%

Table 2.4: 20 Sampled Electricity Feedback Studies

12	Effects of feedback on residential electricity de-mand- Findings from a field trial in Austria	Schleich et al.	2013	-	1500	4.5%
13	Smart meters and energy savings in Italy: Deter-mining the effectiveness of persuasive communi-cation in dwellings	D'Oca et al.	2014	1 year	31	18-57%
14	Effects of continuous feedback on households' electricity consumption: Potentials and barriers	Nilsson et al.	2014	-	72	not signif-icant
15	Keeping energy visible? Exploring how house-holders interact with feedback from smart energy monitors in the longer term	Hargreaves et al.	2013	12 months	11	not sigifnicant
16	Is social norms marketing effective? A case study in domestic electricity consumption	Harries et al.	2013	16 Weeks	316	3%
17	Modifying perceptions of comfort and electricity used for heating by social learning strategies: residential field experiments	Winett et al.	1981	-	200	15%
18	Persuading consumers to reduce their consump-tion of electricity in the home	Smeaton & Doherty	2013	18 Months	24	mixed
19	Real-time feedback and residential electricity consumption: The Newfoundland and Labrador pilot	Mountain	2012	3.5 Years	100	18.1%
20	Real-time Feedback and Electricity Consumption	Houde et al.	2013	8 Months	1065	5.7%

Derived from the table above, comparisons can be made with regards to which achieved higher or lower savings following the intervention. While there is minimal consistency amongst these studies results, the range of results demonstrates the various savings achievable from feedback reports. This study opted to conduct a long-term study of 8 months, as it provided a longer opportunity to test for the attainment and maintenance of savings. The number of participants in the study was limited to the participants involved in the multi-year project.

2.5 Application to Research

Based on the findings in the literature, there are multiple features to take into consideration regarding the format of the feedback, the timing, and the content of such feedback in order to attain positive results. The feedback in this study will be designed to incorporate many of these requirements, such as including various measurements of consumption in order to capture the greatest audience for energy reporting. The research will also acknowledge the many factors contributing to an individual's decision-making process. For instance, although monetary concern may play an important part in an individual's decision, there are other factors which may affect the outcome even more. Therefore, the feedback reports will be designed to appeal to the households in a variety of ways, from the resulting carbon emissions based on their consumption to alert those who are environmentally aware, to the individual desiring to be within the social norm. By combining these elements, the study is designed to integrate the identified positive elements and to test the effectiveness of the feedback report to induce conservative electricity using decisions.

Unlike many previous energy feedback studies, this study builds upon previous research in order to further research on the long-term effects of feedback. Predominantly, when conducting feedback studies, new participants are selected. In this study, participants whom have been involved in energy interventions over the long-term (3-4 years) have been used. This study helps to determine how effective energy feedback can be, once the initial influence and intrigue of feedback has worn off. This information is significant because, while initial electricity savings due to feedback is beneficial, it is the long-term, behavioural changes which are most effective for altering energy consumption for resulting in electricity conservation at large.

Chapter 3: Methods

This research examines the effectiveness of weekly feedback prompts designed to promote conservation and peak shifting by comparing current electricity consumption to historical consumption, by comparing consumption to other households in the community, and by offering appliance specific prompts. Although previous studies have sought to accomplish similar goals (for example Abrahamse, 2008; Abrahamse *et al*., 2007; Becker, 1978; Bonino *et al*., 2012; Darby, 2006; & Dobson & Griffin, 1992), this study offers a different context as the households already have smart meters, time-of-use pricing and disaggregated consumption data. Given this context of pre-existing initiatives to promote conservation, can weekly feedback that includes comparative data to illustrate social norms stimulate further conservation and peak shifting action? The goal is to stimulate engagement by householders who have been involved with energy interventions over multiple years. This research analyzes consumption based on the change in energy use over the shorter term (weekly or intermediate) and the longer term (months or persistent), and evaluates the quintiles of consumption amongst households. The household with the greatest monthly savings, when compared to their previous year's data, receive a certificate commending them for their efforts and recognizing them as the largest conserver during that month amongst their cohort.

Through the following methodology, the four primary research questions are addressed:

1. When provided with feedback, how do households respond/alter their consumption from the previous (baseline) year?
2. Does the eliciting of social norms result in a shift in household consumption levels towards the most efficient cohort of consumers or towards average consumers?
3. When provided with an appliance-specific tip, did households reduce the total or on-peak consumption of the appliance?
4. How do the results of this study, using households whom have been engaged in electricity interventions over multiple years, compare to other studies, in which households have been introduced to short term electricity interventions?

There are multiple steps to undertake this research. The following sections outline the actions taken, beginning with the participant selection, then the development and delivery of the reports, and finally, the follow-up analysis.

3.1 Recruitment and Participant Selection

Participants were recruited with the help of the local utility partner, Milton Hydro. Customers who had expressed an interest in electricity pilot programs were sent an email inviting them to participate in the program. Twenty-eight households accepted the invitation to participate in the EHMS study and from this group, 25 households were selected based on their willingness to have selected circuits controlled and the desire to have a range of house types included (older as well as new, etc.).

Following participant selection, EHMS equipment was installed in each of the participating households. There were two installation periods: November 2011 to January 2012, and April 2012. A 26th household was added in December 2012 after an initial household withdrew from the project and the equipment was relocated. Electricity consumption monitoring began following installation and continued to the current study period of June 2014 to December 2014. This 30 week study period was selected in order to determine initial versus longer term results and to include seasonal variation (summer and fall/winter).

Most households taking part in the study live in single-detached houses (18 of 26). Although there are differences in terms of floor space of the house and household composition (see Tables 4. 1 and 4.2), the EHMS equipment monitors many of the same appliances, such as the washer/dryer and refrigerator, in each house.

3.2 Sample Size and Study Length

The cohort of 26 households participating in this study illustrates household electricity consumption patterns in a growing suburban community, but is too small to be considered representative of households in Ontario, Canada. Prior to the initiation of this feedback study, 5 households discontinued their participation in the study (often because they moved house) and technical problems limited communication with some equipment. As a result, the participating cohort consisted of 16 households. Similar studies have utilized a variety of sample sizes. For instance, Midden et al. (1982) used a sample of 9 identical apartments with middle income families to complete their analysis of feedback consumption responses, while Vassileva et al. (2011) polled 2000 households with a questionnaire with a 33% response rate. When undertaking a more detailed analysis of feedback, smaller sample sizes are common. These studies provide households with the detailed feedback desired.

The study was designed to consist of a seven month, 30 week, reporting period, as documented below. During this time, weekly electricity reports were provided to each household detailing their consumption compared to their usage in the same week of the previous year, and to other households. Many other studies have selected similar study periods, such as Grønhøj & Thøgersen (2011), whom used a five month study period, and Jain et al. (2013), who conducted a 47-day experiment. The seven month period in this study was used for two purposes. Firstly, it allowed for an interpretation of changes in consumption based on short term (1-2 weeks) and longer term (30 weeks) timelines in order to identify whether feedback was more effective during the preliminary stages or whether the feedback elicited a persistent or enduring change in behaviour. Secondly, it enabled the access of data across seasons: summer and fall/winter. In addition to this, it is estimated to take approximately 3 months to form a new behaviour (i.e. engrain electricity conservation as a normalized behaviour) (Darby, 2006), so the longevity of the study was hoped to elicit long-term behavioural changes in households to act more conservatively.

Reporting took place on a weekly basis, from Sunday to Saturday. The purpose of this reporting schedule was to ensure that individuals were able to relate their consumption to the actions they took in their home, and how it affected their conservation performance in comparison to their previous usage. Although data were available to households on a continual basis via the project's web portal, few actively monitored the website. Instead, the weekly feedback reports that arrived in e-mail boxes enabled households to monitor their performance without needing to log into the portal. The study weeks and date are summarized below in Table 3.2.

Table 3.2: Study Weeks and Dates, 2014

Week	Dates Included	Week	Dates Included
1	June 1-7	16	September 14- 20
2	June 8-14	17	September 21-27
3	June 15-21	18	September 28- October 4
4	June 22-28	19	October 5-11
5	June 29- July 5	20	October 12-18
6	July 6-12	21	October 19-25
7	July 13-19	22	October 26-November 1
8	July 20-26	23	November 2-8
9	July 27- August 2	24	November 9-15
10	August 3-9	25	November 16-22
11	August 10-16	26	November 23-29
12	August 17-23	27	November 30-December 6
13	August 24-30	28	December 7-13
14	August 31-September 6	29	December 14-20
15	September 7-13	30	December 21-27

In order to distribute the feedback effectively, the electricity reports were emailed to households on a weekly basis. Although consumption data were available consistently on the portal, the analyzed and comparative data summarized in the feedback reports provided a more detailed and longer term outlook on the household's energy use. Through the use of weekly data, households were able to understand how their actions during that week (i.e. doing laundry) affected their overall energy consumption. Daily reports were seen to be too frequent, being more of an irritant rather than motivator, while monthly reports would only provide an opportunity to make a change in consumption through the use of 7 reports. Therefore, the 30 weekly reports provided many opportunities to make interventions related to particular appliances.

In addition to the weekly reports, a monthly certificate was sent out to award the household with the largest reduction in percentage of electricity use when compared to the previous year. This report was sent in electronically with the weekly reports on the Monday following the end of a month. The certificate itself was sent only to the household with the greatest savings; however, all households were notified of the household's success (identified only by number).

Another component to the feedback schedule was managing the timing of the emails. For this study, the feedback reports were distributed at 10am each Monday morning. These reports summarized the previous week's data from Sunday to Saturday. The mid-morning email at the start of the week provided a time when households would potentially check their email, or would receive the email throughout the period of the week at their discretion.

3.3 The Web Portal

Throughout the EHMS project, households had access to a web portal which provided help information, consumption data and goal setting functions. Households were given access to a web portal, via the world wide web (WWW), displaying household and appliance level energy consumption data on a five minute, hourly, or daily basis. From this, participants were able to discern their energy use, and to choose their preferred monitoring units: $, the monetary cost; kWh, total consumption, and gCO2, resulting carbon dioxide (g CO2) emissions. Usage during on-peak, mid-peak or off-peak periods was also shown. According to Darby (2006), the combination of feedback and other sources of information help to induce further change by giving participants more options to gain information and to get educated on how to effectively conserve electricity.

The portal offered participants the ability to set goals or timelines for specific appliances in order to help facilitate reduced demand overall, or during peak hours. As part of the goal setting application, households were provided with information regarding whether they were on-track to achieve their goal.

Aside from the real-time data regarding electricity use, householders were also provided with a help page in case they needed assistance. This page relayed information about the project, frequently asked questions, and tutorials demonstrating instructions for various functions. Contact information for the researchers was also provided, to allow residents the ability to comment or get in touch with those involved in the project.

In addition to households having access to the web portal, researchers were also given access to the portal in order to obtain data for analysis, under the login of 'reporting'. For the purpose of this study, information regarding each household's usage was used to create weekly consumption reports for each household (reports discussed further in section 3.5 'Feedback Format').

3.4 Surveys

As part of project data collection, surveys were used to gain household information regarding demographics and energy use behaviours. The surveys were distributed online through Fluid Surveys, a site in which surveys can be created for public distribution. The design of the surveys and collection of data were completed earlier in the project by other researchers. The results from the surveys are used to inform this study and the background is provided for context.

During the selection of participants for the study, a household profile survey was distributed to all interested candidates. This survey was used to gain information about the dwelling and household, size of home, date built, ages of residents, and the appliances they wished to be monitored. Households were then selected for this study based on their characteristics.

Once households were selected for the study, and the web portal was established, a welcome survey was sent to the selected participants. This survey was used to understand the motivations behind the household's interest in energy management. This survey also helped gain insight into initial attitudes towards electricity conservation, determine household characteristics and typical energy use.

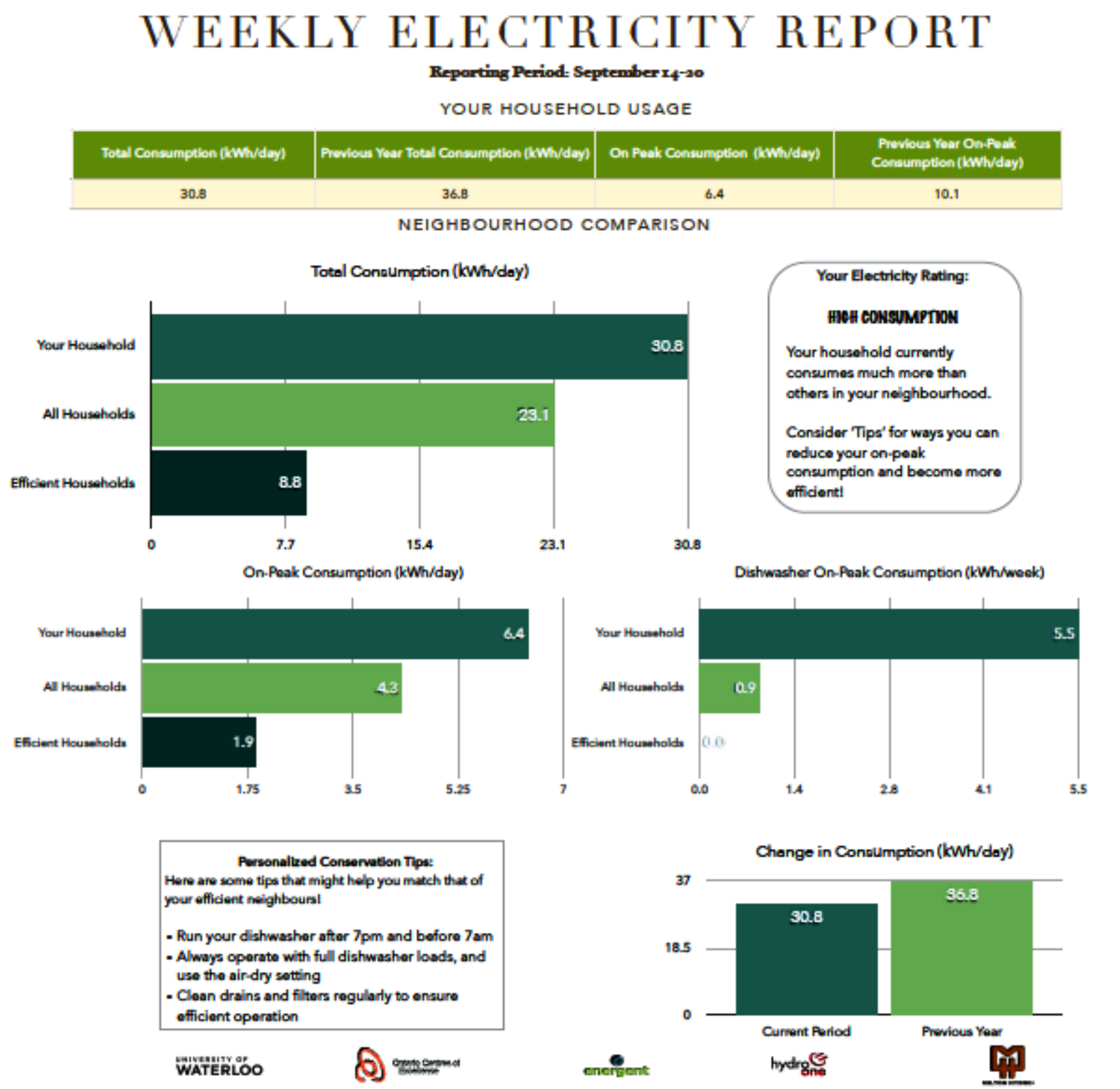
3.5 Feedback Format

The feedback report was designed and implemented as part of this study. The template was created based on an examination of academic literature and utility company materials, billing and information page designs in particular, in order to design feedback with the most effective features. Examining the literature, there were several key components to a successful feedback report. The specific principles used for this feedback report included the seven critical features of feedback:

1.Normative and/or Historic Comparison (neighbourhood and previous/baseline period comparison);
2. Consequent and Direct (reports sent on a weekly basis);
3. Tailored and (Appliance) Specific (broken down by households and major appliances);
4. Multiple measures of consumption (kWh, carbon emissions, price);
5. Persistent and Consistent (weekly reports sent over 7 month/30 week study period);
6. Reinforcement (the monthly certificate); and,
7. Clarity and Attractiveness.

Following these guidelines, a template was created to portray household electricity consumption feedback on a weekly basis, as shown in Figure 3.5.1 . There were four main features used for displaying consumption data: a participant comparison, a previous year comparison, major appliance consumption and on-peak consumption. These measures were then presented in terms of total, on-peak, and seven of the weeks featured the associated carbon emissions. While the information presented was determined by the researcher, households also had the opportunity to identify different variables that they would like to see on their individual feedback report, such as average consumption per person within a household, which were then incorporated into the feedback report.

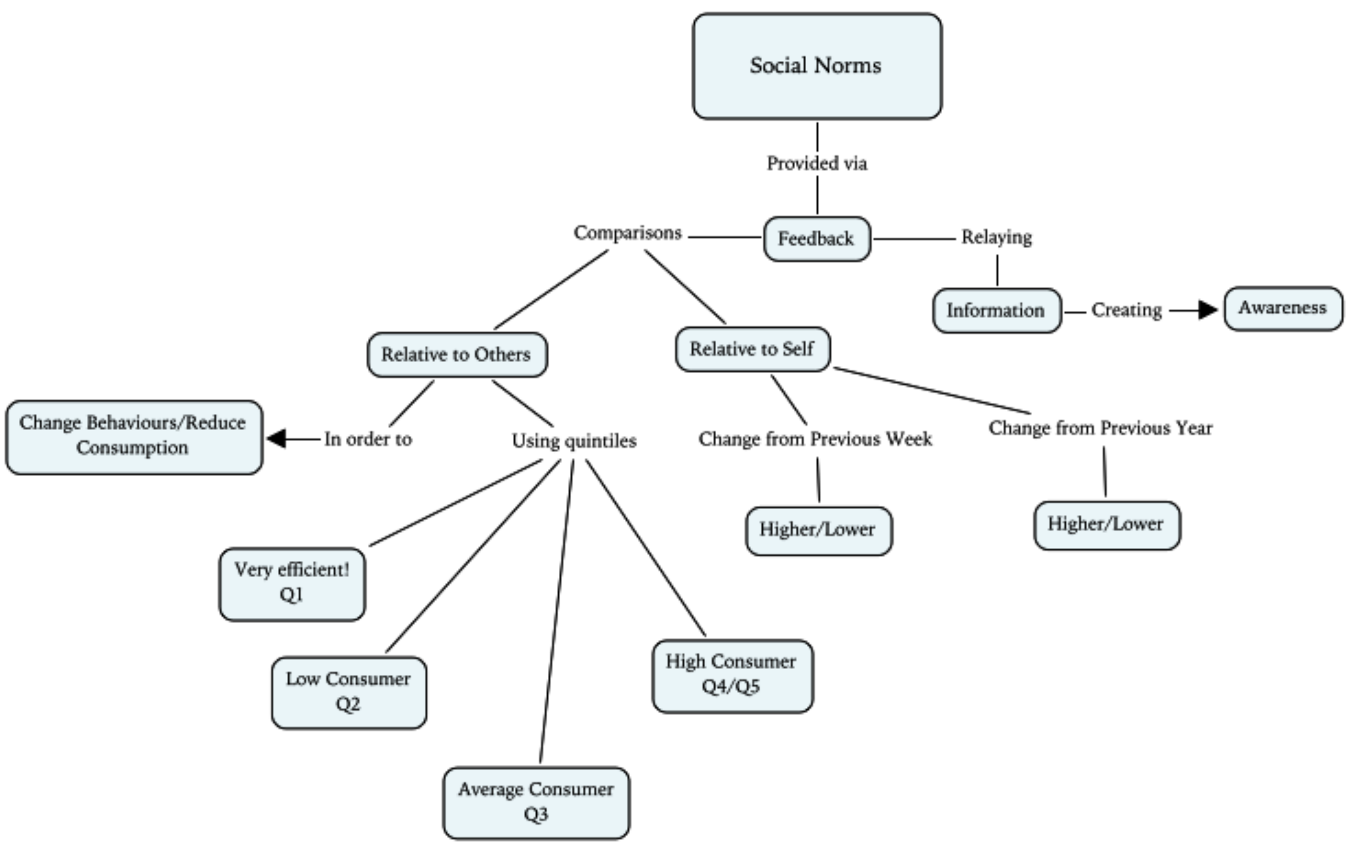
Figure 3.5.1: Sample Weekly Electricity Report



3.5.1 Quintiles

Using social norms as a framework for this research, the participants were divided into quintiles based on total consumption. This differentiated five groups of consumers from the highest to the lowest. The number of households changed each week, thus there were different numbers of households involved in each quintile. The categorization of these quintiles was based upon consumption from the week previous. Based on their consumption, households were compared to 'very efficient households', meaning those who are part of quintile 1, the lowest consumption group, and to the average value for 'all households'. This then served two purposes: to allow for social comparison between the different quintiles and to identify whether different groups of consumers may respond differently to feedback. For example, while there may not be a large net reduction in overall consumption, the top performing quintile may make further reductions in consumption, or the high consumers may achieve a greater reduction due to their desire to match that of the norm. Figure 3.5.2 demonstrates this process.

Figure 3.5.2: Social Norms Model for Feedback



During the study, a varying number of households had accessible data obtainable for the researcher; therefore, the number of households per quintile varied week by week. Problems with access, in which the portal was not producing results for consumption either at the appliance or household level, were often caused by technical communication problems among the measuring devices, router and wireless protocols.

In order to determine whether the promotion of social norms would help elicit a change in consumption over time, households were provided with cohort or quintile data for the most efficient and average quintiles on a weekly basis to compare to their performance. Quintiles were based on the household consumption relative to other households during the previous week. This allowed households to see how their electricity consumption compared to others, and to act as a motivator for high consuming households to make a reduction to match that of average or more efficient quintiles, as social role models help to encourage others to match their consumption (Bamberg & Möser, 2007). Dividing households into quintiles provides the framework for a normative comparison between households, one of the seven critical features of feedback.

Average values for each of the quintiles were calculated to determine whether changes were made in any of the categories and to see whether averages migrated toward any particular quintile (i.e. quintile 1- to move toward that of the lowest consumers, or quintile 3- to move toward that of the average consumer).

3.5.2 Participant Comparison

The literature reported that using socially significant models of comparison sparks greater conservation efforts. Due to this, the study compared the individual household's energy consumption with other participating households in the community. This allowed participants to see how their energy consumption compared to others within the case study, a normative comparison. As part of the weekly reports, comparisons of total, on-peak, and major appliances were made. Households were compared to 'efficient neighbours', the 20% with the lowest consumption, and 'all neighbours', or the average of all households within the study. Total electricity use was calculated by totaling the daily usage of electricity, and then averaging these values to determine the average kWh/day for all households for that particular week. The same procedure was followed for on-peak usage. For the summer period (June-October), all electricity consumption between the hours of 11am and 5pm on weekdays was included as 'on-peak', while in the winter (November-December), 'on-peak' hours occurred during 7-11am and 5-7pm on weekdays.

3.5.3 Previous Year Comparison

Comparisons to the previous year were included in the report. This enabled households to see how their consumption in the current time period compared to that of one year past, which was used a baseline. The historic comparison is one of the critical components of effective feedback. Two years prior (2012) was also examined with consideration to be included as part of the baseline calculation; however, it was determined that, due to gaps in data, 2013 provided a more consistent comparison for a baseline. The two years involved in the study, 2013 baseline and 2014 trial, were quantitatively compared for total electricity use and on-peak electricity use. By using this comparison, it could be determined whether households were changing their consumption on a year over year basis. Yearly data was compared by dates, rather than weeks. To account for weather discrepancies, the 2014 data were normalized for the whole house, the air conditioner, and the furnace due to their weather-dependency; however, for the immediate feedback sent to households, the data were not normalized (see Section 4.2).

In order to analyze the previous year data, the change in consumption per household in its entirety was compared to the previous year. This examined the sum of the total consumption over the 30 weeks for the baseline year, 2013, compared to the sum of the total consumption for the monitoring period, 2014. From this, the sum of the difference was concluded in kWh, which was then converted to a percent by dividing the difference by the 2013 baseline period. From the sum of the difference, a weekly average change was also determined by dividing the change by 30 weeks, and then converting this to a percent.

3.5.4 Major Appliance On-Peak Consumption

In addition to the aggregate measures, major appliance on-peak usage was compared. This was calculated by analyzing total on-peak consumption of the appliance during the week, 11am-5pm in the summer and between 7-11am and 5-7pm in the winter months (Ministry of Energy, 2013a). This analysis provides one of the measures of consumption, as well as a breakdown of specific appliances, two of the seven components of effective feedback. The major appliances used in this study include: the air conditioner, furnace, washer/dryer, dishwasher, refrigerator, and media centre. The following table outlines the major appliances usage and average cost (Table 3.5.4). Based on this table, it is evident that changes in on-peak and total electricity consumption for some high consuming appliances can help reduce the costs associated with their use.

Table 3.5.4: Major Appliance Usage and Average Cost

Appliance	Approx. Wattage	Avg. Monthly Hours of Use	Avg. Monthly kWh	Avg. Monthly Cost (based on TOU)
AC (Central)	3500	300	1050	$150.19
Furnace Fan (Intermittent)	350	160	56	$8.01
Furnace Fan (Continuous)	350	720	252	$36.05
Clothes Dryer	5000	20	100	$14.30
Clothes Washer	500	10	5	$0.72
Dishwasher	1300	10	13	$1.86
Refrigerator	500	150	75	$10.73
Stove	5000	100	500	$71.52
Computer Station	200	100	20	$2.86
Television	100	200	20	$2.86
VCR/DVD	40	10	0.4	$0.06

Source: Toronto Hydro (2016). Appliance Usage Chart. Retrieved from http://www.torontohydro.com/sites/electricsystem/residential/yourbilloverview/Pages/ApplianceChart.aspx

3.5.5 Electricity Consumption Ratings and Quintiles

Ratings were delineated for each of the households based on their total consumption of electricity. Four ratings were created, describing the quintile of the household based on their total consumption for the current week. These ratings/quintiles are presented in Table 3.5.5 along with tag lines selected for communication in the week following their performance:

Table 3.5.5: Quintile Rating and Tagline

Rating & Quintile	Tag Line
Very Efficient Q1	• Your Household currently consumes much less than the average in your neighbourhood, and; • Consider 'Tips' for ways you can further reduce your on-peak consumption, or; • Keep up the good work!
Low Consumption Q2	• Your household currently consumes less than that of the average in your neighbourhood, and; • To increase efficiency, consider 'Tips' for ways you can reduce your on-peak consumption, or; • Keep up the good work!
Average Q3	• Your household currently consumes about the average for your neighbourhood, and; • Consider 'Tips' for ways you can become more efficient!
High Consumption Q4, Q5	• Your household currently consumes much more than the average in your neighbourhood, and; • However, your on-peak and laundry consumption are low. Good start!, or; • Consider 'Tips' for ways you can become more efficient!

In order to be considered within ‘average’, the households were required to fall within the third quintile, if above, they were classified has ‘high consumption’, and below then ‘low consumption’ or ‘very efficient’. These ratings provided households with an understanding of how their consumption compared to others, and may stimulate the desire to reduce their consumption to correspond to that of ‘efficient households’.

3.5.6 Personalized Tips

Personalized tips were created for each of the households based on their energy profile. Using the household’s appliance level data and on-peak usage, tips were distributed based on the household’s rating. The aim of the tips was to reduce on-peak consumption, i.e. demand management. For example, when utilizing the washer/dryer on-peak values, if the household had high on-peak values, relative to other households involved in the study resulting in a quintile 4 or 5 rating, then a tip for that household could be to “Switch your washer/dryer schedule to ‘off-peak’” in order to consume when the demand is lower. If a household had already achieved a low or efficient consumption level, then such households were not provided with tips, and rather were congratulated for their efficient energy use. The high and average consumers, on the other hand, were provided tips to encourage more conservative energy use to match that of the efficient users. Personalized trips were directed towards different areas of the home, such as the kitchen, outdoor areas, entertainment room, or laundry room, predominantly based on the appliance being measured in the report. These tips were derived from utility company materials, such as Milton Hydro and Waterloo North Hydro, and general tips found on government and educational websites, such as the Ministry of Energy and the Ontario Energy Board. Each week, an appliance would be featured on the electricity report, based on the time of year (i.e. air conditioning in the summer) and researcher’s preference. Based on the appliance being featured, such as AC during the hot weeks during the summer, tips would predominantly be provided for the corresponding appliance. If an appliance were showcased multiple weeks in a row, different tips were rotated so that the same tips were not used consecutively. The appliance-specific tips are summarized in the table below (Table 3.5.6).

Table 3.5.6: Appliance-Specific Tips

Appliance	Tips Provided
Washer/Dryer	• Switch your washer/dryer schedule to 'off-peak' • Hang laundry outside to dry • Save laundry loads for the weekend • Consider using a clothesline or drying rack to avoid the cost of a dryer • Wash your clothes in cold or warm water. Hot water can shrink and fade your clothes and approximately 85-90 per cent of the energy used by washing machines is for heating the water • Save laundry for weekends or between 5pm and 11am on weekdays • Dry loads consecutively to use otherwise wasted heat from the dryer. • Adjust the water level setting to match the size of the load. Run full loads when possible, but do not overload the machine.
Dishwasher	• Run your dishwasher after 7pm and before 7am • Always operate with full dishwasher loads, and use the air-dry setting • Clean drains and filters regularly to ensure efficient operation
Air Conditioning	• Use fans to lower AC costs • Turn off AC when you leave the house • Check to see that windows and doors are closed when heating or cooling your home • Consider using fans instead of AC when spot cooling • Avoid running your air conditioner from 11 a.m. to 5 p.m. on weekdays as much as possible. If you are home during this peak period, try cooling off with a fan first. • Cool your home to 25°C instead of the low 20s. Use a portable fan and/or ceiling fan in conjunction with your air conditioner to stay cool.
Media Centre	• Plug home electronics, such as TVs and DVD players, into power strips; turn the power strips off when the equipment is not in use—TVs and DVDs in standby mode still use several watts of power • Unplug infrequently used TV's, as many continue to draw power even when turned off.
Furnace	• Clean the air filter on your furnace every month to improve efficiency. • The electric fans in oil and gas furnaces consume about 13% of the home's electricity. Use the optimize and control function to manage your consumption.
Stove	• Don't use a bigger pot than you need, and match the pot to the right size element for greatest efficiency
Lighting	• Install a motion sensor for outside lighting that automatically turns the lights on and off as needed • Consider switching to CFL or LED light bulbs. They cost more initially, but they last longer, use less electricity and save money over time.
Maintenance/ Insulation	• Make sure your appliances and heating and cooling systems are properly maintained. Check your owner's manuals for the recommended maintenance. • Improve your home's insulation and seal air leaks to reduce energy waste and make the most of your energy dollars • Caulk, seal, and weather strip all seams, cracks, and openings to the outside to increase the efficiency of your AC. • Improving your home's insulation and sealing air leaks are the fastest and most cost-effective ways to reduce energy waste and make the most of your energy dollars. Be sure to seal air leaks before you insulate, because insulating materials won't block leaks. • Try the optimize feature in the EHMS. Just log in and set your desired temperatures and times
Phantom Energy	• Unplug appliances when not in use or use power bars and turn off when not needed temperatures and times • Unplug appliances when not in use to avoid 'phantom energy use'

The effectiveness of the tips was evaluated by looking at the total and on-peak share of the appliance in the week (short term) and month (longer term) following the presentation of a tip. To compare usage before and after the tip, both the week and month prior to a tip were calculated and compared to the time period following. This was determined for the total consumption (kWh) for the appliance, and the on-peak share (%), to see whether households made changes to either variable, particularly for tips which suggested either reducing or shifting usage. For example, "Avoid running your air conditioner from 11 am to 5 pm on weekdays as much as possible", which suggests shifting consumption to hours other than on-peak. On the other hand, suggestions such as "Unplug infrequently used TV's" would imply reducing total consumption by discontinuing electricity consumption of certain appliances or phantom loads. The changes in consumption were measured following the presentation of each tip, with an average value being derived from these changes for each specific appliance.

For weather dependent appliances, comparisons between the years for total electricity use were compared to ensure that a change in consumption was not only found due to the weather. The week or month of the current period was compared to the same week or month of the previous year to determine how consumption changed inter-annually.

Based on Allcott's (2009) study, the use of tips resulted in households changing their day to day behaviours, such as turning off lights or unplugging appliances when they received the prompt to do so. Kantola, Syme, and Campbell (1984), suggest that educational information alone has little to no impact on consumption, and that the presentation of tips can be used to demonstrate how consumers can save electricity, and be used to motivate users to conserve. While tips can prove beneficial, Costa and Kahn (2011), have found that different political preference of consumers will elicit different responses of households to tips and feedback. While this is not measured in this study, it is interesting to note the different variables which may impact a household's response to electricity feedback.

3.5.7 Monthly Certificate

At the end of each month, the household that was able to reduce their total consumption the most from the previous year (2013), was awarded with a certificate. This was determined by comparing the identical month from the previous year's total consumption (not normalized) and determining the percent change between years. In some cases, the full dataset for the month between both years was unavailable, in which case, only comparable data (e.g. only days in which consumption was available for both years) were used. This certificate designated the household as the 'Conservation Champion' of the month. Other households were made aware of the success of the Champion as part of the content of the email on the first Monday of the following month. By rewarding the top conserver each month, it was hoped that a sense of competition would evoke the households to lower their consumption for the following month. A total of seven certificates were sent out throughout the study. Each certificate was sent along with the weekly reports on the Monday following the conclusion of a month.

3.6 Weather Normalization

To compare electricity consumption between years, the process of weather normalization was undertaken. This eliminates the discrepancy between years in terms of weather, as days of extreme heat or cold can significantly increase the demand for electricity. For example, on a day of extreme heat, the requirement for the air conditioning would increase, whereas for days of extreme cold, the furnace fan for gas heating would run more. The weather data used for this process were retrieved from Environment Canada from the Toronto Pearson International Airport weather station. This station was selected as the closest suitable Environment Canada weather station to Milton, Ontario (approximately 33 kilometers). Although Oakville and Mississauga are closer to Milton, the moderating effect of the adjacent Lake Ontario, causes milder temperatures so Toronto Pearson was selected for weather data as it is a similar distance from the Lake.

To normalize, the weather data for two years (2013 and 2014) were collected for heating degree days (HDD), and cooling degree days (CDD). These daily values for the heating degree days and cooling degree days were obtained from Environment Canada, with 18°C used as the threshold for heating or cooling. These values were then compared to the daily kWh for total, air conditioning, and furnace consumption for 2013 (NOTE: only the total, furnace, and AC consumption were normalized due to their potential weather dependent consumption). These values were then plotted to create regression lines for 2013 and 2014 to determine whether the equation for the line of best fit was comparable between years. The line of best fit from the regression analyses was then used for two things. Firstly, to determine the quality of the relationship by examining the R-squared value, and the values for the slope and intercept of the line. Secondly, the line of best fit was used to establish the predicted values for 2014 (monitoring period). The predicted values were created by using of the following formula:

$$y=mx+ b$$

where:

y=predicted value (kWh) for 2014 monitoring period

m=slope (2013)

x= mean annual temperature, cooling degree days, or heating degree days (2014)

b= y-intercept (2013)

The results of predicted values demonstrate what the consumption for 2014 should be, based on consumption patterns from the baseline period (2013) (i.e. when the temperature rises above 20°C, air conditioning consumption rises). From these values, the actual 2014 values were compared to determine the change in consumption between the predicted (with the data normalized to account for change in weather) and the actual value measured during the monitoring period. This was completed through the following formula:

Consumption Change (kWh) = monitoring period consumption-expected consumption

To convert this change into a percentage, the following formula was used:

$$\text{Consumption Change (\%)} = \frac{\text{monitoring period consumption- expected consumption}}{\text{expected consumption}}$$

Following each of these processes the change in consumption between the years was tabulated.

3.7 Measuring Change

Following the 30 weeks of feedback reports, analysis of the results was undertaken. The change in total consumption and shift in peak percentage were measured, in terms of both immediate (1 week following) and persistent change (entirety of the 30 weeks). This was completed for each of the households and major appliances.

The change in total consumption was determined by examining the total consumption at the household and appliance level compared to previous consumption (i.e. the previous week, month, or year). This enabled a determination of whether the household reduced their consumption at the aggregate level. For the weather dependent appliances, this was analyzed in terms of raw (non-normalized) values and values normalized for CDD and HDD.

The shift in peak consumption was measured by examining the change in peak share in terms of the change in the number of kWh's and percentage of total use compared to previous consumption (i.e. the previous week, month, or year). This documented whether the household was able to reduce their on-peak, higher GHG intensive electricity consumption.

To compare whether households made initial changes (immediate) following prompts, consumption was compared to the previous week. This demonstrated whether the tips/prompts helped encourage households to reduce their consumption. In addition to this, consumption was also compared at a monthly level. This demonstrated whether there was a persistent reduction in consumption associated with the delivery of feedback related tips.

3.8 Limitations of Study

Despite all efforts to ensure the soundness of the study, there were some limitations. These limitations include: household withdrawals, dysfunctional meters, communication problems with wireless routers, and changing household composition, as summarized below.

Throughout the period of the study, there were many changes to the number of households partaking in this study. During the preliminary data collection period (to June 2014), five households exited the study. As well, some household's data were not available. This resulted in 16 participating households, rather than the original cohort of 26 households.

In addition to the reduction of participants, many household's systems were not operating properly or went offline during part of the study and as a result, were not producing data. These equipment failures occurred in some cases for as little as a few hours, but in other cases lasted months. This meant that although a particular household may have been involved with the feedback for several months, if one week their data were unavailable, they would not be included in the electricity reports for the week(s) data were unavailable. Due to this, the reports were not sent on a weekly basis to all of the households. The table below (Table 3.8) summarizes which households received a report on a weekly basis. Only three of the 16 households participated in all 30 weeks of the feedback project.

Table 3.8: Reports Sent to Households

WEEK	EHMS																% of all households
	1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26	
1	√		√	√			√	√		√		√				√	50%
2	√		√	√			√	√		√		√				√	50%
3	√		√	√			√	√		√		√				√	50%
4	√		√	√			√	√		√		√		√		√	56%
5			√	√			√	√		√		√		√		√	50%
6			√	√			√	√		√		√		√		√	50%
7			√	√			√	√		√		√		√		√	50%
8			√	√			√	√		√		√		√		√	50%
9			√	√			√	√		√		√		√		√	50%
10			√	√			√			√		√		√		√	44%
11			√	√			√			√		√		√		√	44%

Table 3.8: Reports Sent to Households

12			√	√			√			√		√				√	38%
13			√	√			√			√						√	31%
14	√		√	√			√			√		√				√	44%
15	√	√	√	√		√	√			√		√				√	56%
16	√	√	√	√		√	√		√	√		√		√	√		69%
17	√	√	√	√		√			√	√		√		√	√	√	69%
18	√	√	√	√		√			√	√		√		√	√	√	69%
19	√	√	√	√		√			√	√		√		√	√	√	69%
20	√	√	√	√		√			√	√	√	√		√	√	√	75%
21	√	√	√	√		√	√		√	√	√	√		√	√	√	81%
22	√	√	√	√		√	√		√	√	√	√		√	√	√	81%
23	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	94%
24	√		√	√	√	√	√		√	√	√	√	√	√	√	√	88%
25	√		√	√	√	√	√		√	√	√	√	√	√		√	81%
26	√		√	√	√	√	√		√	√	√	√	√	√		√	81%
27	√	√	√	√	√	√	√		√	√	√	√	√	√		√	88%
28	√	√	√	√	√	√	√		√	√	√	√	√	√		√	88%
29	√	√	√	√		√			√	√	√	√	√			√	69%
30		√	√	√	√	√	√		√	√		√	√	√		√	75%
SUM	20	13	30	30	7	17	25	9	15	30	10	29	9	22	9	29	
%	67%	43%	100%	100%	23%	57%	83%	30%	50%	100%	33%	97%	30%	73%	30%	97%	

The households participating in this study varied (i.e. different economic backgrounds, different demographics, and varying house/household sizes). Due to this, directly comparing households to one another does not represent a fair comparison of individual electricity use. For instance, one household may have members at home during the day, increasing electricity use considerably during total and on-peak hours, while another household may have only two members who are not home during the day.

In addition, there may have been changes in the household composition from that indicated on the surveys at the beginning of the study (2011). In particular, EHMS 2 indicated they went through a change in makeup in 2014, from the initial 3 household members, to one member. This reduction in household size may partly account for the large reduction in electricity use from the baseline period to the monitoring period. Furthermore, outside factors may also affect a household's electricity consumption. For instance, if households were away for a week, changed jobs or purchased a new appliance, it may affect their consumption. As well, circuits were named at the beginning of the study (3-4 years ago) and uses may have changed, thereby producing skewed results for changes in consumption at the appliance level.

Overall, the comparison amongst households was seen primarily as a motivator to the household, rather than a precise measure used to compare the household's conservation efforts. Rather, the household's baseline consumption data were regarded as a better means to determine whether the household was acting to conserve or shift electricity consumption.

Chapter 4: Results/Discussion

Following the seven month recording period, the results from the study were analyzed. The purpose of this chapter is to provide and discuss the profiles of each household partaking in the study, and the consumption from the previous and current period (including the weather normalization for household, AC, and furnace), in order to delineate the changes in electricity consumption and to estimate the effect that feedback had on the households.

4.1 Household Profiles

To establish a profile for each of the households, data provided in the self-reported surveys were compiled. Information from these surveys was obtained from Schulist's (2013) *Investigating the Relationship between Householders' Electricity Consumption and Engagement with Feedback* study, which was collected by the EHMS team. From these surveys, profiles distinguishing the dwelling and socio-demographic characteristics and attitudes towards electricity consumption were created, demonstrating the pre-existing conditions and attitudes that may affect overall electricity consumption.

4.1.1 Dwelling Profiles

In the table 4.1, the size, the year the home was built, and type of dwelling was documented. This was based on the information provided by the participants in the Home Profile and Appliances Selection Survey. As demonstrated in the table, the majority of houses are detached two or more storey homes, built after the year 2000 with only three older houses built in the 1970s. The floor space of all houses ranges from 1500 to 3500 square feet. This profile demonstrates a fairly new, fairly large group of houses. While the recent construction of a house implies that, more efficient technology may be present, the larger the square footage, the more area there is to heat/cool, thus more electricity use. As well, when houses are freestanding (no connecting unit/apartment), they require more electricity to heat or cool, due to the exposure to outside temperatures on all four sides.

Table 4.1.1: Dwelling Profiles

EHMS	Dwelling Size (Square Feet)	Year Built	Style of Dwelling
1	2000-2499	1970-1979	Detached two or more storey
2	1500-1999	1970-1979	Detached two or more storey
4	2000-2499	2000-2006	Semi-detached two or more storey
5	1500-1999	1970-1979	Detached two or more storey

Table 4.1.1: Dwelling Profiles

7	3000-3499	2000-2006	Detached two or more storey
9	1500-1999	2000-2006	Detached one storey
10	1500-1999	2000-2006	Detached two or more storey
11	1500-1999	2007-2010	Condominium town house or semi-detached
16	1000-1499	2000-2006	Row housing (attached on both sides)
17	1500-1999	2000-2006	Semi-detached two or more storey
18	3000-3499	2000-2006	Detached two or more storey
21	2500-2999	2000-2006	Detached two or more storey
22	2500-2999	2007-2010	Detached two or more storey
23	2500-2999	2007-2010	Detached two or more storey
24	2500-2999	2007-2010	Detached two or more storey
26	2500-2999	2007-2010	Detached two or more storey

Electricity Consumption and Dwelling Profile

To evaluate whether feedback was affected by the dwelling profile, the baseline and monitoring period consumption (not normalized) are compared to the dwelling size (square feet), the year built, and style of dwelling.

Dwelling Size

To determine whether the dwelling size affects consumption, the square footage of each of the houses involved in the study is compared to the change in consumption (Table 4.1.2). Based on the following table, ranked by square footage, it is evident that square footage does not directly determine consumption (baseline consumption). As demonstrated in the table, the largest consumers are found for the 2000-2499 square foot range, while those with the largest square footage (3000-3499 square feet), had an average consumption of 158.8 kWh/week. However, based on the change in consumption (%) following the feedback interventions, the highest consumers (2000-2499 square foot households) reduced their consumption the greatest, proportionate to their baseline usage. On average, households with the largest square footage made the greatest increases to consumption. While the literature (Yohanis et al., 2008) typically suggests that larger homes will consume more electricity, it also suggests that the age of the home can play a large factor in electricity consumption (i.e. larger, newer homes can be as efficient as older smaller homes). Those with the largest square footage were constructed in the 2000-2006 period, which demonstrates that they are not the newest homes involved in the study, though are relatively new. In addition to this, often those who consume the most electricity have the greatest opportunity to make reductions, which is evident in this study.

Table 4.1.2: Dwelling Size and Change in Consumption (%) for 30 Weeks

Dwelling Size (Square Feet)	# of Households	Avg. Baseline Consumption (kWh/week)	Avg. Δ Total (%)
3000-3499	2	158.8	3.2%
2500-2999	5	198.8	-10.4%
2000-2499	2	307.8	-19.4%
1500-1999	6	161.3	-12.9%
1000-1499	1	122.3	-3.9%

Year Built

For the year built, those whose houses are built during the 1970-1979 period had an average consumption of 226.8 kWh/week, higher than those built in the 2000-2006 period (176.7 kWh/week), and the 2007-2010 period (184.7 kWh/week) (as shown in Table 4.1.3). As construction methods and insulation improves to meet more stringent building codes, houses are built more energy efficient, thus requiring the use of less electricity. As with the households in this study, the oldest households have the largest baseline consumption, which supports the idea that older houses consume more electricity. However, upgrades may have been made in these homes and these results may be additionally impacted by other household factors.

As for the change in consumption following the feedback intervention, the households that were built in the 1970-1979 category had an average reduction in total consumption of 25%. On the other hand, the 2000-2006 category reduced consumption by 6%, and the 2007-2010 households decreased consumption by 9%. Much like the baseline consumption, in which the oldest households had the large average kWh/week, the oldest houses also made the largest average reductions following the intervention.

Table 4.1.3: Year Built and Change in Consumption (%) for 30 Weeks

Year Built	# of Households	Avg. Baseline Consumption (kWh/week)	Avg. Δ Total (%)
1970-1979	3	226.8	-25.2%
2000-2006	8	176.7	-5.6%
2007-2010	5	184.7	-9.1%

Style of Dwelling

For the style of dwelling, the semi-detached two or more storey home had the highest baseline consumption with an average of 215.9 kWh/week, while the detached one storey household had the lowest baseline consumption with an average of 122.3 kWh/week (as shown in Table 4.1.4). The detached two or more storey, presumably the largest houses, had a baseline consumption of roughly average amongst all types of dwellings with 187.5 kWh/week, demonstrating that the larger, detached households may not necessarily consume the most electricity regardless of their size and lack of additional insulation on the surrounding walls (provided by the attachment to other dwellings).

With regards to the change in consumption following the feedback intervention, the semi-detached two or more storey, houses with the greatest baseline consumption, also had the greatest reduction of 16.0%, with the detached one storey with the lowest baseline consumption demonstrated increases of 0.1%.

The literature suggests that houses which are connected to other houses (as with the case of row houses, apartments, or condominiums) consume less electricity. With regards to the houses in this study, this is not the case. Row houses had the highest initial consumption, and were constructed within the 2000-2006 period, with a relatively small square footage, suggesting that household behaviour or age of appliances may affect consumption more greatly.

When grouping households into detached and semi-detached or row, it is evident that the detached housing options consumed more electricity on average. However, following the intervention, this grouping also made slightly larger reductions than the households with semi-detached/row housing.

Table 4.1.4: Style of Dwelling and Change in Consumption (%) for 30 Weeks

Style of Dwelling	# of Households	Avg. Baseline Consumption (kWh/week)	Avg. Δ Total (%)
Detached	12	216.7	-10.5%
Semi-detached/Row	4	157.9	-10.1%

4.1.2 Socio-Demographic Profiles

The socio-demographic characteristics of the households were identified by household responses in the Home Profile and Appliances Selection Survey. This survey included questions regarding the number of people and ages of those in the household, the highest level of education in the household, and household income before taxes. The following table summarizes the results of this survey.

Table 4.1.5: Socio-Demographic Profiles

EHMS	Age (Years)					Total # of Occupants	Household Income (Before Taxes)	Highest Certificate/ Diploma/ Degree in Household
	0-5	6-13	14-17	18-64	65+			
1	0	0	0	2	0	2	$150, 000 and over	Bachelor's Degree
2	0	0	0	3	0	3	$150, 000 and over	Bachelor's Degree
4	2	2	0	2	0	6	$80, 000-$89, 999	Bachelor's Degree
5	2	0	0	2	0	4	$125, 000-$149, 999	Bachelor's Degree
7	1	0	0	2	0	3	$150, 000 and over	University Certificate or Diploma below Bachelor Level
9	0	2	1	2	0	5	$90, 000-$99, 999	University Certificate or Diploma below Bachelor Level
10	0	1	1	3	0	5	$60, 000-$69, 999	Bachelor's Degree
11	0	0	0	2	0	2	$100, 000-$124, 999	Bachelor's Degree
16	1	1	0	2	0	4	$90, 000-$99, 999	Bachelor's Degree
17	1	1	0	2	0	4	$90, 000-$99, 999	Bachelor's Degree
18	0	2	0	2	0	4	$100, 000-$124, 999	Bachelor's Degree
21	2	0	0	2	0	4	$125, 000-$149, 000	University Certificate or Diploma below Bachelor Level
22	1	0	0	2	0	3	$90, 000-$99, 999	Bachelor's Degree
23	2	0	0	2	0	4	$150, 000 and over	Master's Degree
24	1	2	0	5	0	8	$150, 000 and over	Bachelor's Degree
26	0	0	0	2	0	2	$150, 000 and over	PhD

Based on the table above, it is evident that most participants' households have a member with a bachelor's degree or higher. However, the higher the level of education is not indicative of the household income (before taxes). Income is relevant in this study, as it has been found in other studies (such as Yan

& Lifang, 2011) to motivate households to reduce electricity consumption in order to save money. The number of occupants ranges from 2 to 8 people, with three-quarters of the households having children present under the age of 13. The number of household occupants can affect electricity use for certain appliances. For example, the amount of that the washer/dryer or dishwasher is used is typically higher with a greater number of occupants.

Electricity Consumption and Socio-Demographic Profiles

To determine whether socio-demographic characteristics affect consumption, the number of occupants, income (before taxes), and level of education are compared to the change in consumption (not normalized).

Number of Occupants

Comparing the baseline consumption to the number of occupants shows that households with a larger number of occupants may not necessarily have a correspondingly higher consumption (Table 4.1.6). For instance, households with only 2 occupants had an average of 217.1 kWh/week (the second highest average for all numbers of occupants), while households with 8 members had an average of 162.9 kWh/week (the second lowest average for all numbers of occupants), thus confirming that factors aside from, or in addition to, number of occupants may affect consumption more strongly (i.e. behaviours, number of appliances, age of home, etc.). Examining the change in consumption following the feedback reports, those who made the greatest reductions had the largest number of occupants (8), reducing on average by approximately 18.0%.

Table 4.1.6: Number of Occupants and Change in Consumption (%) for 30 Weeks

Number of Occupants	# of Households	Avg. Baseline Consumption (kWh/week)	Avg. Δ Total (%)
8	1	162.9	-18.0%
6	1	297.4	-14.5%
5	2	194.6	-2.0%
4	6	184.2	-12.8%
3	3	137.3	-7.4%
2	3	217.1	-10.7%

Income

With regards to the relationship between income and consumption, households with the highest incomes ($150, 000 and above), have the highest average baseline consumption (225.1 kWh/week), while the lowest incomes ($60, 000-$69, 999), have the lowest average baseline consumption (80.0 kWh/week) (Table 4.1.6). With the exception of the $100, 000-$124, 999 income range, there is a trend that the lower the income, the lower the average baseline consumption, possibly suggesting a direct link between income and electricity consumption as discussed in Yang & Lifang's (2011) article.

As for the change in consumption (%), those with the highest incomes ($150, 000 and above), have an average savings of 14.2%. The greatest savings are found for the $100, 000-$124, 999 income range, who also had the lowest average baseline consumption, with savings of 15.6%. On the other hand, those with the lowest income category had the lowest savings of 4.0%.

Table 4.1.7: Income and Change in Consumption (%) for 30 Weeks

Income (before taxes)	# of Households	Avg. Baseline Consumption (kWh/week)	Avg. Δ Total (%)
$150, 000 and over	6	225.1	-14.2%
$125,000-$149,000	2	191.5	-4.3%
$100,000-$124,999	2	143.1	-15.6%
$90,000-$99,999	4	187.3	-5.6%
$80,000-$89,999	1	169.0	-14.5%
$60,000-$69,999	1	80.0	-4.0%

Level of Education

For the level of education, the households with a bachelor's degree have the lowest baseline consumption of 179 kWh/week, while the highest average is for the household's with a master's degree is 262.8 kWh/week (Table 4.1.8). There are no trends amongst the data to suggest that level of education directly impacts consumption, based on the households involved in this study.

For the change in consumption, those with a master's degree have the largest savings of 18.5%. Contrary to this, the households with a university certificate or diploma below bachelor level increased consumption on average by 7.3%. This demonstrates that those with an education of bachelor's level or above make greater reductions in total electricity use than those with a certificate or diploma, possibly a result of increased knowledge and awareness through further education.

Table 4.1.8: Level of Education and Change in Consumption (%) for 30 Weeks

Highest Certificate/ Diploma/ Degree in Household	# of Households	Avg. Baseline Consumption (kWh/week)	Avg. Δ Total (%)
PhD	1	204.5	-3.5%
Master's Degree	1	262.8	-18.5%

Table 4.1.8: Level of Education and Change in Consumption (%) for 30 Weeks

Bachelor's Degree	11	179.3	-15.1%
University Certificate or Diploma below Bachelor Level	3	192.7	7.3%

4.1.3 Awareness, Attitudes, and Actions towards Electricity

The actions, attitudes, and behaviours of households with regards to energy use are analyzed through the use of various questions presented in a survey. The following tables outline the questions or statements with household responses, beginning with household awareness, attitudes, actions, and action frequency during all seasons, cooling seasons, and heating seasons. These responses are then used to determine the households pre-disposition to electricity conservation. In addition to this, households also identified goals which they would like to accomplish throughout the study, which can be measured to see how their consumption has changed throughout the study. Three households did not complete surveys: EHMS 2, 22, and 24.

Awareness

To determine household awareness regarding electricity consumption, questions asking households about about the amount, $ value, and carbon emissions associated with the use of appliances were asked.

It is evident from looking at the results of household awareness regarding electricity use that many, prior to the EHMS study, had little knowledge about how and where electricity is used and its associated emissions and cost, as shown in Table 4.1.9. By being given access to a web portal breaking down electricity usage, cost, and associated emissions, it is hoped that through the process of this entire project (3-4 years), households would have different answers to such questions. Through this particular study, in which further breaks down electricity usage on a weekly and appliance specific basis, households were given detailed information discerning the electricity usage of various appliances and the costs of consuming them (and in turn, presumably, increased their awareness of electricity consumption).

Table 4.1.9: Summary of Household Awareness about Electricity Consumption

Please indicate how you perceive your level of awareness with regards to the following:	Currently, I am aware of how much electricity is used by each of my electric appliances.	Currently, I am aware of how much money it costs to use each of my electric appliances.	Currently, I am aware of the carbon footprint associated with using each of my electric appliances.
Agree (somewhat, strongly)	2	2	0

Table 4.1.9: Summary of Household Awareness about Electricity Consumption

Neither Agree nor disagree	3	1	2
Disagree (some-what, strongly)	8	10	11

Attitudes

To determine household attitudes, questions regarding conservation and peak shifting were asked of households. These responses help determine whether households are motivated to use electricity resources more efficiently, and whether they believe in shifting consumption away from on-peak times.

Examining the results, all households believe in conserving and peak shifting their electricity consumption, as presented in the table below (Table 4.1.10).

Table 4.1.10: Summary of Household Attitudes about Electricity Consumption

To what extent do the following statements describe your attitudes towards energy management in your home?	I believe that it is important to conserve as much energy in my home as possible.	I believe that it is important to reduce my electricity usage during on-peak times as much as possible.
Agree (somewhat, strongly)	13	13
Neither Agree nor disagree	0	0
Disagree (somewhat, strongly)	0	0

Comparing these results to the results of this study, the average household change in consumption for the total, and on-, mid-, and off-peak shares, demonstrate that households generally did respond accordingly to their responses in the survey. On average, households reduced their total consumption by 20.0 kWh/week and reduced on-peak consumption by 4.8 kWh/week, or an average of 0.4%, as indicated on Table 4.1.11.

Table 4.1.11: Summary Table for Average Change in Consumption (kWh/week) and Peak Share (%) for 30 Weeks

On-Peak		Mid-Peak		Off-Peak		Total
Avg. Δ kWh/week	Avg. Δ Peak Share (%)	Avg. Δ kWh/week	Avg. Δ Peak Share (%)	Avg. Δ kWh/week	Avg. Δ Peak Share (%)	Avg. Δ kWh/week
-4.8	-0.4%	-0.7	-0.1%	-14.6	0.4%	-20.0

Actions

To further gage information about conservation efforts, the following table outlines whether households act to conserve or shift peak consumption. Much like the results for household attitudes towards electricity conservation, the majority of households responded to the survey indicating that they conserve and peak shift their electricity (summarized in Table 4.1.12).

Table 4.1.12: Summary of Household Actions towards Electricity Conservation

To what extent do the following statements describe your actions towards energy management in your home?	I try to conserve as much energy in my home as possible.	I try to reduce my electricity usage during on-peak times as much as possible.
Agree (strongly, somewhat)	11	10
Neither agree nor disagree	2	3
Disagree (strongly, somewhat)	0	0

Breaking this down, it is evident that most households reduced total consumption following the feedback, with the exception of EHMS 9, EHMS 23, and EHMS 24. The survey results indicate that 11 households stated "I try to conserve as much energy in my home as possible", which is corresponded with many of the households' total change in consumption. However, the households mentioned above, that all suggested that they conserve total and on-peak electricity, increased their consumption following the intervention. Therefore, while households may believe in electricity conservation and reducing on-peak share, they may have cognitive dissonance in which their actions do not reflect their attitudes. The following table (Table 4.1.13) shows the change in average change in consumption for each of the three response types. Those who strongly agreed with trying to conserved electricity correspondingly had the greatest reductions in electricity use when compared to the previous year.

For the on-peak change in consumption (%), five households made increases in on-peak share. Unlike the survey results, in which 10 households stated they try to reduce electricity usage during on-peak times, not all households acted accordingly. EHMS 1, 5, 9, 11, and 16, all made increases in on-peak share from the baseline period. For the household actions regarding on-peak electricity use, those who strongly agreed with reducing as much on-peak consumption as possible had the largest reductions in total and on-peak electricity use. On the other hand, those who agreed made increases in total and on-peak in the amount of 8.2% and 1.0%, respectively.

Table 4.1.13: Reported Household Actions and Change in Consumption (%) from Previous Year

I try to conserve as much energy in my home as possible.	Number of Households	Avg. Δ Total (%)	Avg. Δ On- Peak Share (%)
Strongly Agree	6	-15.6%	-8.3%
Agree	5	-3.3%	-1.4%
Somewhat Agree	2	-9.5%	0.7%
I try to reduce my electricity usage during on-peak times as much as possible.	Number of Households	Avg. Δ Total (%)	Avg. Δ On- Peak Share (%)
Strongly Agree	7	-15.9%	-40.0%
Agree	3	8.2%	1.0%
Somewhat Agree	3	-14.2%	-2.1%

Actions (Seasonal)

Breaking down specific electricity conserving actions into their frequency in particular seasons and throughout all seasons, the following tables demonstrate how often households report conserving electricity. The tables below present the results of the frequency of electricity conserving actions between seasons.

Breaking these actions down into seasons, it is evident that certain electricity conserving activities take place at different times. For example, while the majority of households will turn off their lights when no one is in the room daily, almost half of the households never hang their clothes to dry or adjust heating/cooling vents in rooms not in use, as shown in Table 4.1.14.

During the cooling months, it appears more households put forth an effort to conserve electricity by opening windows, closing drapes, or adjusting the AC temperature on a daily basis.

During the heating months, most households state that they adjust their thermostat when no one is home or they are sleeping; however, there is a split with regards to wearing warmer clothing so that the thermostat can be set lower. Much like suggested in Yan & Lifang's (2011) study, households are less likely to modify their energy behaviours when it disrupts personal comfort, of which temperature greatly affects.

Table 4.1.14: Summary of Electricity Conserving Actions

	All Seasons						
In the past year, how often have the following actions been performed in your home to conserve energy?	At least daily	Every 2-3 days	Once per week	Every 2-3 weeks	Once per season	Once per year	Never
Use less hot water	2	2	3	0	1	1	3
Turn off lights when no one is in the room	12	1	0	0	0	0	0
Turn off T.V., stereo, computer, printer when not in use	5	5	1	1	0	0	1
Hang clothes to dry	1	0	3	0	1	2	6
Adjust heating/cooling vents in rooms not in use	1	1	4	0	0	1	6
Run electric appliances at off-peak times	2	7	2	0	0	0	1
	Cooling Months						
Use fans/open windows instead of air conditioning	6	0	0	3	1	0	3
Raise the indoor temperature by adjusting the air-conditioner	5	3	0	2	0	1	2
Close drapes during hot summer days	8	3	0	1	0	0	1
	Heating Months						
Adjust thermostat to lower heat when no one is home	7	0	2	0	2	0	2
Adjust thermostat to lower heat when my family is asleep	8	0	0	0	1	1	3
Wear warmer clothes, so the thermostat can be kept lower	4	0	0	3	1	1	4

Comparing the results of the survey to the change in consumption for the various appliances, it is demonstrated that a reduction in AC usage is consistent with household opinion on energy saving activities for this appliance (Table 4.1.15). The majority of households stated that they would make adjustments in order to reduce their electricity usage for the AC. On the other hand, while the majority of households stated they never hang clothes to dry rather than use the dryer, households on average did make reductions to washer/dryer electricity consumption in terms of kWh and peak share. This is reflected in 7 of the households stating they use electricity consuming appliances during off-peak times approximately 2-3 times a week.

Table 4.1.15: Summary of Change in Appliance Level Consumption

		Household	AC	Furnace	Washer/Dryer	Dishwasher	Refrigerator	Media Centre
30 Weeks	Avg. Δ On-Peak kWh/week	-4.8	-3.4	1.7	-0.7	0.1	0.0	-1.5
	Avg. Δ On-Peak Share (%)	-0.4%	0.9%	-0.4%	-2.7%	-0.6%	-0.7%	-2.8%
12 Week Summer	Avg. Δ On-Peak kWh/week	-4.8	-3.4	1.0	-1.3	0.1	0.4	-1.5
	Avg. Δ On-Peak Share (%)	-0.1%	0.9%	-0.8%	-2.8%	-1.8%	-0.3%	-0.3%
18 Week Fall/Winter	Avg. Δ On-Peak kWh/week	-4.7	n/a	1.6	-0.3	0.1	-0.3	-1.5
	Avg. Δ On-Peak Share (%)	-0.6%	n/a	0.4%	-1.4%	-0.7%	-0.5%	-3.0%

Goal-Setting

Prior to the introduction of the case study and setting up of the smart meters, households were asked if they would like to set goals for what they would achieve throughout the study. These results were collected throughout the 2012/2013 installation periods. For the households whom responded with a goal of conserving or minimizing an increase in consumption, all were able to achieve their goals, except for EHMS 5, who increased consumption on average by 6.0 kWh/week (Table 4.1.16). In the table below, the reductions made throughout the study are tabulated, with an average 17.9 kWh/week reduction over the 7 month/30 week study period.

While these goals were stated three years before this particular study took place, their attitudes towards conserving evidently persisted with a decrease in consumption for most households (compared to the baseline year).

Table 4.1.16: Goal-Setting and Change in Consumption (%) from Previous Year

EHMS	"I would like to set goals that help…"	Avg. Δ kWh/week
5	Decrease my home's electricity consumption	6.0
11	Minimize an increase of my home's electricity consumption	-5.9
16	Decrease my home's electricity consumption	-4.8
17	Decrease my home's electricity consumption	-13.9
18	Decrease my home's electricity consumption	-41.2
21	Decrease my home's electricity consumption	-27.4
23	Decrease my home's electricity consumption	-48.8
26	Decrease my home's electricity consumption	-7.2

4.2 General Change in Consumption

To answer research question #1: *When provided with feedback, how do households respond/alter their consumption from the previous year?* , the inter-annual change in consumption is examined. This is the change in consumption between the baseline period (2013) and monitoring period (2014) in order to evaluate whether households made reductions in their electricity consumption following the feedback reports. This is broken down into household and appliance data and is determined by both the total and on-peak consumption (kWh/week), and peak share (%). For reference, data in this section is not normalized unless specifically stated.

When examining the general change in consumption (total, on-peak, mid-peak, and off-peak) for the household and several of the major appliances throughout the 30-week monitoring period, trends can be noted as to how consumption has changed from the previous, baseline year (2013). The following sections outline the results for the household and each of the major appliances on-, mid-, off-, and total consumption change. Values for the change in consumption are presented in weekly values due to the data availability and many missing values. This allowed for comparisons between the households, as the changes would be proportionate to the number of weeks of available data.

On-Peak

On-peak consumption is of particular interest because reducing the peak has the greatest potential to reduce costs and emissions. Consumption over the 30 week period was compared with the previous year. Average weekly on-peak consumption declined by 4.8 kWh per household (Table 4.2.1). The air conditioner, laundry and media centre showed a similar pattern to that of the household total, of reduced on-peak consumption, with averages of 3.4, 0.7 and 1.5 kWh/week respectively.

While a reduction may be found for the average kWh/week of use for a specific appliance or household, the change in peak percentage may not necessarily be negative. This is because the peak percentage measures the proportion of the consumption that is on-peak, rather than the actual kWh. The peak percentage measures the proportion of on-, mid-, or off-peak consumption to the total consumption.

In the case of the furnace (fan) there is an increase in the average peak consumption (1.7 kWh/week), as well as a reduction in the peak share (0.4%), indicating that a larger increase occurred at other times. Refrigerator and dishwasher consumption levels showed little change while the peak share of the air conditioning consumption increased (0.9%). Overall, aggregate household on-peak consumption declined by 0.4% and the discretionary uses (laundry and media centre) showed the greatest reductions of 2.7% and 2.8% respectively.

Table 4.2.1: Average Change in On-Peak Consumption by Household & Major Appliance for 30 Weeks*

Appliance	Avg. Δ On-Peak (kWh/week) Per Household	Avg. Δ On-Peak Share (%) Per Household
Household	-4.8	-0.4%
AC	-3.4	0.9%
Furnace	1.7	-0.4%
Washer/Dryer	-0.7	-2.7%
Dishwasher	0.1	-0.6%
Refrigerator	0.0	-0.7%
Media Centre	-1.5	-2.8%

*only 12 weeks are used for the AC

During seasonal extremes, different appliances are used (for example, air conditioning during the summer). For this reason, an analysis was completed distinguishing the difference between the spring/summer and fall/winter months.

At the household level, there is reduced average on-peak consumption for both the 12 week summer and 18 week fall/winter, to the amount of 4.8 and 4.7 kWh/week respectively (Table 4.2.2). During the 12 week summer, the appliance with the most notable reduction is the washer/dryer, reducing on-peak share by 2.8%. For the 18 week fall/winter, the media centre made the largest reduction in on-peak share of total consumption, 3.0%.

Table 4.2.2: Average Change in On-Peak Consumption by Household & Major Appliance by Season

Appliance	12 Week Summer		18 Week Fall/Winter	
	Avg. Δ On-Peak kWh/week	Avg. Δ On-Peak Share (%)	Avg. Δ On-Peak kWh/week	Avg. Δ On-Peak Share (%)
Household	-4.8	-0.1%	-4.7	-0.6%
AC	-3.4	0.9%	n/a	n/a
Furnace	1.0	-0.8%	1.6	0.4%
Washer/Dryer	-1.3	-2.8%	-0.3	-1.4%
Dishwasher	0.1	-1.8%	0.1	-0.7%
Refrigerator	0.4	-0.3%	-0.3	-0.5%
Media Centre	-1.5	-0.3%	-1.5	-3.0%

During the 12 weeks of summer, on a weekly basis, all households except EHMS 1 made reductions in household total kWh/week (Appendix C) . Many of the major appliances, including the furnace (fan) and washer/dryer consumption had variable change, with a mix of households increasing or decreasing consumption from the previous year.

For the change in peak share for the 12 week summer, all households either made no change or reduced peak share, with the exception of EHMS 1, 4, and 11. Similar to the change in kWh, there are mixed results for the change in on-peak share for households and major appliances.

The 18 week fall/winter period demonstrated a decrease in total household consumption amongst all participants except for EHMS 5, 7, and 9, which increased consumption by 4.5, 6.2 and 3.5 kWh/week, respectively. For each of the major appliances, there is a mixture of increases and decreases in consumption. One notable change in consumption is EHMS 4 washer/dryer consumption, which was reduced by 6.0 kWh/week from the baseline year.

The change in peak share for the 18 week fall/winter demonstrates a reduction in on-peak share for EHMS 4, 7, 10, 17, 18, 21, 22, 23, 24, and 26, while EHMS 1, 2, 5, 9, and 16 increased on-peak share. The largest reductions were made for the media centre with EHMS 24 reducing consumption by 15.9%.

Mid-Peak

For the mid-peak consumption, there was a reduction in consumption for most major appliances and the household consumption, with the exception of the furnace and refrigerator (Table 4.2.3). There was a reduction in mid-peak consumption of 3.5 kWh/week on average per household. All appliances reduced mid-peak share, except the furnace, with the largest reduction in peak share found for the washer/dryer of 4.7%.

Table 4.2.3: Change in Mid-Peak Consumption by Household & Major Appliance for 30 Weeks

Appliance	Avg. Δ Mid-Peak (kWh/week) Per Household	Avg. Δ Mid-Peak Share (%) Per Household
Household	-3.5	-0.1%
AC	-2.2	-0.1%
Furnace	1.8	17.5%
Washer/Dryer	-0.8	-4.7%
Dishwasher	-0.2	-2.0%
Refrigerator	0.0	-1.0%
Media Centre	-1.3	-2.2%

*only 12 weeks are used for the AC

Looking at the 12 week summer and 18 week fall/winter, there are reductions in mid-peak kWh/week for the household, air conditioning, washer/dryer, and media centre for both seasonal extremes (Table 4.2.4). While increases were made during the initial 12 weeks for the dishwasher and refrigerator, there are decreases in consumption for the final 18 weeks of 0.2 kWh/week for each appliance. For the mid-peak share all appliances made reductions for the 18 week fall/winter, while for the 12 week summer only the air conditioning, washer/dryer, and refrigerator saw a reduction in consumption.

Table 4.2.4: Change in Mid-Peak Consumption Per Household & Appliance by Season

	12 Week Summer		18 Week Fall/Winter	
	Avg. Δ Mid-Peak (kWh/week)	Avg. Δ Mid-Peak Share (%)	Avg. Δ Mid-Peak (kWh/week)	Avg. Δ Mid-Peak Share (%)
Household	-0.7	1.1%	-4.5	-0.6%
AC	-2.2	-0.1%	n/a	n/a
Furnace	1.7	0.2%	1.5	-2.3%
Washer/Dryer	-0.9	-3.4%	-0.6	-3.5%
Dishwasher	0.1	2.8%	-0.2	-3.7%
Refrigerator	0.4	-0.2%	-0.2	-0.9%
Media Centre	-1.5	0.2%	-1.3	-3.1%

Examining the change in mid-peak consumption over the 12 week summer (Appendix C), each of the major appliances had a mix of increases/decreases in consumption for all households, aside from air conditioning, in which all households, except EHMS 11 reduced consumption.

Putting these values into terms of percent change of mid-peak share for the 12 weeks, there are mixed results for each of the appliances and households. EHMS 1 demonstrates the most notable reduction in consumption for multiple appliances, including the air conditioning (12.9%) and the washer/dryer (15.5%).

Looking at the 18 fall/winter weeks for the mid-peak kWh/week, the change in consumption varies greatly by both appliance and household. The appliance with the greatest consistency in reduction is the media centre with all but EHMS 5 and 23 reducing consumption from the previous year..

As for the mid-peak share (%), there was a range of responses in consumption. The most notable changes were made by EHMS 7 for the washer/dryer, in which mid-peak share was reduced by 20.7%, and EHMS 1, for the dishwasher, where there was a 22.7% decrease.

Off-Peak

Overall, off-peak consumption was reduced by 305 kWh per household over the study period, or 14.6 kWh per week (Table 4.2.5). While the household, air conditioning, dishwasher, and media centre had decreases in off-peak kWh, the furnace and washer/dryer increased off-peak kWh. Unlike the other peak rates, on- or mid-peak, an increase in the share of off-peak consumption can be a positive shift in consumption. For the off-peak share, all appliances, with the exception of the media centre demonstrated an increase in off-peak share with the washer/dryer increasing the most, 5.3%.

Table 4.2.5: Change in Off-Peak Consumption by Household & Major Appliance for 30 Weeks

Appliance	Avg. Δ Off-Peak (kWh/week) Per Household	Avg. Δ Off-Peak Share (%) Per Household
Household	-14.6	0.4%
AC*	-11.8	0.9%
Furnace	7.4	0.4%
Washer/Dryer	0.4	5.3%
Dishwasher	-0.1	4.3%
Refrigerator	0.0	1.4%
Media Centre	-4.6	-10.5%

*only 12 weeks are used for the AC

The change in consumption over the 12 week summer and 18 week fall/winter shows decreases in off-peak consumption for the household for both seasons (10.0 and 15.5 kWh/week respectively) (Table 4.2.6). The washer/dryer demonstrate a shift to off-peak usage throughout the summer months. For the off-peak share, the media centre demonstrated a large reduction in off-peak share for the fall/winter. Having had a reduction in on-, and mid-peak as well, it is evident large reductions in usage for this category were made.

Table 4.2.6: Change in Off-Peak Consumption Per Household & Major Appliance for 12 Week Summer

	12 Week Summer		18 Week Fall/Winter	
	Avg. Δ Off-Peak kWh/week	Avg. Δ Off-Peak Share (%)	Avg. Δ Off-Peak kWh/week	Avg. Δ Off-Peak Share (%)
Household	-10.0	1.0%	-15.5	0.2%
AC	-11.8	0.9%	n/a	n/a
Furnace	7.3	0.6%	6.0	-1.3%
Washer/Dryer	2.4	7.2%	-0.6	0.5%
Dishwasher	-0.1	1.9%	-0.1	3.0%
Refrigerator	1.4	0.5%	-0.8	0.8%
Media Centre	-4.6	2.8%	-4.1	-12.9%

The off-peak consumption for the initial 12 weeks demonstrates a mix increases/decreases for each of the households (Appendix C); however, there is an average 10 kWh/week reduction at the household level. All hubs decreased off-peak household-level consumption with the exception of EHMS 1 and 5, who increased consumption on average by 34.4 and 7.4 kWh/week, respectively. In addition to the household consumption, EHMS 1 and 5 also made increases in air conditioning off-peak consumption, while all other households decreased consumption. For the furnace, EHMS 5 and 10 made significant increases to off-peak consumption, with EHMS 5 increasing by 45.1 kWh/week, and EHMS 10 by 28.8 kWh/week. While an increase in absolute off-peak consumption does not demonstrate conservation of electricity, it does show that some some electricity consuming activities have been moved to off-peak times, in which helps alleviate the demand during peak hours.

The change of share in off-peak for the 12 week summer shows an increase in share (%) for each household, excluding EHMS 11 and 23, which decreased peak share by 2.7% and 5.6%, respectively. The greatest increases to off-peak share are from the air conditioning, in which EHMS 1 had an increase of 28.1%, and EHMS 5 had an increase of 20.5%.

Overall, for the change in off-peak consumption (kWh), at the household level, 13 out of 16 households reduced their consumption. A reduction in off-peak consumption can either suggest a reduction at all times of usage, or that users are using electricity consuming appliances during other times periods of the day. Looking to specific appliances, while some have a mix of increases and decreases (namely the furnace, dishwasher, and washer/dryer), the refrigerator and media centre have 10 households decreasing off-peak consumption, with only 4 households for each increasing.

For the off-peak share (%) another story is presented. At the household level, it is an even split (8 to 8) for increases or decreases in off-peak share. The washer/dryer most strongly demonstrates an increase of households switching to off-peak usage, with 11 households increasing off-peak share, with 4 decreasing.

Total

When looking at the change in total consumption, two analyses were completed. The first compared consumption directly between the two years; the second, compared the monitoring period consumption to the predicted values obtained through the weather normalization processes (for the household, air conditioning, and furnace).

The direct comparison through the baseline and monitoring period demonstrates the average decrease in consumption per household to be 20.0 kWh/week (Table 4.2.7). The average household made reductions for the household, air conditioning, washer/dryer, dishwasher, refrigerator, and media centre, while the furnace increased in terms of kWh/week.

Table 4.2.7: Change in Total Consumption Per Household & Major Appliance for 30 Weeks

Appliance	Avg. Δ Total (kWh/week) Per Household	Avg. Δ Total (%) Per Household
Household	-20.0	-10.4%
AC*	-19.3	-30.9%
Furnace	10.9	30.0%
Washer/Dryer	-1.2	-8.1%
Dishwasher	-0.1	3.6%
Refrigerator	-0.1	0.8%
Media Centre	-6.8	-29.7%

* only 12 weeks are used for the AC analysis

When looking at the individual households (Appendix C), three households showed an increase in total household consumption: EHMS 5, 7, and 9, with increases of 6.0, 53.6, and 0.2 kWh/week, respectively. The increase in total consumption for EHMS 5 is evident amongst all appliances aside from the dishwasher and media centre, in which small reductions are made.

Total: Normalized

For the CDD normalization, there is a decrease in both the household and air conditioning total consumption of 22.5 and 14.1 kWh/week, respectively; while for the HDD normalization, there is a decrease in household consumption, and an increase in furnace consumption of 5.6 kWh/week and 13.9 kWh/week, respectively (Table 4.2.8). This shows that, dependent upon the method of normalization, different results may be found.

Between 2013 and 2014, there were 157 fewer HDD, from 1441 HDD in 2013 to 1284 HDD in 2014, a reduction of 11%, thus, the electricity requirement should be lower for 2014 than 2013 with regards to heating. In particular, during the 18 week fall/winter period, there was a 139 HDD reduction (-9.9%), equating to an average of 7.7 HDD per week. As determined through the weather normalization for HDD, furnace consumption increased 13.9 kWh/week for 2014. Without normalization, there was an average increase of 10.9 kWh/week. As expected, when adjusted for the reduced number of HDD, the year over year normalized consumption rose by an additional 3 kWh/week.

For the AC, between 2013 and 2014, for the 30 week study period there was a decrease of 50 CDD, from 302 CDD in 2013 to 252 CDD in 2014, a 17% change. This means that there should be reductions in electricity consumption when compared to the previous year. According to the normalization, AC reduced, on average, 14.1 kWh/week for each household. Without normalization, it was found to have a 19.3 kWh/week reduction. For the 12 week summer, there was a change of 43 CDD, from 235 CDD in 2013 to 192 in 2014, an 18% change.

Table 4.2.8: Average Change in Total Consumption (kWh/week) Per Appliance & Household for 30 or 12 Weeks; Normalized by CDD & HDD

Normalization	Household	AC	Furnace
CDD	-22.5	-14.1	-
HDD	-5.6	-	13.9

30 Weeks: Household & Furnace HDD

12 Weeks: Household & AC CDD

Converting these values into percentages, there are differences in change for the two normalization methods. For the household, the normalization for HDD presents an average decrease in consumption of 2.0% (Table 4.2.9). For the AC, the CDD present around a 25% reduction in consumption. On the other hand, for the furnace, the HDD result in an increase between 40-80%. Based on these results, the AC and furnace have consistent increases/decreases across multiple normalization methods; however, for the household there are large discrepancies.

Table 4.2.9: Average Change in Total Consumption (%) Per Appliance & Household for 30 or 12 Weeks; Normalized by CDD & HDD

Normalization	Household	AC	Furnace
CDD	8.0%	-23.5%	-
HDD	-2.4%	-	37.5%

Summary (Normalized)

To summarize, while there is variation amongst households for each of the major appliances and household, on-, mid-, off- peak, and total consumption, there is a general trend for average reductions in all categories of use, except for the average change in off-peak share. This result shows that through the use of feedback, the peak hours in which the demand for electricity is at its highest and carbon intensive sources of electricity are used, there has been a reduction made by these households. Concurrently, there has been an increase in the off-peak share for most appliances, demonstrating the shifting of peak electricity use.

Comparing the raw change in consumption between years to the normalized data, the CDD and HDD calculations changed in the expected direction, but the differences were only a few kWh/week (Table 4.2.10). For this reason, the raw data are used for the more detailed comparisons between the baseline and monitoring period.

Table 4.2.10: Comparison Between Normalized/Non-Normalized Change in Total Consumption over 30 Weeks (kWh/week)

Normalization	Household	AC	Furnace
CDD	-22.5	-14.1	-
HDD	-5.6	-	13.9
Not Normalized	-20.0	-19.3	10.9

30 Weeks (Not-Normalized)

Over the 30 week period, the changes in electricity consumption, both total and on-peak, at the appliance level and household level are calculated between the baseline period of 2013 and the monitoring period in 2014, using non-normalized data. Reductions in on-peak share of electricity consumption were achieved in the laundry (washer/drier) and media centre, 2.7% and 2.8% respectively (Table 4.2.11). The biggest reduction in mid-peak consumption was achieved with the washer/dryer (-4.7%) while smaller reductions were made in media centre and dishwasher mid-peak shares (-2.2% and -2.0% respectively).

The shift in timing of use was demonstrated for the discretionary loads of washer/drier and dishwasher where the on-peak share reduction was balanced with an off-peak share increase of 5.3% and 4.3% respectively. In the case of the media centre, reductions were made in all three periods. The larger reduction in off-peak consumption may reflect the adoption of the tip (described in more detail later) to turn off the devices with a power bar to avoid phantom loads. Slight reductions in on- and mid-peak consumptions were also found for the refrigerator. This may be attributed to the number of openings and closings of the doors, resulting in greater or lesser consumption, or due to the possibility that some circuits labelled refrigerator may contain more than one appliance (i.e. a smart panel with multiple appliances such as microwave, kettle, refrigerator, on a single circuit) and changes were made in the use of other appliances on the circuit.

Table 4.2.11: Average Change in Consumption (%) and Peak Share (%) from Baseline by Household & Major Appliance for 30 Weeks*

Appliance	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
Household	-0.4%	-0.1%	0.4%	-10.4%
AC	0.9%	-0.1%	0.9%	-30.9%
Furnace	-0.4%	17.5%	0.4%	30.1%
Washer/Dryer	-2.7%	-4.7%	5.3%	-8.1%
Dishwasher	-0.6%	-2.0%	4.3%	3.6%
Refrigerator	-0.7%	-1.0%	1.4%	0.8%
Media Centre	-2.8%	-2.2%	-10.5%	-29.7%

* only 12 weeks were used for the AC analysis

12 Week Summer (Not-Normalized)

For the summer months, the largest reductions in on-peak share were made for the washer/dryer and dishwasher. All appliances and the household demonstrated an increase in off-peak share, showing a switch from on- to off-peak usage. While the AC had minimal changes in terms of peak share, large reductions in overall usage were found of 30.9% (4.2.12). The media centre also had reductions in total consumption, 18.6%.

Table 4.2.12: Average Change in Consumption (%) and Peak Share (%) from Baseline by Household & Major Appliance for 12 Week Summer

Appliance	On-Peak Share	Mid-Peak Share	Off-Peak Share	Δ Total Consumption
Household	-0.1%	1.1%	1.0%	-4.5%
AC	0.9%	-0.1%	0.9%	-30.9%

Table 4.2.12: Average Change in Consumption (%) and Peak Share (%) from Baseline by Household & Major Appliance for 12 Week Summer

Washer/Dryer	-2.8%	-3.4%	7.2%	-0.5%
Dishwasher	-1.8%	2.8%	1.9%	20.2%
Refrigerator	-0.3%	-0.2%	0.5%	10.8%
Media Centre	-0.3%	0.2%	2.8%	-18.6%

18 Week Fall/Winter (Not-Normalized)

For the fall/winter, reductions in on-peak share were made for all measured major appliances and the household with the exception of the furnace, whereas for the mid-peak share all appliances, including the furnace, presented reductions (4.2.13). In terms of total consumption all appliances made reductions exception for the furnace.

Table 4.2.13: Average Change in Consumption (%) and Peak Share (%) from Baseline by Household & Appliance over 18 Week Fall/Winter

Appliance	On-Peak Share	Mid-Peak Share	Off-Peak Share	Δ Total Consumption
Household	-0.6%	-0.6%	0.2%	-11.5%
Furnace	0.4%	-2.3%	-1.3%	35.4%
Washer/Dryer	-1.4%	-3.5%	0.5%	-9.7%
Dishwasher	-0.7%	-3.7%	3.0%	-4.5%
Refrigerator	-0.5%	-0.9%	0.8%	-5.6%
Media Centre	-3.0%	-3.1%	-12.9%	-25.7%

4.3 Quintile Comparison

For the second research question: ‘Does the eliciting of social norms result in a shift in household consumption levels towards the most efficient cohort of consumers or towards average consumers?’, the average total and on-peak consumption for each quintile was calculated on a weekly basis. The listing of household’s quintile rating and the number of households per quintile per week are found in Appendix D. The following tables show the equation for the line of best fit for each quintiles through the entire 30 weeks, the 12 week summer, and the 18 week fall/winter, which will then be further discussed and compared to quintile 1 and 3 to determine whether trends are evident for households steering their consumption towards quintile 1 or 3. Quintile 1 represents the lowest consumers, and is used to determine whether other quintiles were making improvements to move toward that of the most efficient households. Quintile 3 was used to examine whether the households were drawn to match that of the average household. According to Darby's (2006) review of effective feedback, there is evidence to suggest that higher consumers may make greater reductions to energy use compared to lower users. Using these quintiles, it can be determined how each of the quintiles performed, and determine whether the highest consumers (Q4 and Q5) made the greatest reductions.

Presented below are the equations for the line of best fit, in which high correlation demonstrates a continuous process of change, for each of the quintile's weekly average total consumption. These values are used to describe the consumption pattern.

Firstly, the y-intercept is higher as you go from Q1 to Q5, thus showing the increase in consumption for the various quintiles (Table 4.3.1). Secondly, the slope is negative indicating a declining consumption pattern over time. The slope is smallest for Q1, perhaps reflecting that they have the lowest consumption and least room to reduce further. The slopes of Q2-Q5 are similar. Third, the R-squared values are moderate indicating that weekly points are scattered rather than fitting closely along the line. The number of households in each quintile varies per week, though this does not have large impacts on the average weekly quintile value. Although the weekly values do not fit along a straight line, there is a usually a smooth trend week-to-week throughout the study.

Table 4.3.1: Quintile Weekly Average Total Consumption for 30 Weeks

Quintile	Equation for Line of Best Fit	R- Squared
1	y= -0.11x+14.55	0.07
2	y= -0.53x+33.51	0.37
3	y= -0.47x+38.10	0.32
4	y= -0.48x+42.29	0.35
5	y= -0.58x+49.08	0.39

The equations for the line of best fit for quintile weekly average on-peak consumption are also compiled to determine whether households made shifts in their peak consumption throughout the study Table 4.3.2). These values are compared to the equations produced by the line of best fit for the comparison to quintile 1 and 3 on-peak values.

Table 4.3.2: Quintile Weekly Average On-Peak Consumption for 30 Weeks

Quintile	Equation for Line of Best Fit	R- Squared
1	y= 0.02x+2.37	0.03
2	y= 0.02x+4.15	0.01
3	y= -0.04x+6.76	0.04
4	y= -0.18x+11.70	0.36
5	y= -0.27x+15.52	0.30

Comparison to Quintile 1: Total

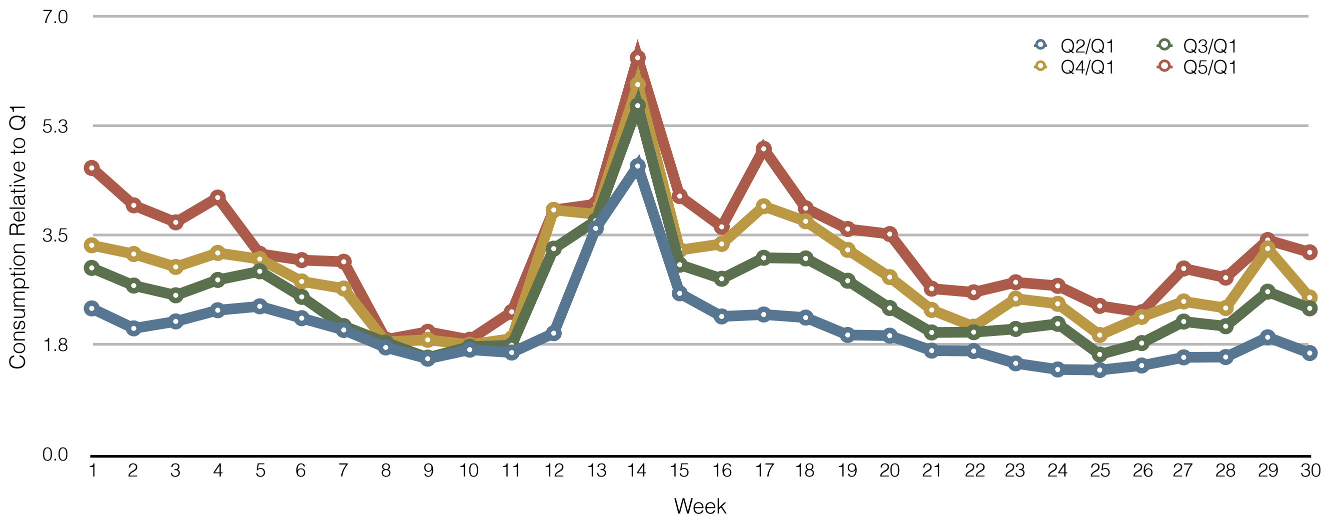
For the comparison to quintile 1, the R-squared values are low so the points are scattered. However, the overall trend is negative slopes, indicating that the ratio is getting smaller and consumption is moving closer to that of Q1 (by 2% of Q1 consumption per week) (Table 4.3.3). The seasonal equations show steeper slopes and higher R-squared values, but this is strongly influenced by higher consumption levels in early June and Sept.

Table 4.3.3: Quintile Weekly Average Total Consumption Ratio (Qx/Q1) for Comparison to Quintile 1

Quintile	Equation for Line of Best Fit	R- Squared
2	y= -0.03x+2.43	0.12
3	y= -0.02x+2.83	0.04
4	y= -0.02x+3.17	0.03
5	y= -0.02x+3.69	0.05

Looking at this on a graph (Figure 4.3.1), values throughout the 30 weeks are relatively consistent across all quintiles, with a large spike occurring during week 14 (August 31-September). This is a result of the comparatively low consumption for quintile 1 (8.9 kWh/day), rather than a sudden increase in consumption by others. This low value may be due to a holiday and compares to daily consumption of 10.6 kWh/day in the previous week. This may be attributed, in part, to week 14 having only 6 households producing usable data to compare for quintiles, with the result that only 1 household was in Q1.

Figure 4.3.1: Total Weekly Consumption Comparison to Quintile 1 for 30 Weeks



Comparison to Quintile 1: On-Peak

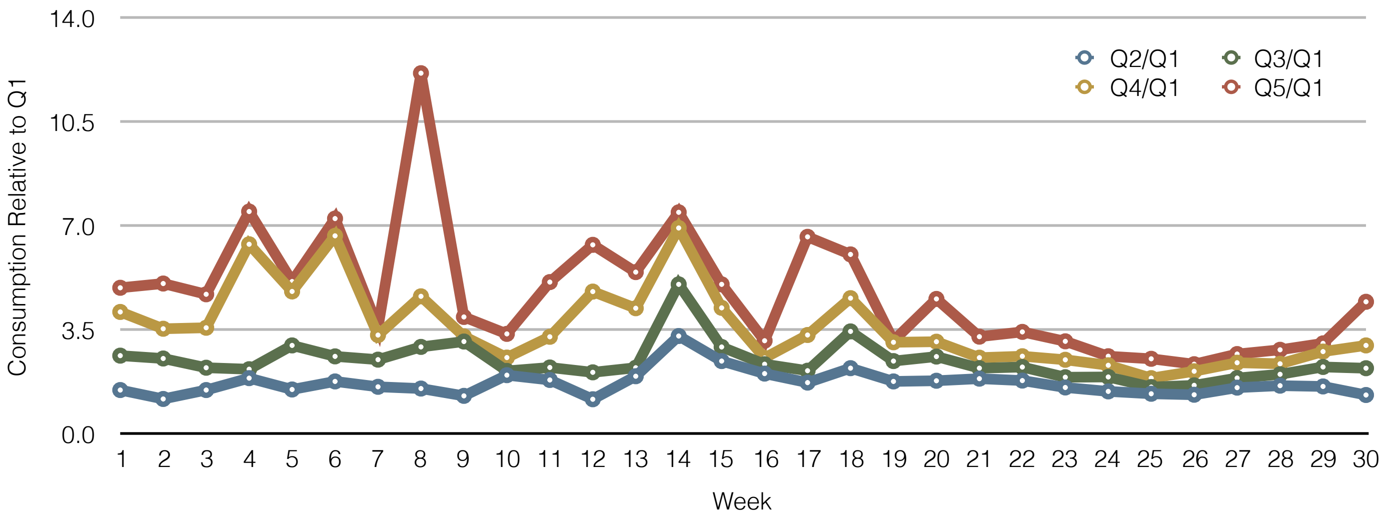
The equations derived from the line of best fit for the weekly average on-peak consumption compared to quintile 1 show a large different between the weeks of 13-20, and 21-30 (Table 4.3.4). For the initial 8 weeks, (13-20), there are large differences between quintiles, while the final 10 weeks the quintile ratios remain relatively consistent. Particularly for week 8 (July 20-26), quintile 5 shows a sharp increase in consumption. This is a result of the vast difference between Q1 (2.0 kWh/d) and Q5 (24.3 kWh/d) during this week.

Table 4.3.4: Quintile Weekly Average On-Peak Consumption Comparison to Quintile 1

Quintile	Equation for Line of Best Fit	R- Squared
2	y= -0.00x+1.75	0.00
3	y= -0.03x+2.85	0.12
4	y= -0.09x+4.99	0.36
5	y= -0.12x+6.65	0.28

Looking at this on a table, it is evident that there is much more variance in the first 15 weeks, while the final 15 weeks remain relatively stable (Figure 4.3.2).

Figure 4.3.2: Quintile Weekly On-Peak Consumption Comparison to Quintile 1 for 30 Weeks



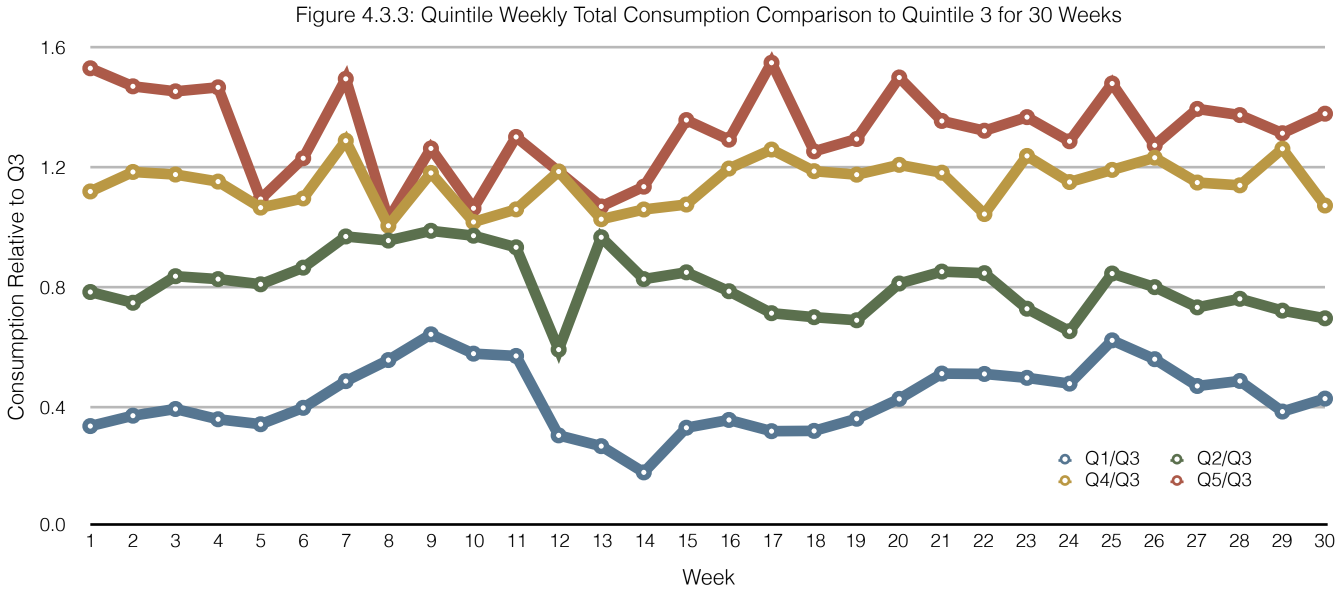
Comparison to Quintile 3: Total

For the comparison to quintile 3, firstly, there is poor fit as measured by R-squared values (Table 4.3.5). This means that there is not a strong trend over time in the ration of quintile consumption to that of quintile 3. Secondly, slopes are flat instead of rising for Q1 and Q2 and falling for Q4 & Q5, so there is no evidence of convergence on Q3 average values by the two lower consumption quintiles.

Table 4.3.5: Quintile Weekly Average Total Consumption Comparison to Quintile 3

Quintile	Equation for Line of Best Fit	R- Squared
1	y= 0.00x+0.38	0.05
2	y= -0.00x+0.88	0.18
4	y= 0.00x+1.12	0.05
5	y= 0.00x+1.29	0.00

Converting this to a graph, there are clear differences in consumption between the quintiles. While the trends appear similar for quintile 1 and 2, quintile 4 and 5 appear to have more fluctuations in weekly ratios (Figure 4.3.3). Overall, it is evident that households are not changing consumption habits to match that of the "average" quintile.



Comparison to Quintile 3: On-Peak

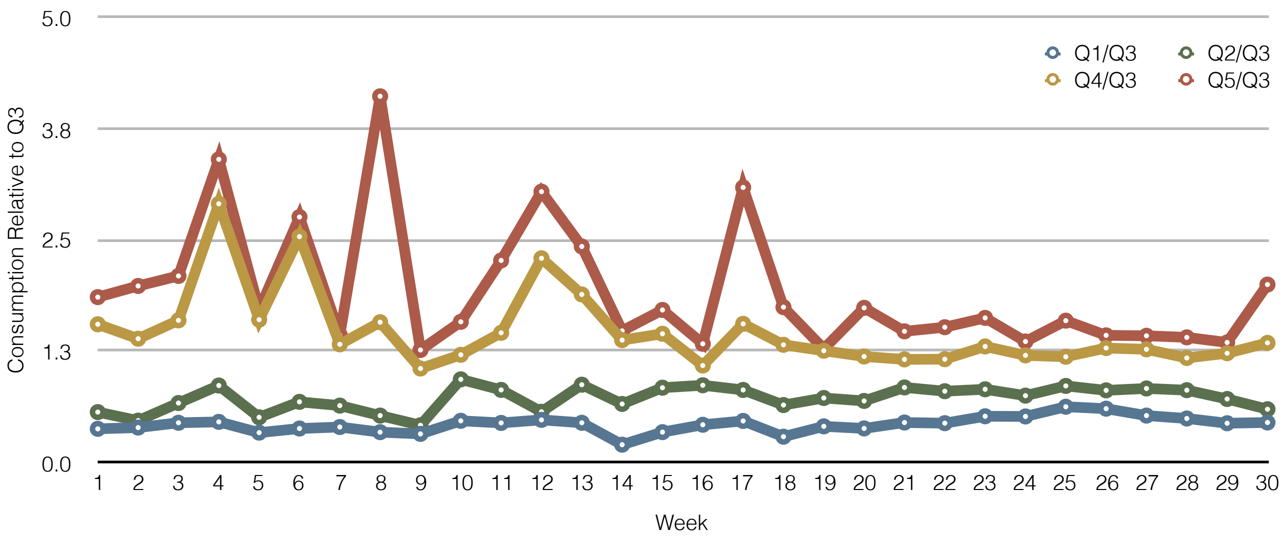
When comparing the weekly average on-peak consumption to quintile 3, quintile 1 and 2 are flat, suggesting no relationship with quintile 3 (Table 4.3.6). On the other hand, quintile 4 is rising further away from quintile 3, while quintile 5 is declining toward the quintile 3. Overall, only 1 of 4 quintiles is moving toward Q3.

Table 4.3.6: Quintile Weekly Average On-Peak Consumption Comparison to Quintile 3

Quintile	Equation for Line of Best Fit	R- Squared
1	y= 0.00x+0.35	0.23
2	y= 0.00x+0.62	0.18
4	y= 0.02x+1.84	0.25
5	y= -0.03x+2.46	0.19

This is further evidenced in Figure 4.3.4, demonstrating the relative weekly consumption to quintile 3.

Figure 4.3.4: On-Peak Weekly Consumption Comparison to Quintile 3 for 30 Weeks



Summary

Over the course of the 30 week period, it is evident that the larger consuming quintiles are making the largest reductions to lower consumption towards the lowest consumers (quintile 1). Based on evidence from previous studies, households involved in electricity interventions tend to respond to social norms as a motivation for reducing consumption to match or lower their consumption to that of the social norm. In addition to these trends, specific appliance prompts were provided, comparing households to the lowest consumers and providing tips about ways they can lower their appliance consumption to match that of other, lower consuming households. The following section outlines the results of such tips.

4.4 Tip Response

To determine the change in consumption following a tip, research question #3: *When provided with an appliance-specific tip, did households reduce the total or on-peak consumption of the appliance through the implementation of such tip?* Change in consumption following a tip week was evaluated for both the shorter term (one week) and longer term (one month). Using these two measures, it was determined whether households made initial changes in their electricity use for the specific appliance, and whether they continued that behaviour up to a month following the tip (Note: for the month long comparison, if data were missing from the month long period, only data which was comparable between be month before and after the tip was used). These tips are broken down by appliance to measure whether there was a change in use for the total consumption or the percentage of peak share for that appliance. This was calculated for the weeks prior to and following a tip to analyze trends. The five electricity consuming appliances which received tips include: the washer/dryer, dishwasher, air conditioner, media centre, and furnace. Based on previous studies, households are able to make changes in electricity uses to appliances which are not time sensitive, such as cooking (using the stove). Due to this, discretionary appliances results are also analyzed separately. Discretionary appliances are those that can be used at various times. These appliances include the washer/dryer, dishwasher, and media centre.

Following the presentation of a tip, households made larger reductions to consumption by discretionary appliances (washer/dryer, dishwasher, and media centre) for both the week and month analysis. The AC had reductions of 0.5 kWh/week and an increase of 0.2% of peak share in the week following a tip, while the month following reductions of 2.0kWh/week were made, with an increase of peak share of 2.5%. In the week following a tip, the furnace reduced 2.4 kWh/week and reduced on-peak share by 0.9%, while over the course of a month, large increases were made of 13.9 kWh/week or a 7.6% increase in on-peak share.

For the discretionary appliances (washer/dryer, dishwasher, and media centre), there were reductions of 3.5 and 2.4 kWh/week for the laundry and media centre, respectively, while the dishwasher increased by 0.7 kWh/week. Reductions in on-peak share are found for all three appliances with the laundry reducing by 1.4%, dishwasher 8.7%, and media centre 2.2.% for the week following. In the month following discretionary appliances showed reductions in both the kWh and on-peak share. The washer/dryer and media centre made large reductions of 6.9 and 6.0 kWh/month, respectively, while the dishwasher reduced by 1.0 kWh/month. The peak share shows decreases of 0.5% for the washer/dryer, 1.3% for the dishwasher, and 6.3% for the media centre.

Table 4.4.1: Average Change in kWh and Peak Share Following a Tip

	Weekly Analysis		Monthly Analysis	
Appliance	Avg. Δ kWh/week	Avg. Δ Peak Share	Avg. Δ kWh/month	Avg. Δ Peak Share
AC	-0.5	0.2%	-2.0	2.5%
Furnace	-2.4	-0.9%	13.9	7.6%
Washer/Dryer	-3.5	-1.4%	-6.9	-0.5%
Dishwasher	0.7	-8.7%	-1.0	-1.3%
Media Centre	-2.4	-2.2%	-6.0	-6.3%

Observing the shorter term comparison (Appendix E), the change in consumption showed a large range between households (some increasing, some decreasing). While almost all households reduced media centre consumption following a tip, the other appliances did not show reductions or increases in consumption across all households. However, therefore were some large reductions made by some households and appliances. For instance, EHMS 21 made an average reduction of 7.9 kWh/week following an air conditioning specific tip. EHMS 11 also made a large reduction following a washer/dryer tip week of an average 9.5 kWh/week. The largest average reduction for all households is for the washer/dryer, with an average reduction of 3.5 kWh/week following the presentation of a tip. The change in peak share for the weekly comparison again shows inconsistency in change amongst all households and appliances. Some extreme decreases in peak share include EHMS 4 with an average 64.9% decrease in dishwasher on-peak share following a tip week. The largest appliance level reduction in peak share of consumption is from the dishwasher, where households reduced the on-peak share by 8.7%, on average.

As for the monthly comparison (Appendix E), some households made increases while others made decreases to consumption following the presentation of a tip. Aside from the furnace, in which all households increased consumption the month following a tip, except for EHMS 7 who made an average reduction of 80.8 kWh/month following a tip, all appliances showed very different results. For some households, large reductions were made. For example, EHMS 10 reduced air conditioning consumption on average by 36.9 kWh/month following a tip. On the other hand, there were some households who made large increases, including EHMS 11 for the average change in AC consumption the month following a tip. Overall, the appliance with the greatest overall reduction in kWh/month following a tip week is the washer/dryer, with an average reduction of 6.9 kWh/month. When examining the change in peak share, there were, once again, a range of results. Some households increased on-peak share by up to 98.4%, EHMS 18 for the furnace, while others reduced on-peak share by 33.6%, EHMS 24 for the washer/dryer.

While a reduction in consumption can be found in most cases following the prompting of a tip, there are many other factors which may contribute to this result. Firstly, there are discretionary appliances and continuous appliances. This means that while some have the ability to be shifted to different times of use, such as the washer/dryer, others may be continuous, meaning they are continually used, such as the furnace (predominantly used in fall/winter, but may also be left on throughout year for ventilation), or uses that may be more time fixed (in the case of cooking dinner, difficult to shift oven usage to off-peak times). Also, certain electricity consuming tasks, such as laundry, may not be necessary on a weekly basis, and may instead, be completed every two weeks. If this were the case, then the week a tip was presented would line up with either a laundry week or a non-laundry week, with the week following being the opposite. This may give skewed results, as households may not actually be conserving or peak shifting their consumption, but rather, simply following normal routine. To alleviate some of these issues, average values were used.

Tip Week Comparison Between Years (2013 and 2014)

Another potential issue stems from the variation in consumption following a tip were due to change in weather. To eliminate this issue, the consumption values for weeks of and following a tip are compared to the previous, baseline period of 2013. As demonstrated in the following table, (Table 4.4.2), there are reductions in consumption when comparing the date of the tip week in 2013 to the week and month following that date. This shows that while reductions were made for the 2014 period following tip weeks, it may be more closely related to a change in weather for the weeks following (for appliances that are weather dependent). For example, following the weeks in which AC tips were provided, there were large reductions in kWh in 2013, without the prompting of a tip. On the other hand, a non-weather dependent appliance, the washer/dryer, also demonstrates a reduction in consumption following tip weeks. This may be a result of routine, in which laundry is only required every few weeks, or months.

Table 4.4.2: Average Change in Tip Week Consumption between Years (2013 & 2014)

Appliance	Avg. Δ kWh/week	Avg. Δ kWh/month
AC	-90.2	-318.5
Furnace	8.2	24.0
Washer/Dryer	-10.7	-18.0
Dishwasher	1.7	-0.9
Media Centre	-14.1	-31.7

Tips Provided to Households

For each of the appliances, a number of tips were provided to households. The table below (Table 4.4.3) summarizes the number of tips provided to each household per appliance over the 30 week study period. The largest number of tips were provided for the washer/dryer, totaling 81 tips for all households, or 5.1 tips for each household. The washer/dryer consumption or peak share was also reduced the greatest following a tip, suggesting that the persistence of tips may have helped motivate households to practice conservative energy use for this appliance. Despite the AC receiving the second largest number of tips, there was not a correspondingly high reduction in consumption.

Table 4.4.3: Number of Tips Received Per Appliance & Household for 30 Weeks

EHMS	AC	Furnace	Washer/Dryer	Dishwasher	Media Centre	SUM
1	2	1	8	1	5	17
2	0	1	0	n/a	1	2
4	9	1	14	4	4	32

Table 4.4.3: Number of Tips Received Per Appliance & Household for 30 Weeks

5	4	1	8	3	4	20
7	0	1	0	0	1	2
9	0	1	3	0	1	5
10	9	1	8	2	0	20
11	1	0	2	0	0	3
16	0	0	0	0	0	0
17	1	1	1	0	3	6
18	0	1	2	0	3	6
21	6	2	13	n/a	3	24
22	0	0	0	0	0	0
23	6	0	12	2	2	22
24	0	0	2	1	0	3
26	5	1	8	2	4	20
AVG.	2.7	0.8	5.1	1.1	1.9	11.4
SUM	43.0	12.0	81.0	15.0	31.0	182.0

4.5 Monthly Certificate

In addition to examining household responses to tips, the results from the analysis of monthly consumption was used to determine the recipient of the monthly certificate. This analysis is used to determine whether the certificate helped motivate households to further reduce their consumption to be crowned the 'Conservation Champion' of the month. The results of the monthly winners and their reduction in consumption are presented.

The following table (Table 4.5.1) summarizes the household with the greatest reduction in percentage of use for each of the monitored months (June-December). EHMS 2 made the greatest reductions for 3 of the 7 months (September, October, December), while EHMS 17 made the greatest reductions for 2 of the months (July & November).

Table 4.5.1: Summary of Monthly Certificate Results

Month	Conservation Champion	Δ Total (kWh/month)	Δ Total (%)
June	EHMS 23	-33.8	-11.7%
July	EHMS 17	-148.3	-34.4%
August	EHMS 4	-437.7	-26.6%

Table 4.5.1: Summary of Monthly Certificate Results

September	EHMS 2	-214.1	-49.6%
October	EHMS 2	-310.0	-55.5%
November	EHMS 17	-70.9	-18.0%
December	EHMS 2	-541.5	-66.0%

To determine whether specific households were making larger reductions in order to accomplish greater savings, the individual household's monthly change in consumption is summarized in the table below (Table 4.5.2). According to the table, EHMS 2 made the largest average monthly reductions of 57%. During interviews for another study in this research project, it was stated that this household went through a change in makeup in 2014, from the initial 3 household members, to one full-time member. This reduction in household size may partly account for the large reduction in electricity use from the baseline period to the monitoring period. Similarly, EHMS 4, whom made the largest reductions for August, disclosed in an email, that their household had six members in 2014, rather than seven, with two, instead of three, members home every day (on top of a home-based business), potentially affecting change in consumption. There are also large increases found, with EHMS 7 increasing on average by 30.3%.

While looking at the monthly change in consumption (%) for households helps to determine whether individual households were reducing throughout the study, the aggregate monthly change (%) for all households presents the general change. On average, households reduced consumption by 5.0% per month. The largest savings occurred during July, when households reduced electricity use on average by 22.1%. The largest increase in consumption occurred during the first month of the study, June, when households increased consumption on average by 4.5%.

Table 4.5.2: Monthly Change in Consumption (%) Per Household

EHMS	June	July	August	September	October	November	December	AVG
1	33.5%	-	-	-38.7%	-51.1%	-15.1%	-24.4%	-19.2%
2	-	-	-	-49.6%	-55.5%	-	-66.0%	-57.0%
4	-3.2%	-22.4%	-26.6%	-8.7%	-26.6%	-6.3%	-9.4%	-14.7%
5	14.8%	-7.6%	7.7%	13.2%	-12.0%	14.1%	-15.8%	2.1%
7	-	-	-	-	29.8%	33.6%	27.5%	30.3%
9	-	-	-	7.5%	2.6%	-12.6%	4.4%	0.4%
10	5.0%	-28.2%	7.6%	0.6%	-14.8%	-0.1%	24.5%	-0.8%

Table 4.5.2: Monthly Change in Consumption (%) Per Household

11	-2.5%	-27.1%	-	-	-	-	-	-14.8%
16	-	-	-	2.3%	-11.7%	-2.2%	0.6%	-2.7%
17	-9.3%	-34.4%	-5.8%	-0.0%	-31.7%	-18.0%	-8.4%	-15.4%
18	-	-	-	-	-30.0%	-17.1%	-21.0%	-22.7%
21	0.2%	-21.5%	-1.4%	4.1%	3.8%	5.3%	-30.0%	-5.6%
22	-	-	-	-	10.8%	-1.7%	2.2%	3.8%
23	-11.7%	-26.5%	-2.6%	10.5%	-20.1%	-14.9%	-22.9%	-12.6%
24	-	-	-	1.8%	-11.2%	-	-	-4.7%
26	13.5%	-9.3%	15.7%	56.2%	-55.0%	2.0%	11.6%	5.0%
AVG	4.5%	-22.1%	-0.8%	-0.1%	-18.2%	-2.5%	-9.1%	-8.0%

It is not evident from the table as to whether households were making larger reductions over the course of the study. The majority of households show a mix of increases/decreases throughout the months, or do not show a steady increase in savings across the seven months. With the exception of household 2, Champion households had smaller savings in the month after receiving the certificate than in the month when they had the biggest reductions. Therefore, it cannot be determined that the provision of the monthly certificate helped elicit further savings in electricity use.

4.6 Comparison to Other Studies

For this study, households whom have been previously involved in electricity interventions were used as participants. Other studies predominantly use newly engaged households to determine the effectiveness of feedback. The research question: *How do the results of this study, using households whom have been engaged in electricity interventions over multiple years, compare to other studies, in which households have been introduced to short term electricity interventions?* is used to determine how effective feedback is for long-term participants, rather than newly-appointed participants. As noted in the study conducted by Hargreaves *et al.* (2013), there are 3 main issues with the delivering of longitudinal feedback with the intention of motivating households to reduce consumption. Firstly, the extended access to information via the smart meter can become 'backgrounded' with time, meaning that the initial effect the smart meter may have on consumption, may lessen with time. With regards to the participants involved in this study, two previous case studies have taken place that have measured engagement with the web portal. Schulist (2013) found that there was a low engagement with the web portal overall, with a drop in engagement after the first seven months, resulting in a lowering of the number of participants conserving after this point, and no relationship being found between portal engagement and electricity conservation. Additionally, Khorrami (2014), found that the engagement with the web portal was highest in the first three months of participation. This suggests that participants became less engaged over time.

A second issue with longitudinal feedback is that electricity monitors have limits with regards to how much they can motivate households to reduce consumption (i.e. they can only motivate a household so much, if at all, to reduce consumption). Once households have made electricity saving changes, they hit a wall with how much further they can reduce without making significant changes to their household. Thirdly, once households obtain information about their consumption and have made attempts to reduce consumption, it may become harder to induce greater savings once the basic behavioural practices are altered without further policy or institutional support. On the other hand, according to Smeaton & Doherty (2013), through the use of a combination of tactics to engage households, for instance providing feedback in the form of a newsletter in addition to a real-time webportal used in this study, there is a greater chance of sustaining user interest. Based on these assertions, this study sought to determine how these hindrances to achieving electricity savings impact a longitudinal study, and whether the use of multiple sources of feedback for households enhanced the savings achieved.

Comparing the results of this study to the 20 studies with newly engaged participants, the following table demonstrates the results, demonstrating an average of 12.3% savings (Table 4.6.1).

Table 4.6.1: Results from 20 Reviewed Feedback Articles

Savings Achieved	# of Studies	Avg. # of Participants	Avg. Length of Study (Months)
0%	3	35.7	15
1-5%	7	867	12
6-10%	2	542.5	6.5
11-15%	5	484.2	13.1
16-20%	3	65.5	32
>21%	3	55.5	4.3

Breaking down the studies into six reduction classifications following the interventions (0%, 1-5%, 6-10%, 11-15%, 16-20%, and >20%), trends can be noted about how the least/most effective studies undertook their research. These results are used to determine whether specific features of methods of feedback yielded greater savings.

For the studies in which no savings were achieved, the studies were over 1 year in length, and the number of participants ranged from 11 to 72 (Table 4.6.2). Only 3 of 20 studies did not produce savings, and there is no clear distinction as to why these studies did not induce savings in electricity use.

Table 4.6.2: Studies Achieving Results of 0%

Study Name	Author	Year	Length of Study (Months)	# of Partic-ipants	Savings
Effects of continuous feedback on households' electricity consumption: Potentials and barriers	Nilsson *et al.*	2014	-	72	not signif-icant
Keeping energy visible? Exploring how house-holders interact with feedback from smart energy monitors in the longer term	Hargreaves *et al.*	2013	12	11	not sigifni-cant
Persuading consumers to reduce their consump-tion of electricity in the home	Smeaton & Doherty	2013	18	24	mixed

For the studies that had savings of 1-5%, the studies ranged in length from 2 to 42 months, with the majority lasting less than 1 year (Table 4.6.3). As for the number of participants, they ranged from 100 to 1500. These 7 studies have a shorter length of study, with a larger number of participants compared to the studies with 0% savings.

Table 4.6.3: Studies Achieving 1-5%

Study Name	Author	Year	Length of Study (Months)	# of Partici-pants	Savings
Conservation Effect of Immediate Electricity Cost Feedback on Residential Consumption Behaviour	Dobson & Griffin	1992	2	100	5%
The effect of Feedback by Text Message (SMS) and email on household electricity consumption: Experimental evidence	Gleerup *et al.*	2010	12	1452	3%
The dubuque electricity portal: evaluation of a city-scale residential electricity consumption feedback system	Erickson *et al.*	2013	4.6	765	3.7%
Effects of feedback on residential electricity de-mand- Findings from a field trial in Austria	Schleich *et al.*	2013	-	1500	4.5%
Is social norms marketing effective? A case study in domestic electricity consumption	Harries *et al.*	2013	3.7	316	3%
Real-time Feedback and Electricity Consumption	Houde *et al.*	2013	8	1065	5.7%
Real-time feedback and residential electricity consumption: British Columbia and Newfound-land and Labrador pilots	Mountain	2007	42	-	2.7-18.1 %

For the studies of 6-10% savings, the length of study ranged from 5-8 months, with 20-1065 participants (Table 4.6.4).

Table 4.6.4: Studies Achieving 6-10%

Study Name	Author	Year	Length of Study (Months)	# of Partici-pants	Savings
Feedback on household electricity consumption: learning and social influence processes	Grønhøj & Thøgersen	2011	5	20	8.1%
Real-time Feedback and Electricity Consumption	Houde *et al.*	2013	8	1065	5.7%

For the studies with 11-15% savings, the lengths ranged from a couple weeks to 4 years, with 3 of the 5 studies lasting under 3 months (Table 4.6.5). The number of participants vary from 12 to 2000.

Table 4.6.5: Studies Achieving 11-15%

Study Name	Author	Year	Length of Study (Months)	# of Partici-pants	Savings
Effects of Self-Monitoring and Feedback on Residential Electricity Consumption	Winett *et al.*	2013	1	12	13%
Effects of monetary rebates, feedback, and information on residential electricity conservation	Winett *et al.*	1978	3	129	12%
Joint effect of feedback and goal-setting on performance: A field study of residential energy conservation	Becker	1978	0.5	80	13-25.1 %
The impact of consumers' feedback preferences on domestic electricity consumption	Vassileva *et al.*	2012	48	2000	15%
Modifying perceptions of comfort and electricity used for heating by social learning strategies: residential field experiments	Winett *et al.*	1981	-	200	15%

For the 3 studies with savings of 16-20%, all studies lasted over 1 year with 31-100 participants (Table 4.6.6).

Table 4.6.6: Studies Achieving 16-20%

Study Name	Author	Year	Length of Study (Months)	# of Partici-pants	Savings
Smart meters and energy savings in Italy: Determining the effectiveness of persuasive communication in dwellings	D'Oca *et al.*	2014	12	31	18-57%
Real-time feedback and residential electricity consumption: British Columbia and Newfoundland and Labrador pilots	Mountain	2007	42	-	2.7-18.1 %

Table 4.6.6: Studies Achieving 16-20%

Real-time feedback and residential electricity consumption: The Newfoundland and Labrador pilot	Mountain	2012	42	100	18.1%

For the studies with savings greater than 21%, the length of study lasted from a couple of weeks to 1 year with between 31 and 80 participants (Table 4.6.7). Only 3 of the 20 studies achieved savings over 21%.

Table 4.6.7: Studies Achieving >21%

Study Name	Author	Year	Length of Study (Months)	# of Participants	Savings
Dormitory Residents reduce electricity consumption when exposed to real-time visual feedback and incentives	Peterson *et al.*	2007	0.5	2 Dormitories	32%
Joint effect of feedback and goal-setting on performance: A field study of residential energy conservation	Becker	1978	0.5	80	13-25.1 %
Smart meters and energy savings in Italy: Determining the effectiveness of persuasive communication in dwellings	D'Oca *et al.*	2014	12	31	18-57%

Comparing the results of the 20 surveyed studies, yielding an average 12.3% savings following the interventions; this study achieved a 10.4% savings following the 30 weeks of feedback reporting. While this study had lower average savings when compared to the other studies, it had comparable or higher savings than at least 10 other studies. As well, while other studies may have recorded higher savings, according to Davis *et al*. (2013), there are 6 major biases apparent in many feedback studies which induce inflated savings. Firstly, with regards to participant selection, bias arises when participants volunteer to take part in the study. Those who chose to partake in a study are much more likely to change their consumption rather than those from the general population, leading to greater than average savings. Secondly, the intervention selection bias occurs when participants are given options about the conditions they will undergo in the study, there is a bias in that they may choose which experimental conditions suits their lifestyle the best. The third bias, the sequence generation bias, is related to the intervention selection bias in which non-random protocols are used to assign participants to certain experimental conditions. Fourthly, the allocation concealment bias, in which those involved in the study (experimenters or participants) are aware of the sequence of the study and may manipulate the study results. Fifthly, the blinding bias occurs when the researchers' knowledge of group assignments of households affects their treatment in the study. Finally, the attrition bias, is when participants who do not appease the results of the study are removed before its conclusion to ensure positive results. Through the combination of these biases, studies may find greater savings than actually attributed to a change in behaviour to conserve or peak shift. While some of these biases are difficult to avoid, for instance the participation selection bias, they are worth noting as a consideration when undertaking feedback studies.

For this particular study, there is only one bias which may be present-the participation bias. However, this bias is likely dampened in this study, as the intervention took place years after participants joined the study. While the participants did represent bias in the initial signup of the study, the participants have been involved for many years, and are less likely to have a keen electricity saving attitude this far along in the study, as proven from previous research on this case study (Khorrami, 2014; Schulist, 2013).

Chapter 5: Conclusion

5.1 Summary of Findings

Throughout the 30 week study period, four research questions were used to address or compare the changes in electricity consumption that households made throughout this study. These questions examined the general change in consumption following feedback, the influence of social norms or quintiles on households receiving feedback, the effect of appliance-specific tips on reducing associated total and on-peak electricity consumption, and the comparison of this study to other similar studies. The following sections reiterate the results previously discussed.

Research Question #1

1. *When provided with feedback, how do households respond/alter their consumption from the previous (baseline) year?*

To reiterate the results of this study over the 30 week period, households at the aggregate level reduced consumption. This was accomplished through the provision of feedback as a whole, with the inclusion of appliance-specific and household level tips. As described in the literature, feedback studies typically result in a 5-20% change in consumption following feedback (Fischer, 2010). While it is evident changes were made, there may be other factors which also contributed to the change in consumption between the baseline and monitoring period

Overall, on average households reduced consumption by 10.4% (Table 5.1.1). For the initial 12 weeks of summer, there was an average reduction of 4.5%, and for the concluding 18 weeks of fall/winter reductions of 11.5%.

∴ Households made reductions in both total consumption and on-peak share, with corresponding increases to off-peak share, demonstrating conservation of electricity and peak shifting.

Table 5.1.1: Average Change in Household Total Consumption and Peak Share (%)

Time Period	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
30 Weeks	-0.4%	-0.1%	0.4%	-10.4%
12 Week Summer	-0.1%	1.1%	1.0%	-4.5%
18 Week Fall/Winter	-0.6%	-0.6%	0.2%	-11.5%

For the major appliances (AC, furnace, washer/dryer, dishwasher, refrigerator, and media centre), there are various changes in consumption (Table 5.1.2). For the AC, there was an average reduction of 30.9% for the cooling season. Comparing this to the normalized data, there is an approximate 25% reduction.

∴ While there are decreases to the total AC consumption (conservation of electricity), there is an increase to AC on-peak share.

Table 5.1.2: Average Change in Air Conditioning Total Consumption and Peak Share (%)

Time Period	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
12 Week Summer	0.9%	-0.1%	0.9%	-30.9%

For the furnace, there was an average increase in consumption of 30.1%, with comparable values for the 18 week fall/winter (35.4%) (Table 5.1.3).

∴ Large increases in furnace consumption are found.

Table 5.1.3: Average Change in Furnace Total Consumption and Peak Share (%)

Time Period	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
30 Weeks	-0.4%	17.5%	0.4%	30.1%
18 Week Fall/Winter	0.4%	-2.3%	-1.3%	35.4%

The washer/dryer saw an 8.1% reduction in total consumption, while there were reductions of 2.7% and 4.7%, respectively, for the on- and mid-peak consumption (Table 5.1.4). While the change in total consumption varies amongst different time periods, there were consistent reductions in on-peak and mid-peak share throughout all time periods.

∴ Households made large reductions to on- and mid-peak share for the washer/dryer, with increases in off-peak share, demonstrating that households shifted their on-peak consumption.

Table 5.1.4: Average Change in Washer/Dryer Total Consumption and Peak Share (%)

Time Period	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
30 Weeks	-2.7%	-4.7%	5.3%	-8.1%
12 Week Summer	-2.8%	-3.4%	7.2%	-0.5%
18 Week Fall/Winter	-1.4%	-3.5%	0.5%	-9.7%

For the dishwasher, there is an average increase in total consumption of 3.6% over the 30 weeks, with increases over the initial 12 weeks (20.2%), and a decrease in the 18 week fall/winter (-4.5%) (Table 5.1.5). On the other hand, reductions are found in all time periods for the on-peak share, and for the mid-peak share over the 30 weeks and 18 week fall/winter.

∴ While households increased the total consumption of the dishwasher (except for the 18 week fall/winter), the on- and mid-peak share are reduced, with an increase in off-peak share, thus demonstrating peak shifting.

Table 5.1.5: Average Change in Dishwasher Total Consumption and Peak Share (%)

Time Period	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
30 Weeks	-0.6%	-2.0%	4.3%	3.6%
12 Week Summer	-1.8%	2.8%	1.9%	20.2%
18 Week Fall/Winter	-0.7%	-3.7%	3.0%	-4.5%

For the refrigerator, there are increases in total consumption for the 30 week study period (0.8%), and the initial 12 week summer period (10.8%) (Table 5.1.6). There is a reduction in total consumption for the concluding 18 week fall/winter, with a reduction of 5.6%. Throughout all time periods there are small reductions to both the on- and mid-peak share, with corresponding small increases to off-peak share.

∴ Despite increases to total consumption, households on average made reductions to the refrigerator on-peak share and increases to the off-peak share (peak shifting).

Table 5.1.6: Average Change in Refrigerator Total Consumption and Peak Share (%)

Time Period	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
30 Weeks	-0.7%	-1.0%	1.4%	0.8%
12 Week Summer	-0.3%	-0.2%	0.5%	10.8%
18 Week Fall/Winter	-0.5%	-0.9%	0.8%	-5.6%

For the media centre, there are reductions in total consumption for the 30 weeks (29.7%), the 12 week summer (18.6%), and for the 18 week fall/winter (25.7%) (Table 5.1.7). Reductions are also made to all categories of time for the on-peak share.

∴ In addition to reductions in total consumption, for the media centre, households reduced on-peak share; however, there was not a corresponding increase to off-peak share, which suggests that the reduction in peak share may not be associated to peak shifting.

Table 5.1.7: Average Change in Media Centre Total Consumption and Peak Share (%)

Time Period	Δ On-Peak Share	Δ Mid-Peak Share	Δ Off-Peak Share	Δ Total Consumption
30 Weeks	-2.8%	-2.2%	-10.5%	-29.7%
12 Week Summer	-0.3%	0.2%	2.8%	-18.6%
18 Week Fall/Winter	-3.0%	-3.1%	-12.9%	-25.7%

Overall, changes were made for both the household level consumption, as well as the appliance level consumption. For the household level, a variety of factors may have contributed to this change, from altering behaviours to match those of the other, lower consuming households, a change in daily routine unattributed to this study, or other factors. It is evident between years that there was a reduction in total consumption (10.4%). Much like other studies, it is expected for a 5-20% reduction in consumption following feedback studies (Fischer, 2008), as a result of providing tailored feedback prompts disaggregating data and making it easier for households to understand.

In the case of the appliances, there were a range of changes following feedback; however, the majority of appliances had a reduction in on-peak share. This demonstrates that households shifted their consumption following the prompts provided in the feedback.

Overall, the results for the change in consumption demonstrate consistent results with other literature—households make reductions in electricity usage when provided with feedback. While reductions vary depending on the scope of the project and the various methods undertaken, the results of this research are within range of other electricity intervention studies.

Research Question #2

2. *Does the eliciting of social norms result in a shift in household consumption levels towards the most efficient cohort of consumers or towards average consumers?*

The quintiles demonstrate a change in electricity consumption towards quintile 1 (the lowest consuming quintile). Much of the literature suggests that using an average consumption group will elicit greater savings, as the “social norm” will spark a competitive edge that higher consumers will respond to, and match their consumption with what is considered normal (Allcott, 2011; Chen et al., 2011; Jain et al., 2013; Schultz et al., 2007; Stern, 1992). Being outside of this norm is considered “deviant” (Schultz et al., 2007). While this pattern is found in some studies, for this particular study, the average consumers were not those who households tended to mimic, rather, it was the top performing quintile that consumers were moving towards.

Research Question #3

3. When provided with an appliance-specific tip, did households reduce the total or on-peak consumption of the appliance?

Changes to total electricity consumption and on-peak share following a tip were analyzed and compared using a one week (shorter-term), and one month (longer-term) analysis. According to the literature, the eliciting of tips is expected to help aid in the day-to-day energy usage behaviours by motivating households to do things such as turning off lights, or adjusting thermostats, that households may have already known, but acted to remind households to conserve (Allcott, 2009). Based on these results, reductions were made in terms of kWh, consistently between the week and month analysis for the AC, washer/dryer, and media centre. The persistence of reductions through the week and month analysis demonstrate the greater likelihood that households made behavioural changes, rather than the changes in consumption based on weekly routines.

For the change in peak share, reductions are found for both the week and month following a tip for the washer/dryer, dishwasher, and media centre. These appliances are those which have more flexibility in timing of use, thus potentially demonstrating households shifting of these appliances use to off-peak times, i.e. discretionary appliances.

Breaking this down into specific appliances change in use, the following table (5.1.8) demonstrates the average change in kWh and peak share following a tip. The largest savings in kWh, in the week following are achieved by the washer and dryer, with a reduction of 3.5 kWh, while the largest change in peak share is found for the dishwasher, with an 8.7% reduction in on-peak share. For the monthly analysis, the washer and dryer, again, had the largest reduction in kWh, while the media centre made the largest reductions in on-peak share (%).

Table 5.1.8: Average Change in kWh and Peak Share Following a Tip

	Weekly Analysis		Monthly Analysis	
Appliance	Avg. Δ kWh/week	Avg. Δ Peak Share	Avg. Δ kWh/month	Avg. Δ Peak Share
AC	-0.5	0.2%	-2.0	2.5%

Table 5.1.8: Average Change in kWh and Peak Share Following a Tip

Furnace	-2.4	-0.9%	13.9	7.6%
Washer/Dryer	-3.5	-1.4%	-6.9	-0.5%
Dishwasher	0.7	-8.7%	-1.0	-1.3%
Media Centre	-2.4	-2.2%	-6.0	-6.3%

∴ Following the presentation of a tip, households made larger reductions to consumption by discretionary appliances (washer/dryer, dishwasher, and media centre) for both the week and month analysis. Reductions of of 3.5 and 2.4 kWh/week for the laundry and media centre were found, respectively, while the dishwasher increased by 0.7 kWh/week. Reductions in on-peak share are found for all three appliances with the laundry reducing by 1.4%, dishwasher 8.7%, and media centre 2.2.% for the week following. In the month following discretionary appliances showed reductions in both the kWh and on-peak share. The washer/dryer and media centre made large reductions of 6.9 and 6.0 kWh/month, respectively, while the dishwasher reduced by 1.0 kWh/month. The peak share shows decreases of 0.5% for the washer/dryer, 1.3% for the dishwasher, and 6.3% for the media centre.

Research Question #4

4. *How do the results of this study, using households whom have been engaged in electricity interventions over multiple years, compare to other studies, in which households have been introduced to short term electricity interventions?*

Comparing this study to others in which households are newly selected for the particular study (of the 20 studies surveyed), an average of 12.3% savings is apparent, while this study achieved an average 10.4% savings over the 30 weeks. Despite the use of participants whom have been previously used in electricity interventions for this study, similar results are found when compared to newly engaged or short term feedback participants.

∴ Despite the assertion that electricity monitoring devices eventually become ‘backgrounded’ in households, (Hargreaves *et al*., 2013), participants were still able to make reductions in electricity consumption (in terms of total or peak share) throughout the 30 week study period, even resulting in similar findings to other studies in which participants are newly engaged in the study.

5.2 Further Research

This study sought to understand the effect of feedback on long-term study participants to determine whether electricity savings could be achieved, in terms of kWh or peak shifting. This research builds upon previous research conducted on this case study, in which household engagement, as measured by use of the web portal, dropped off within three months. The findings from this study demonstrate an average 10.4% savings in total electricity consumption, and an average 0.4% reduction in on-peak share. These results show the capability of feedback to produce electricity savings for long-term study participants and be used as a re-engagement tactic.

The provision of tips resulted in a reduction of consumption for discretionary appliances (washer/dryer, dishwasher, and media centre). The week following a tip, there were reductions of 3.5 and 2.4 kWh/week for the laundry and media centre, respectively, while the dishwasher increased by 0.7 kWh/week. Reductions in on-peak share were found for all three discretionary appliances with the laundry reducing by 1.4%, dishwasher 8.7%, and media centre 2.2.% for the week following. In the month following discretionary appliances showed reductions in both the kWh and on-peak share. The washer/dryer and media centre made large reductions of 6.9 and 6.0 kWh/month, respectively, while the dishwasher reduced by 1.0 kWh/month. The peak share shows decreases of 0.5% for the washer/dryer, 1.3% for the dishwasher, and 6.3% for the media centre.

Due to some of the limitations of this study, there are opportunities for further research. Specifically, updated surveys and interviews with households addressing their responses and opinions to the feedback are needed. These interviews would be helpful with providing information about the best practices for engaging households in the study to continue conserving electricity within their homes. This follow-up survey on household electricity awareness, actions, and attitudes would determine how they have learned throughout the process of the study (3-4 years) and would provide insight into which interventions were most helpful to households in achieving further knowledge and electricity savings.

In addition to this, continued feedback reporting would help further elicit details about the effects of feedback on previously engaged households. Due to the technical difficulties in some data collection equipment and communication links throughout the 30 weeks, not all households were able to receive consistent or consecutive feedback. If households were able to receive such feedback on a consistent and long-term basic, further explanations about the effect of feedback might be identified.

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Appendices

Appendix A: Survey Responses

Table 4.2: Dwelling Size and Change in Total Consumption (%) for 30 Weeks

EHMS	Dwelling Size (Square Feet)	Baseline Consumption (avg. kWh/week)	Δ % (using sums)	Δ % (using weekly averages)
1	2000-2499	318.2	-24.2%	-19.6%
2	1500-1999	131.4	-53.9%	-51.2%
4	2000-2499	297.4	-14.5%	-13.1%
5	1500-1999	238.8	2.5%	5.8%
7	3000-3499	162.8	32.9%	63.8%
9	1500-1999	169.0	0.1%	1.3%
10	1500-1999	220.1	-4.0%	-0.1%
11	1500-1999	128.7	-4.5%	-2.9%
16	1000-1499	122.3	-3.9%	-3.6%
17	1500-1999	80.0	-17.4%	-13.5%
18	3000-3499	154.7	-26.6%	-26.8%
21	2500-2999	246.4	-11.1%	-5.0%
22	2500-2999	117.6	-1.1%	-0.0%
23	2500-2999	262.8	-18.5%	-16.2%
24	2500-2999	162.9	-18.0%	-18.2%
26	2500-2999	204.5	-3.5%	11.2%

Table: Year Built and Change in Total Consumption (%) for 30 Weeks

EHMS	Year Built	Baseline Consumption (avg. kWh/week)	Δ % (using sums)	Δ % (using weekly averages)
1	1970-1979	162.9	-24.2%	-19.6%
2	1970-1979	297.4	-53.9%	-51.2%
4	2000-2006	169.0	-14.5%	-13.1%
5	1970-1979	220.1	2.5%	5.8%
7	2000-2006	238.8	32.9%	63.8%
9	2000-2006	122.3	0.1%	1.3%
10	2000-2006	80.0	-4.0%	-0.1%
11	2007-2010	154.7	-4.5%	-2.9%

Table: Year Built and Change in Total Consumption (%) for 30 Weeks

16	2000-2006	246.4	-3.9%	-3.6%
17	2000-2006	262.8	-17.4%	-13.5%
18	2000-2006	131.4	-26.6%	-26.8%
21	2000-2006	162.8	-11.1%	-5.0%
22	2007-2010	117.6	-1.1%	-0.0%
23	2007-2010	318.2	-18.5%	-16.2%
24	2007-2010	128.7	-18.0%	-18.2%
26	2007-2010	204.5	-3.5%	11.2%

Table 4.1: Style of Dwelling and Change in Consumption (%) for 30 Weeks

EHMS	Style of Dwelling	Baseline Consumption (avg. kWh/week)	Δ % (using sums)	Δ % (using weekly averages)
1	Detached two or more storey	162.9	-24.2%	-19.6%
2	Detached two or more storey	297.4	-53.9%	-51.2%
4	Semi-detached two or more storey	169.0	-14.5%	-13.1%
5	Detached two or more storey	220.1	2.5%	5.8%
7	Detached two or more storey	238.8	32.9%	63.8%
9	Detached one storey	122.3	0.1%	1.3%
10	Detached two or more storey	80.0	-4.0%	-0.1%
11	Condominium town house or semi-detached	154.7	-4.5%	-2.9%
16	Row housing (attached on both sides)	246.4	-3.9%	-3.6%
17	Semi-detached two or more storey	262.8	-17.4%	-13.5%
18	Detached two or more storey	131.4	-26.6%	-26.8%
21	Detached two or more storey	162.8	-11.1%	-5.0%
22	Detached two or more storey	117.6	-1.1%	-0.0%
23	Detached two or more storey	318.2	-18.5%	-16.2%
24	Detached two or more storey	128.7	-18.0%	-18.2%
26	Detached two or more storey	204.5	-3.5%	11.2%

Table 4.3: Number of Occupants and Change in Total Consumption (%) for 30 Weeks

EHMS	# of Occupants	Baseline Consumption (avg. kWh/week)	Δ % (using sums)	Δ % (using weekly averages)
1	2	318.2	-24.2%	-19.6%
2	3	131.4	-53.9%	-51.2%
4	6	297.4	-14.5%	-13.1%
5	4	238.8	2.5%	5.8%
7	3	162.8	32.9%	63.8%
9	5	169.0	0.1%	1.3%
10	5	220.1	-4.0%	-0.1%
11	2	128.7	-4.5%	-2.9%
16	4	122.3	-3.9%	-3.6%
17	4	80.0	-17.4%	-13.5%
18	4	154.7	-26.6%	-26.8%
21	4	246.4	-11.1%	-5.0%
22	3	117.6	-1.1%	-0.0%
23	4	262.8	-18.5%	-16.2%
24	8	162.9	-18.0%	-18.2%
26	2	204.5	-3.5%	11.2%

Table: Income and Change in Total Consumption (%) for 30 Weeks

EHMS	Income (before taxes)	Baseline Consumption (avg. kWh/week)	Δ % (using sums)	Δ % (using weekly averages)
1	$150, 000 and over	162.9	-24.2%	-19.6%
2	$150, 000 and over	297.4	-53.9%	-51.2%
4	$80, 000- $89, 999	169.0	-14.5%	-13.1%
5	$125, 000- $149, 999	220.1	2.5%	5.8%
7	$150, 000 and over	238.8	32.9%	63.8%
9	$90, 000- $99, 999	122.3	0.1%	1.3%
10	$60, 000- $69, 999	80.0	-4.0%	-0.1%
11	$100, 000- $124, 999	154.7	-4.5%	-2.9%
16	$90, 000- $99, 999	246.4	-3.9%	-3.6%
17	$90, 000- $99, 999	262.8	-17.4%	-13.5%
18	$100, 000- $124, 999	131.4	-26.6%	-26.8%

Table: Income and Change in Total Consumption (%) for 30 Weeks

21	$125, 000- $149, 000	162.8	-11.1%	-5.0%
22	$90, 000- $99, 999	117.6	-1.1%	-0.0%
23	$150, 000 and over	318.2	-18.5%	-16.2%
24	$150, 000 and over	128.7	-18.0%	-18.2%
26	$150, 000 and over	204.5	-3.5%	11.2%

Table: Level of Education and Change in Total Consumption (%) for 30 Weeks

EHMS	Highest Certificate/ Diploma/ Degree in Household	Baseline Consumption (avg. kWh/week)	Δ % (using sums)	Δ % (using weekly averages)
1	Bachelor’s Degree	318.2	-24.2%	-19.6%
2	Bachelor's Degree	131.4	-53.9%	-51.2%
4	Bachelor's Degree	297.4	-14.5%	-13.1%
5	Bachelor's Degree	238.8	2.5%	5.8%
7	University Certificate or Diploma below Bachelor Level	162.8	32.9%	63.8%
9	University Certificate or Diploma below Bachelor Level	169.0	0.1%	1.3%
10	Bachelor's Degree	220.1	-4.0%	-0.1%
11	Bachelor’s Degree	128.7	-4.5%	-2.9%
16	Bachelor’s Degree	122.3	-3.9%	-3.6%
17	Bachelor's Degree	80.0	-17.4%	-13.5%
18	Bachelor's Degree	154.7	-26.6%	-26.8%
21	University Certificate or Diploma below Bachelor Level	246.4	-11.1%	-5.0%
22	Bachelor's Degree	117.6	-1.1%	-0.0%
23	Master's Degree	262.8	-18.5%	-16.2%
24	Bachelor's Degree	162.9	-18.0%	-18.2%
26	PhD	204.5	-3.5%	11.2%

Table 4.3: Household Awareness about Electricity Consumption

Please indicate how you perceive your level of awareness with regards to the following:	Currently, I am aware of how much electricity is used by each of my electric appliances.	Currently, I am aware of how much money it costs to use each of my electric appliances.	Currently, I am aware of the carbon footprint associated with using each of my electric appliances.
EHMS 1	Somewhat agree	Somewhat agree	Neither agree nor disagree
EHMS 4	Disagree	Disagree	Disagree
EHMS 5	Disagree	Somewhat agree	Disagree
EHMS 7	Somewhat agree	Somewhat disagree	Somewhat disagree
EHMS 9	Neither agree nor disagree	Somewhat disagree	Disagree
EHMS 10	Somewhat disagree	Somewhat disagree	Somewhat disagree
EHMS 11	Disagree	Disagree	Disagree
EHMS 16	Disagree	Disagree	Disagree
EHMS 17	Neither agree nor disagree	Neither agree nor disagree	Neither agree nor disagree
EHMS 18	Somewhat disagree	Disagree	Strongly disagree
EHMS 21	Disagree	Disagree	Disagree
EHMS 23	Neither agree nor disagree	Somewhat disagree	Disagree
EHMS 26	Strongly disagree	Strongly disagree	Strongly disagree

Table 4.4: Household Attitudes about Electricity Consumption

To what extent do the following statements describe your attitudes towards energy management in your home?	I believe that it is important to conserve as much energy in my home as possible.	I believe that it is important to reduce my electricity usage during on-peak times as much as possible.
EHMS 1	Strongly agree	Strongly agree
EHMS 4	Agree	Somewhat agree
EHMS 5	Strongly agree	Strongly agree
EHMS 7	Somewhat agree	Somewhat agree
EHMS 9	Strongly agree	Strongly agree
EHMS 10	Agree	Somewhat agree
EHMS 11	Somewhat agree	Agree

Table 4.4: Household Attitudes about Electricity Consumption

EHMS 16	Agree	Agree
EHMS 17	Agree	Strongly Agree
EHMS 18	Strongly Agree	Strongly Agree
EHMS 21	Strongly Agree	Strongly Agree
EHMS 23	Agree	Agree
EHMS 26	Strongly Agree	Strongly Agree

Table 4.5: Household Actions towards Electricity Conservation

To what extent do the following statements describe your actions towards energy management in your home?	I try to conserve as much energy in my home as possible.	I try to reduce my electricity usage during on-peak times as much as possible.
EHMS 1	Strongly agree	Strongly agree
EHMS 4	Neither agree nor disagree	Neither agree nor disagree
EHMS 5	Somewhat agree	Agree
EHMS 7	Neither agree nor disagree	Neither agree nor disagree
EHMS 9	Agree	Agree
EHMS 10	Somewhat agree	Somewhat agree
EHMS 11	Somewhat agree	Somewhat agree
EHMS 16	Agree	Agree
EHMS 17	Agree	Agree
EHMS 18	Somewhat agree	Somewhat agree
EHMS 21	Somewhat agree	Agree
EHMS 23	Agree	Neither agree nor disagree
EHMS 26	Agree	Agree

Table 4.6: Electricity Conserving Actions Frequency (All Seasons)

In the past year, how often have the following actions been performed in your home to conserve energy?	Use less hot water	Turn off lights when no one is in the room	Turn off T.V., stereo, computer, printer when not in use	Hang clothes to dry	Adjust heating/ cooling vents in rooms not in use	Run electric appliances at off-peak times
EHMS 1	Once per week	At least daily	Every 2-3 days	Never	Never	Every 2-3 days
EHMS 4	n/a	At least daily	Every 2-3 days	Once per year	Never	n/a
EHMS 5	Once per week	At least daily	Never	Never	Once per week	At least daily
EHMS 7	Once per year	Every 2-3 days	Every 2-3 days	Never	Never	Once per week
EHMS 9	Every 2-3 days	At least daily	At least daily	Once per week	Once per week	Every 2-3 days
EHMS 10	At least daily	At least daily	Every 2-3 days	Once per week	Once per week	Every 2-3 days
EHMS 11	Once per season	At least daily	Every 2-3 days	Once per season	Once per year	Every 2-3 days
EHMS 16	At least daily	At least daily	At least daily	Never	Never	At least daily
EHMS 17	Once per week	At least daily	At least daily	Once per week	Never	Every 2-3 days
EHMS 18	Never	At least daily	Every 2-3 weeks	Once per year	Never	Every 2-3 days
EHMS 21	Never	At least daily	Once per week	At least daily	Every 2-3 days	Every 2-3 days
EHMS 23	Never	At least daily	At least daily	Never	At least daily	Never
EHMS 26	Every 2-3 days	At least daily	At least daily	Never	Once per week	Once per week

Table 4.7: Electricity Conserving Actions Frequency (Cooling Months)

In the past year, how often have the following actions been performed in your home to conserve energy?	Use fans/open windows instead of air conditioning	Raise the indoor temperature by adjusting the air-conditioner	Close drapes during hot summer days

Table 4.6: Electricity Conserving Actions Frequency (All Seasons)

EHMS 1	Never	At least daily	At least daily
EHMS 4	Every 2-3 weeks	Every 2-3 days	At least daily
EHMS 5	Never	Every 2-3 weeks	At least daily
EHMS 7	Once per season	Never	Every 2-3 days
EHMS 9	At least daily	At least daily	At least daily
EHMS 10	At least daily	At least daily	At least daily
EHMS 11	Every 2-3 weeks	Every 2-3 weeks	Every 2-3 weeks
EHMS 16	At least daily	At least daily	At least daily
EHMS 17	At least daily	Every 2-3 days	At least daily
EHMS 18	Never	Never	Never
EHMS 21	At least daily	At least daily	At least daily
EHMS 23	Every 2-3 weeks	Once per year	Every 2-3 days
EHMS 26	At least daily	Every 2-3 days	Every 2-3 days

Table 4.8: Electricity Conserving Actions Frequency (Heating Months)

In the past year, how often have the following actions been performed in your home to conserve energy?	Adjust thermostat to lower heat when no one is home	Adjust thermostat to lower heat when my family is asleep	Wear warmer clothes, so the thermostat can be kept lower
EHMS 1	At least daily	At least daily	Never
EHMS 4	Never	Never	Never
EHMS 5	At least daily	At least daily	Every 2-3 weeks
EHMS 7	Never	Never	Never
EHMS 9	At least daily	At least daily	Every 2-3 weeks
EHMS 10	Once per week	At least daily	At least daily
EHMS 11	Once per season	Once per season	Every 2-3 weeks
EHMS 16	At least daily	At least daily	At least daily
EHMS 17	At least daily	At least daily	At least daily
EHMS 18	Once per season	Never	Never
EHMS 21	At least daily	At least daily	At least daily
EHMS 23	At least daily	At least daily	Once per season

Table 4.8: Electricity Conserving Actions Frequency (Heating Months)

EHMS 26	Once per week	Once per year	Once per year

Table 4.9: Goal-Setting Electricity Consumption for Households

EHMS	"I would like to set goals that help…"
1	I do not know
4	I do not know
5	Decrease my home's electricity consumption
7	I do not know
9	I do not know
10	I do not know
11	Minimize an increase of my home's electricity consumption
16	Decrease my home's electricity consumption
17	Decrease my home's electricity consumption
18	Decrease my home's electricity consumption
21	Decrease my home's electricity consumption
23	Decrease my home's electricity consumption
26	Decrease my home's electricity consumption

Appendix B: Weather Normalization Results

Table: Predicted Total Consumption (kWh/week) normalized for Mean Outdoor Temperature

	1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26
1	393.0	-	326.8	247.8	-	-	92.0	37.0	-	42.3	-	80.6	-	-	-	210.4
2	397.0	-	330.0	248.8	-	-	90.3	34.7	-	40.9	-	75.2	-	-	-	211.8
3	400.0	-	332.4	249.6	-	-	89.0	32.9	-	39.8	-	71.1	-	-	-	212.9
4	414.0	-	343.7	253.1	-	-	82.9	24.6	-	34.9	-	51.8	-	123.5	-	217.8
5	-	-	347.4	254.3	-	-	80.9	21.9	-	33.3	-	45.5	-	120.4	-	219.4
6	-	-	337.9	251.3	-	-	86.0	28.8	-	37.4	-	61.6	-	128.3	-	215.3
7	-	-	333.1	249.8	-	-	88.6	32.4	-	39.6	-	69.9	-	132.4	-	213.1
8	-	-	339.6	251.8	-	-	85.1	27.6	-	36.7	-	58.8	-	126.9	-	216.0
9	-	-	335.7	250.6	-	-	87.2	30.5	-	38.4	-	65.5	-	130.2	-	214.3
10	-	-	340.9	252.2	-	-	84.4	-	-	36.2	-	56.6	-	125.8	-	216.5
11	-	-	330.8	249.1	-	-	89.8	-	-	40.5	-	73.7	-	134.2	-	212.2
12	-	-	334.7	250.3	-	-	87.7	-	-	38.8	-	67.1	-	-	-	213.9
13	-	-	340.5	252.1	-	-	84.6	-	-	36.3	-	-	-	-	-	216.4
14	417.9	7.1	346.9	254.1	-	72.5	81.2	-	-	33.6	-	46.4	-	-	-	219.1
15	383.0	43.6	318.7	245.3	-	95.2	96.3	-	-	45.8	-	94.3	-	-	-	206.9
16	362.5	65.1	302.2	240.1	-	108.5	105.2	-	70.0	52.9	-	122.5	-	158.2	100.2	-
17	380.7	46.1	316.8	244.7	-	96.7	-	-	60.6	46.6	-	97.5	-	145.9	93.2	206.1
18	383.7	42.9	319.3	245.4	-	94.7	-	-	59.1	45.5	-	93.4	-	143.9	92.1	207.2
19	348.2	80.1	290.6	236.5	-	117.8	-	-	77.4	57.9	-	142.1	-	167.8	105.7	194.8
20	363.3	64.3	302.8	240.3	-	108.0	-	-	69.6	52.7	98.1	121.5	-	157.7	99.9	200.0

Table: Predicted Total Consumption (kWh/week) normalized for Mean Outdoor Temperature

21	341.6	87.0	285.3	234.8	-	122.1	114.3	-	80.9	60.2	105.4	151.2	-	172.3	108.3	192.5
22	329.2	100.0	275.3	231.7	110.8	130.2	119.6	-	87.3	64.6	109.6	168.2	75.8	180.6	113.1	188.1
23	320.7	109.0	268.4	229.5	119.1	135.7	123.3	-	91.7	67.5	112.4	179.9	80.2	186.4	116.4	185.2
24	304.1	-	255.0	225.3	135.3	146.5	130.5	-	100.3	73.3	118.0	202.7	88.8	197.6	122.8	179.4
25	266.7	-	224.9	215.9	171.8	170.8	146.7	-	119.7	86.4	130.6	254.0	108.2	222.8	-	166.3
26	301.9	-	253.3	224.8	137.4	147.9	131.5	-	101.4	74.1	118.8	205.7	89.9	199.1	-	178.6
27	289.6	141.5	243.3	221.7	149.4	155.9	136.8	-	107.8	78.4	122.9	222.6	96.3	207.3	-	174.3
28	283.3	148.1	238.3	220.1	155.6	160.0	139.5	-	111.1	80.6	125.0	231.2	99.6	211.6	-	172.1
29	290.4	140.7	243.9	221.8	-	155.4	-	-	107.4	78.1	122.7	221.5	95.9	-	-	174.6
30	-	120.3	259.7	226.8	129.7	142.7	128.0	-	97.3	71.3	-	194.8	85.8	193.7	-	181.4
SUM	6970.8	1195.8	9118.2	7219.6	1109.1	2160.6	2581.4	270.4	1341.6	1564.6	1163.5	3526.9	820.5	3566.6	951.7	5816.6

Table 4.12: Predicted Total Consumption (kWh/week) normalized for Cooling Degree Days

EHMS	1	4	5	10	11	17	21	23	26
1	401.9	331.6	231.9	223.7	117.0	48.1	213.4	-	166.2
2	407.7	336.5	238.7	232.2	121.3	52.5	222.0	-	171.6
3	414.7	342.5	247.0	242.4	126.5	57.7	232.3	-	178.0
4	440.5	364.6	277.4	280.1	145.7	77.1	270.4	348.0	201.7
5	-	374.3	290.9	296.7	154.2	85.6	287.2	364.5	212.2
6	-	352.1	260.2	258.8	134.8	66.1	248.8	326.9	188.3
7	-	339.1	242.2	236.6	123.5	54.7	226.4	304.9	174.3
8	-	354.1	263.0	262.3	136.6	67.9	252.4	330.4	190.5
9	-	346.6	252.6	249.4	130.1	61.3	239.4	317.7	182.4
10	-	357.4	267.5	267.8	-	70.8	258.0	335.9	194.0
11	-	340.5	244.1	238.9	-	55.9	228.8	307.3	175.8
12	-	345.6	251.2	247.7	-	60.4	237.6	-	181.3

Table 4.12: Predicted Total Consumption (kWh/week) normalized for Cooling Degree Days

SUM	1664.8	4184.9	3066.7	3036.6	1189.7	758.1	2916.7	2635.6	2216.3

Table 4.13: Predicted Total Consumption (kWh/week) normalized for Heating Degree Days

EHMS	1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26
1	323.5	-	267.9	181.8	-	-	166.4	90.0	-	73.2	-	193.3	-	-	-	218.1
2	323.9	-	268.2	181.0	-	-	166.4	89.6	-	73.0	-	192.3	-	-	-	218.8
3	323.9	-	268.2	180.9	-	-	166.4	89.5	-	73.0	-	192.3	-	-	-	218.8
4	324.8	-	268.7	179.2	-	-	166.5	88.7	-	72.5	-	190.2	-	222.7	-	220.2
5	-	-	268.6	179.3	-	-	166.5	88.7	-	72.5	-	190.3	-	222.7	-	220.2
6	-	-	268.5	179.8	-	-	166.4	89.0	-	72.7	-	190.9	-	222.8	-	219.8
7	-	-	268.5	179.6	-	-	166.5	88.9	-	72.6	-	190.7	-	222.8	-	219.9
8	-	-	268.7	179.2	-	-	166.5	88.7	-	72.5	-	190.2	-	222.7	-	220.2
9	-	-	268.5	179.8	-	-	166.4	89.0	-	72.7	-	191.0	-	222.9	-	219.7
10	-	-	268.7	179.2	-	-	166.5	-	-	72.5	-	190.2	-	222.7	-	220.2
11	-	-	268.2	180.7	-	-	166.4	-	-	72.9	-	192.1	-	223.1	-	219.0
12	-	-	268.2	180.8	-	-	166.4	-	-	72.9	-	192.2	-	-	-	218.9
13	-	-	268.5	179.8	-	-	166.4	-	-	72.7	-	-	-	-	-	219.7
14	370.9	96.8	268.6	179.4	-	138.0	166.5	-	-	72.6	-	190.4	-	-	-	220.1
15	319.9	104.7	266.7	186.2	-	142.8	166.3	-	-	74.3	-	198.6	-	-	-	214.6
16	318.1	115.0	264.3	195.0	-	148.9	166.1	-	115.9	76.6	-	209.3	-	224.7	174.6	-
17	321.6	104.4	266.8	185.9	-	142.6	-	-	113.2	74.2	-	198.3	-	224.4	177.6	214.8
18	319.8	103.3	267.1	184.9	-	141.9	-	-	112.9	74.0	-	197.1	-	229.7	177.9	215.6

Table 4.13: Predicted Total Consumption (kWh/week) normalized for Heating Degree Days

19	312.7	123.6	262.2	202.4	-	154.1	-	-	118.2	78.4	-	218.2	-	227.4	172.2	201.4
20	316.6	114.8	264.3	194.8	-	148.8	-	-	115.9	76.5	148.5	209.1	-	230.7	174.7	207.5
21	311.6	127.6	261.2	205.8	-	156.5	165.8	-	119.2	79.3	148.0	222.4	-	232.7	171.1	198.6
22	306.7	135.0	259.4	212.2	175.4	160.9	165.7	-	121.1	81.0	147.7	230.1	106.9	234.0	169.0	193.3
23	306.0	140.2	258.2	216.7	179.0	164.0	165.6	-	122.5	82.1	147.5	235.5	108.8	236.6	167.6	189.7
24	300.1	-	255.8	225.3	186.0	170.0	165.4	-	125.1	84.3	147.1	245.9	112.4	242.7	164.8	182.7
25	291.3	-	250.2	245.5	202.5	184.1	164.9	-	131.2	89.5	146.2	270.3	120.8	237.1	-	166.3
26	300.7	-	255.3	226.9	187.4	171.2	165.4	-	125.6	84.7	147.0	247.9	113.1	239.7	-	181.4
27	294.6	162.3	252.9	235.7	194.5	177.3	165.1	-	128.2	87.0	146.6	258.5	116.7	239.8	-	174.3
28	297.1	162.7	252.8	236.0	194.8	177.5	165.1	-	128.3	87.1	146.6	258.9	116.9	238.7	-	174.0
29	296.9	158.4	253.8	232.3	-	175.0	-	-	127.2	86.1	146.8	254.5	115.3	-	-	177.0
30	-	146.7	256.6	222.2	183.6	167.9	165.5	-	124.2	83.5	-	242.2	111.1	235.7	-	185.2
SUM	6280.7	1795.5	7905.6	5928.3	1503.2	2721.5	4151.1	802.1	1828.7	2316.9	1472	6182.9	1022	5056.3	1549.5	5950.0

Table 4.15: Predicted AC Consumption (kWh/week) normalized for Mean Outdoor Temperature

EHMS	1	4	5	10	11	17	23	26
1	41.9	93.1	57.8	71.8	29.9	0.0	-	65.7
2	47.7	102.4	67.1	82.1	35.3	0.0	-	72.0
3	52.0	109.3	74.1	89.8	39.4	1.3	-	76.8
4	72.5	141.9	106.9	126.0	58.5	10.7	137.7	99.3
5	-	152.5	117.6	137.7	64.7	13.8	148.7	106.6
6	-	125.3	90.2	107.6	48.8	5.9	120.5	87.9
7	-	111.2	76.1	91.9	40.5	1.8	105.9	78.2
8	-	130.2	95.1	112.9	51.6	7.3	125.5	91.2
9	-	118.8	83.6	100.3	44.9	4.0	113.7	83.3

Table 4.15: Predicted AC Consumption (kWh/week) normalized for Mean Outdoor Temperature

10	-	133.8	98.8	117.0	-	8.4	129.3	93.7
11	-	104.9	69.7	84.9	-	0.0	99.3	73.8
12	-	116.1	80.9	97.3	-	3.2	-	81.5
SUM	214.1	1439.5	1017.9	1219.3	413.6	56.4	980.6	1010.0

Table 4.16: Predicted AC Consumption (kWh/week) normalized for Cooling Degree Days

EHMS	1	4	5	10	11	17	21	23	26
1	34.3	138.3	51.5	92.5	28.8	0.5	40.5	-	64.9
2	39.0	139.7	57.6	98.2	33.0	0.7	46.7	-	69.7
3	44.8	141.3	65.0	105.1	38.2	3.5	54.2	-	75.4
4	65.9	147.4	92.2	130.6	57.1	7.0	81.8	143.7	96.4
5	-	150.1	104.3	141.8	65.5	17.0	94.0	156.0	105.7
6	-	144.0	76.8	116.2	46.4	5.5	66.2	127.8	84.5
7	-	140.4	60.8	101.2	35.2	3.0	49.9	111.3	72.1
8	-	144.5	79.4	118.5	-	4.3	68.7	130.4	86.5
9	-	142.5	70.1	109.9	-	3.8	59.3	120.9	79.3
10	-	145.4	83.4	122.3	-	3.6	72.8	134.5	89.6
11	-	140.8	62.5	102.8	-	2.7	51.6	113.1	73.4
12	-	142.2	68.8	108.7	-	1.9	58.0	-	78.3
SUM	184.0	1716.6	872.4	1347.8	304.2	53.5	743.7	1037.7	975.8

Table 4.18: Predicted Furnace Consumption (kWh/week) normalized for Mean Outdoor Temperature

EHMS	1	2	4	5	7	9	10	11	17	18	21	22	23	24	26
1	0.0	-	61.2	25.6	-	-	20.2	0.0	0.0	-	0.0	-	-	-	0.0
2	0.0	-	61.6	28.3	-	-	18.7	0.0	0.0	-	0.0	-	-	-	0.0
3	0.0	-	61.9	30.3	-	-	17.6	0.0	0.0	-	0.0	-	-	-	0.0
4	0.0	-	63.5	39.8	-	-	12.6	0.0	0.0	-	0.0	-	1.0	-	0.0
5	-	-	64.0	42.9	-	-	10.9	0.0	0.0	-	0.0	-	1.9	-	0.0
6	-	-	62.7	35.0	-	-	15.2	0.0	0.0	-	0.0	-	2.6	-	0.0
7	-	-	62.0	30.9	-	-	17.3	0.0	0.0	-	0.0	-	3.9	-	0.0

Table 4.18: Predicted Furnace Consumption (kWh/week) normalized for Mean Outdoor Temperature

8	-	-	62.9	36.4	-	-	14.4	0.0	0.0	-	0.0	-	2.0	-	0.0
9	-	-	62.4	33.1	-	-	16.2	0.0	0.0	-	0.0	-	2.8	-	0.0
10	-	-	63.1	37.4	-	-	13.8	-	0.0	-	0.0	-	1.5	-	0.0
11	-	-	61.7	29.0	-	-	18.3	-	0.0	-	0.0	-	3.5	-	0.0
12	-	-	62.3	32.3	-	-	16.6	-	0.0	-	0.0	-	-	-	0.0
13	-	-	63.0	37.1	-	-	14.0	-	0.0	-	-	-	-	-	0.0
14	0.0	0.0	63.9	42.4	-	0.0	11.2	-	0.0	-	0.0	-	-	-	0.0
15	0.0	0.0	60.1	18.9	-	4.7	23.8	-	0.0	-	0.2	-	-	-	0.1
16	0.0	1.0	57.9	5.1	-	12.0	31.2	-	0.0	-	0.9	-	13.4	0.0	-
17	0.0	0.0	59.8	17.3	-	3.4	-	-	0.0	-	0.1	-	8.3	0.0	0.0
18	0.0	0.0	60.2	17.7	-	3.7	-	-	0.0	-	0.4	-	5.6	0.0	0.4
19	0.0	3.2	56.3	0.0	-	19.2	-	-	0.1	-	2.5	-	15.3	0.0	2.4
20	0.0	0.9	58.0	4.9	-	12.1	-	-	0.3	0.3	1.7	-	12.0	0.0	1.7
21	0.0	4.3	55.6	0.0	-	22.8	38.7	-	0.5	1.5	3.2	-	17.8	0.0	3.2
22	0.0	6.2	54.3	0.0	24.2	29.3	43.2	-	2.6	7.0	6.2	7.8	17.8	1.0	6.4
23	2.4	7.5	53.3	0.0	27.6	33.8	46.3	-	3.5	9.2	7.5	9.6	22.1	1.8	7.6
24	7.8	-	51.5	0.0	34.2	42.6	52.3	-	6.0	15.5	10.9	15.0	24.9	4.2	11.2
25	20.0	-	47.5	0.0	49.0	62.4	65.8	-	12.3	31.3	18.5	27.6	34.6	-	19.3
26	8.5	-	51.3	0.0	35.0	43.8	53.1	-	6.7	17.1	11.3	15.7	26.3	-	11.7
27	12.5	12.4	50.0	0.0	39.9	50.3	57.5	-	8.5	21.6	13.8	19.9	28.8	-	14.4
28	14.6	13.4	49.3	0.0	42.4	53.6	59.8	-	9.5	24.3	15.1	22.0	30.3	-	15.7
29	12.3	12.3	50.1	0.0	-	49.9	-	-	8.3	21.3	13.7	19.6	-	-	14.2
30	-	9.2	52.2	0.0	31.8	39.6	50.2	-	5.1	-	9.7	13.0	24.3	-	10.0
SUM	78.1	70.4	1743.6	544.4	284.1	483.2	738.9	0.0	63.4	149.1	115.7	150.2	300.7	7.0	118.3

Table 4.19: Predicted Furnace Consumption (kWh/week) normalized for HDD

EHMS	1	2	4	5	7	9	10	11	17	18	21	22	23	24	26
1	4.9	-	59.4	17.3	-	-	24.2	1.6	1.8	-	7.7	-	-	-	7.1
2	4.8	-	59.6	17.0	-	-	23.6	1.1	1.7	-	7.5	-	-	-	6.9
3	4.8	-	59.6	17.0	-	-	23.6	1.1	1.7	-	7.5	-	-	-	6.9
4	4.7	-	59.9	16.6	-	-	22.4	0.0	1.3	-	7.1	-	22.1	-	6.4

Table 4.19: Predicted Furnace Consumption (kWh/week) normalized for HDD

5	-	-	59.9	16.6	-	-	22.5	0.0	1.3	-	8.2	-	22.1	-	6.5
6	-	-	59.8	16.7	-	-	22.8	0.3	1.4	-	7.3	-	22.2	-	6.6
7	-	-	59.8	16.7	-	-	22.7	0.2	1.4	-	7.2	-	22.2	-	6.6
8	-	-	59.9	16.6	-	-	22.4	0.0	1.3	-	7.1	-	22.1	-	6.4
9	-	-	59.8	16.8	-	-	22.9	0.4	1.5	-	7.3	-	22.3	-	7.5
10	-	-	59.9	16.6	-	-	22.4	-	1.3	-	7.1	-	22.1	-	6.4
11	-	-	59.6	17.0	-	-	23.5	-	1.6	-	7.6	-	22.4	-	7.0
12	-	-	59.6	14.6	-	-	23.5	-	1.8	-	7.3	-	-	-	6.7
13	-	-	59.8	16.7	-	-	22.8	-	1.4	-	-	-	-	-	6.6
14	4.7	0.0	59.9	16.6	-	6.2	22.5	-	1.4	-	7.3	-	-	-	6.6
15	5.2	1.1	58.6	17.6	-	12.4	27.3	-	3.1	-	9.2	-	-	-	8.9
16	5.8	2.7	57.0	21.3	-	20.4	33.4	-	3.8	-	9.9	-	25.4	6.7	-
17	5.2	0.6	58.7	18.4	-	12.1	-	-	2.5	-	8.4	-	23.5	5.2	8.0
18	5.1	0.8	58.9	17.1	-	11.3	-	-	3.2	-	9.2	-	23.3	5.4	8.9
19	6.3	4.9	55.6	22.4	-	27.1	-	-	5.7	-	12.1	-	27.0	8.3	12.5
20	5.8	3.0	57.0	20.5	-	20.2	-	-	4.3	17.7	10.5	-	25.4	6.7	10.6
21	6.5	6.0	55.0	23.8	-	30.2	41.0	-	6.1	22.0	12.5	-	27.7	8.8	13.0
22	7.0	8.1	53.8	23.8	42.5	36.0	45.4	-	7.9	24.5	14.5	16.8	29.0	10.8	15.5
23	7.3	9.5	53.0	26.3	44.5	40.1	48.5	-	8.2	26.3	14.8	18.8	30.0	11.1	15.9
24	7.9	-	51.4	27.9	48.5	47.9	54.5	-	10.3	29.7	17.3	22.6	31.8	13.5	18.8
25	9.3	-	47.6	33.1	57.9	66.2	68.6	-	13.5	37.7	20.8	31.5	36.0	-	23.2
26	8.0	-	51.0	28.8	49.3	49.4	55.7	-	10.1	30.4	17.0	23.3	32.1	-	18.5
27	8.6	15.7	49.4	31.7	53.4	57.3	61.8	-	12.3	33.8	19.5	27.2	33.9	-	21.5
28	8.7	15.8	49.4	31.1	53.5	57.6	62.0	-	11.4	33.9	18.5	27.3	34.0	-	20.3
29	8.4	14.6	50.0	29.7	-	54.3	-	-	11.5	32.5	18.6	25.7	-	-	20.4
30	-	11.4	51.9	28.6	47.1	45.1	52.4	-	9.2	-	15.9	21.3	31.1	-	17.2
SUM	129.0	94.2	1694.8	634.9	396.7	593.8	872.4	4.7	144.0	288.5	324.9	214.5	587.7	76.5	327.4

Appendix C: General Change in Consumption

On-Peak

Table: Average Change in On-Peak Consumption (kWh/week) Per Household & Major Appliance for 12 Week Summer

		1	4	5	10	11	17	21	23	26	AVG.
Household	2013	71.4	78.5	47.1	86.0	23.5	16.5	39.0	67.4	28.6	50.9
	2014	103.7	64.7	38.1	66.7	22.5	11.2	29.7	57.9	20.3	46.1
	Δ kWh	32.3	-13.8	-9.0	-19.3	-1.0	-5.3	-9.3	-9.5	-8.3	-4.8
AC	2013	14.8	22.4	17.4	25.6	8.9	2.3	2.7	23.9	17.0	15.0
	2014	11.0	22.1	1.1	25.4	9.1	0.0	1.0	30.9	4.1	11.6
	Δ kWh	-3.8	-0.3	-16.3	-0.2	0.2	-2.3	-1.7	7.0	-12.9	-3.4
Furnace	2013	2.3	10.7	6.7	6.0	2.0	1.1	1.4	8.1	4.7	4.8
	2014	1.6	10.8	11.9	12.6	4.0	0.2	1.2	8.4	1.7	5.8
	Δ kWh	-0.7	0.1	5.2	6.6	2.0	-0.9	-0.2	0.3	-3.0	1.0
Washer/Dryer	2013	0.2	12.7	0.0	9.1	2.1	0.0	0.3	1.1	1.0	2.9
	2014	1.2	4.3	1.1	4.2	0.0	0.0	0.6	2.2	1.1	1.6
	Δ kWh	1.0	-8.4	1.1	-4.9	-2.1	0.0	0.3	1.1	0.1	-1.3
Dishwasher	2013	0.2	1.0	0.0	0.7	0.0	0.0	-	0.2	0.0	0.3
	2014	0.0	2.7	0.1	0.3	0.0	0.0	-	0.0	0.0	0.4
	Δ kWh	-0.2	1.7	0.1	-0.4	0.0	0.0	-	-0.2	0.0	0.1
Refrigerator	2013	1.2	2.9	4.5	1.7	1.7	5.5	1.6	1.5	1.7	2.5
	2014	0.9	3.5	6.4	2.3	1.7	6.1	1.6	1.8	1.6	2.9
	Δ kWh	-0.3	0.6	1.9	0.6	0.0	0.6	0.0	0.3	-0.1	0.4
Media Centre	2013	16.8	4.6	1.6	0.0	0.3	4.9	3.7	3.6	1.8	4.1
	2014	8.0	4.0	1.7	0.0	0.2	2.4	3.0	3.6	1.0	2.7
	Δ kWh	-8.8	-0.6	0.1	0.0	-0.1	-2.5	-0.7	0.0	-0.8	-1.5

Table 4.21b: Average Change in On-Peak Share (% of total consumption) Per Household & Major Appliance for 12 Week Summer

		1	4	5	10	11	17	21	23	26	AVG
Household	2013	18.8%	22.3%	16.8%	30.0%	15.2%	20.5%	13.6%	19.7%	19.3%	19.6%
	2014	24.8%	22.9%	13.9%	27.6%	18.7%	17.8%	13.2%	19.0%	18.4%	19.6%
	Δ %	6.1%	0.6%	-2.9%	-2.4%	3.5%	-2.8%	-0.4%	-0.7%	-1.0%	-0.0%
AC	2013	26.8%	18.4%	21.3%	22.0%	17.4%	2.7%	4.3%	15.3%	15.5%	16.0%
	2014	34.8%	27.7%	1.2%	32.3%	22.6%	0.0%	1.0%	27.9%	4.0%	16.8%
	Δ %	8.0%	9.3%	-20.1%	10.3%	5.2%	-2.7%	-3.3%	12.6%	-11.5%	0.9%
Furnace	2013	28.2%	15.7%	21.5%	19.4%	10.4%	8.7%	6.7%	19.9%	14.6%	16.1%
	2014	33.9%	16.2%	10.3%	17.6%	17.6%	8.0%	5.3%	22.6%	2.5%	14.9%
	Δ %	7.7%	1.2%	-11.1%	-1.8%	2.7%	-0.7%	-1.4%	6.7%	-10.4%	-0.8%
Washer/Dryer	2013	2.6%	26.1%	0.1%	49.5%	12.6%	0.0%	1.1%	8.9%	5.1%	11.8%
	2014	3.8%	10.5%	6.9%	19.6%	0.0%	0.0%	5.5%	10.9%	13.1%	7.8%
	Δ %	3.1%	-16.2%	7.8%	-29.9%	-9.7%	0.0%	4.4%	7.0%	8.7%	-2.8%
Dishwasher	2013	10.7%	8.9%	0.0%	33.6%	0.0%	0.0%	-	7.6%	0.0%	7.6%
	2014	0.0%	19.7%	2.6%	14.1%	0.0%	6.0%	-	6.8%	0.0%	6.1%
	Δ %	-9.4%	12.5%	2.8%	-18.2%	0.0%	10.0%	-	-12.2%	0.0%	-1.8%
Refrigerator	2013	15.5%	19.6%	19.5%	15.6%	16.4%	17.8%	15.9%	16.4%	16.9%	17.1%
	2014	17.4%	17.3%	19.7%	13.1%	15.9%	17.9%	16.0%	16.9%	16.6%	16.7%
	Δ %	0.7%	-2.9%	0.1%	-2.5%	-0.7%	0.1%	0.1%	2.4%	-0.1%	-0.3%
Media Centre	2013	18.1%	22.1%	15.3%	0.0%	6.8%	27.0%	18.7%	13.9%	12.8%	15.0%
	2014	17.8%	18.5%	18.1%	0.0%	9.1%	23.3%	15.8%	14.7%	15.0%	14.7%
	Δ %	-0.3%	-3.6%	2.7%	0.0%	2.3%	-3.7%	-2.8%	0.8%	2.2%	-0.3%

Table: Average Change in On-Peak Consumption (kWh/week) Per Household & Major Appliance for 18 Week Fall/Winter

		1	2	4	5	7	9	10	16	17	18	21	22	23	24	26	AVG
Household	2013	45.8	19.2	56.9	32.4	31.3	26.1	38.7	21.2	15.4	29.6	38.3	21.0	44.7	25.7	37.1	32.2
	2014	30.6	10.8	41.9	36.9	37.5	29.6	34.1	20.7	11.8	20.5	34.1	19.6	32.0	20.5	32.4	27.5

Table: Average Change in On-Peak Consumption (kWh/week) Per Household & Major Appliance for 18 Week Fall/Winter

	Δ kWh	-15.2	-8.4	-15.0	4.5	6.2	3.5	-4.6	-0.5	-3.6	-9.1	-4.2	-1.4	-12.7	-5.2	-4.7	-4.7
Furnace	2013	0.7	2.2	8.0	2.4	8.1	7.3	9.7	-	1.6	3.8	1.8	4.9	7.0	0.6	1.9	4.3
	2014	1.6	2.3	11.1	9.4	20.3	10.3	9.4	-	0.2	5.4	1.7	4.0	4.0	0.3	2.5	5.9
	Δ kWh	0.9	0.1	3.1	7.0	12.2	3.0	-0.3	-	-1.4	1.6	-0.1	-0.9	-3.0	-0.3	0.6	1.6
Washer/ Dryer	2013	0.8	0.8	8.9	0.0	1.0	1.2	4.5	-	0.1	2.3	1.9	0.0	2.7	1.5	0.8	1.9
	2014	1.3	0.0	2.9	5.3	0.1	1.5	1.3	-	0.0	1.3	2.7	0.0	2.6	1.7	1.1	1.6
	Δ kWh	0.5	-0.8	-6.0	5.3	-0.9	0.3	-3.2	-	-0.1	-1.0	0.8	0.0	-0.1	0.2	0.3	-0.3
Dishwasher	2013	0.1	-	1.7	0.0	0.2	0.2	0.8	-	0.0	6.2	-	0.0	0.3	0.2	0.4	0.8
	2014	0.0	-	1.9	0.0	0.1	0.0	0.5	-	0.0	7.9	-	0.0	0.2	0.2	0.3	0.9
	Δ kWh	-0.1	-	0.2	0.0	-0.1	-0.2	-0.3	-	0.0	1.7	-	0.0	-0.1	0.0	-0.1	0.1
Refrigerator	2013	1.4	-	3.5	4.2	0.3	1.4	2.9	-	4.3	2.3	1.6	3.3	1.9	2.4	1.6	2.4
	2014	0.9	-	4.0	4.7	0.2	1.8	1.5	-	3.7	1.6	1.5	2.5	1.5	2.2	1.7	2.1
	Δ kWh	-0.5	-	0.5	0.5	-0.1	0.4	-1.4	-	-0.6	-0.7	-0.1	-0.8	-0.4	-0.2	0.1	-0.3
Media Centre	2013	16.9	1.1	4.4	2.0	0.0	3.2	0.0	-	3.6	6.4	4.2	-	3.2	7.1	2.1	4.2
	2014	13.2	0.8	3.9	1.8	0.0	0.6	0.0	-	2.6	3.2	3.3	-	3.7	0.2	2.0	2.7
	Δ kWh	-3.7	-0.3	-0.5	-0.2	0.0	-2.6	0.0	-	-1.0	-3.2	-0.9	-	0.5	-6.9	-0.1	-1.5

Table 4b: Average Change in On-Peak Share (% of total consumption) Per Household & Major Appliance for 18 Week Fall/Winter

	EHMS	1	2	4	5	7	9	10	16	17	18	21	22	23	24	26	AVG
House-hold	2013	14.7%	12.8%	20.5%	14.3%	19.2%	15.1%	21.6%	17.2%	18.9%	19.1%	16.4%	17.9%	19.9%	15.8%	18.4%	17.5%
	2014	15.6%	15.4%	17.8%	16.5%	17.0%	16.4%	18.3%	17.3%	17.0%	17.3%	16.0%	16.8%	18.4%	15.6%	17.3%	16.9%
	Δ %	1.0%	2.5%	-2.7%	2.2%	-2.2%	1.2%	-3.3%	0.1%	-1.9%	-1.8%	-0.4%	-1.1%	-1.4%	-0.1%	-1.1%	-0.6%
Furnace	2013	17.6%	22.0%	15.1%	7.9%	16.9%	16.7%	16.8%	-	13.4%	17.8%	12.3%	18.3%	22.2%	17.7%	12.2%	16.2%

Table 4b: Average Change in On-Peak Share (% of total consumption) Per Household & Major Appliance for 18 Week Fall/ Winter

	2014	19.4%	12.3%	17.3%	15.1%	17.6%	17.1%	15.6%	-	13.6%	16.5%	12.1%	16.7%	17.6%	12.9%	12.1%	15.4%
	Δ %	5.7%	-1.5%	2.1%	10.0%	0.2%	-0.4%	-3.1%	-	0.9%	3.4%	-0.4%	-0.7%	-6.4%	-5.1%	0.7%	0.4%
Washer/ Dryer	2013	3.3%	13.0%	15.9%	0.0%	13.0%	6.2%	24.9%	-	7.6%	11.5%	8.8%	1.7%	11.8%	18.2%	4.8%	10.0%
	2014	8.4%	5.7%	6.5%	13.9%	1.8%	10.6%	5.6%	-	5.0%	15.8%	12.0%	0.0%	11.2%	16.4%	7.2%	8.6%
	Δ %	2.0%	-19.1%	-9.4%	25.1%	-10.1%	3.7%	-15.1%	-	-11.1%	0.6%	3.9%	-0.1%	0.8%	6.8%	2.0%	-1.4%
Dishwasher	2013	5.3%	-	14.9%	0.0%	9.5%	5.3%	28.8%	-	0.0%	18.7%	-	1.0%	11.7%	16.1%	9.0%	10.0%
	2014	3.8%	-	17.5%	4.8%	2.8%	0.0%	23.1%	-	0.0%	25.3%	-	2.0%	10.0%	13.5%	9.2%	9.3%
	Δ %	-4.1%	-	2.6%	0.0%	-1.0%	-6.3%	-5.3%	-	0.0%	6.7%	-	2.0%	-3.3%	1.9%	-1.4%	-0.7%
Refrigerator	2013	16.5%	-	20.5%	15.3%	14.3%	16.1%	17.7%	-	16.5%	18.4%	17.7%	17.5%	18.2%	17.9%	16.5%	17.2%
	2014	15.3%	-	18.0%	21.9%	15.4%	16.5%	14.8%	-	18.0%	17.4%	16.8%	17.6%	18.0%	17.1%	16.1%	17.1%
	Δ %	-2.8%	-	-2.4%	5.8%	0.2%	-0.2%	-2.9%	-	1.7%	-1.9%	-0.7%	-0.6%	-0.4%	-1.2%	-0.8%	-0.5%
Media Centre	2013	18.1%	17.0%	20.1%	16.7%	5.1%	17.1%	0.0%	-	24.3%	18.3%	21.0%	-	18.1%	18.0%	16.2%	16.1%
	2014	17.3%	15.0%	17.8%	22.1%	0.0%	3.6%	4.5%	-	19.4%	19.3%	16.9%	-	16.2%	2.0%	17.4%	13.2%
	Δ %	-0.8%	-2.0%	-2.3%	5.4%	-5.1%	-13.6%	4.5%	-	-4.9%	1.1%	-4.1%	-	-1.9%	-15.9%	1.2%	-3.0%

Mid-Peak

Table: Average Change in Mid-Peak Consumption (kWh/week) Per Household & Major Appliance for 12 Week Summer

		1	4	5	10	11	17	21	23	26	AVG
Household	2013	84.2	125.2	85.1	84.9	22.4	28.6	85.0	90.4	56.7	73.6
	2014	109.8	101.8	91.9	82.9	24.6	20.9	68.1	95.8	60.0	72.9
	Δ kWh	25.6	-23.4	6.8	-2.0	2.2	-7.7	-16.9	5.4	3.3	-0.7
AC	2013	14.1	24.1	19.1	16.4	3.7	2.0	9.2	19.8	14.3	13.6
	2014	6.6	19.7	18.9	15.9	4.8	0.0	5.1	18.0	14.2	11.5
	Δ kWh	-7.5	-4.4	-0.2	-0.5	1.1	-2.0	-4.1	-1.8	-0.1	-2.2
Furnace	2013	1.6	11.3	7.3	4.3	1.0	0.8	6.4	6.4	4.1	4.8

Table: Average Change in Mid-Peak Consumption (kWh/week) Per Household & Major Appliance for 12 Week Summer

	2014	0.7	10.7	15.1	12.4	3.2	0.1	6.1	6.1	5.4	6.6
	Δ kWh	-0.9	-0.6	7.8	8.1	2.2	-0.7	-0.3	-0.3	1.3	1.8
Washer/Dryer	2013	5.3	8.1	0.8	2.9	2.8	0.0	3.6	2.8	2.1	3.2
	2014	2.4	4.2	0.4	2.8	0.4	0.0	3.8	5.1	0.9	2.2
	Δ kWh	-2.9	-3.9	-0.4	-0.1	-2.4	0.0	0.2	2.3	-1.2	-0.9
Dishwasher	2013	0.1	1.2	0.1	0.2	0.0	0.0	-	0.2	0.6	0.3
	2014	0.0	2.0	0.1	0.4	0.0	0.1	-	0.5	0.5	0.5
	Δ kWh	-0.1	0.8	0.0	0.2	0.0	0.1	-	0.3	-0.1	0.2
Refrigerator	2013	1.4	3.1	5.0	2.1	2.1	5.5	2.0	1.8	1.7	2.7
	2014	1.1	3.9	6.6	2.9	1.9	6.3	1.8	2.0	1.7	3.1
	Δ kWh	-0.3	0.8	1.6	0.8	-0.2	0.8	-0.2	0.2	0.0	0.4
Media Centre	2013	17.0	4.1	1.8	0.0	0.7	3.4	4.8	5.0	2.6	4.4
	2014	8.0	4.1	2.2	0.0	0.3	2.0	3.7	4.3	1.0	2.8
	Δ kWh	-9.0	0.0	0.4	0.0	-0.4	-1.4	-1.1	-0.7	-1.6	-1.5

Table 6b: Average Change in Mid-Peak Share (% of total consumption) Per Household & Major Appliance for 12 Week Summer

		1	4	5	10	11	17	21	23	26	AVG
Household	2013	15.0%	19.9%	17.5%	16.3%	9.4%	19.2%	16.6%	15.4%	14.0%	15.9%
	2014	16.5%	19.4%	18.2%	18.6%	11.7%	18.0%	16.6%	18.5%	15.8%	17.0%
	Δ %	1.5%	-0.5%	0.6%	2.3%	2.3%	-1.1%	-0.1%	3.1%	1.8%	1.1%
AC	2013	32.7%	20.1%	25.9%	22.1%	6.9%	2.3%	13.4%	12.6%	12.9%	16.6%
	2014	19.8%	24.4%	25.5%	22.3%	12.2%	0.0%	10.5%	16.5%	16.7%	16.4%
	Δ %	-12.9%	4.2%	-0.4%	0.2%	5.3%	-2.3%	-2.9%	3.9%	3.8%	-0.1%
Furnace	2013	16.5%	16.6%	24.6%	14.2%	8.8%	4.1%	13.9%	13.0%	12.8%	13.8%

Table 6b: Average Change in Mid-Peak Share (% of total consumption) Per Household & Major Appliance for 12 Week Summer

	2014	13.5%	16.7%	17.1%	17.4%	13.8%	5.0%	9.4%	17.0%	16.1%	14.0%
	Δ %	-3.0%	0.1%	-7.5%	3.2%	5.0%	1.0%	-4.5%	4.0%	3.3%	0.2%
Washer/Dryer	2013	21.7%	17.6%	2.9%	13.9%	13.3%	5.2%	14.7%	14.7%	12.1%	12.9%
	2014	6.2%	9.9%	1.8%	13.5%	3.0%	0.0%	15.6%	24.8%	11.0%	9.5%
	Δ %	-15.5%	-7.7%	-1.1%	-0.4%	-10.3%	-5.2%	0.9%	10.1%	-1.1%	-3.4%
Dishwasher	2013	3.6%	11.5%	5.1%	14.9%	0.0%	6.9%	-	10.0%	12.5%	8.1%
	2014	0.0%	16.8%	4.2%	26.5%	0.0%	7.2%	-	15.0%	17.3%	10.9%
	Δ %	-3.6%	5.3%	-0.9%	11.6%	0.0%	0.3%	-	5.0%	4.8%	2.8%
Refrigerator	2013	16.8%	21.0%	21.7%	19.2%	19.2%	17.7%	19.7%	16.9%	17.1%	18.8%
	2014	21.0%	18.8%	20.5%	16.6%	17.9%	18.5%	18.1%	19.2%	17.0%	18.6%
	Δ %	4.2%	-2.2%	-1.2%	-2.6%	-1.3%	0.8%	-1.6%	2.2%	-0.0%	-0.2%
Media Centre	2013	18.3%	19.5%	18.0%	0.0%	16.5%	18.4%	23.8%	18.9%	18.8%	16.9%
	2014	17.7%	18.7%	23.3%	0.0%	22.0%	19.4%	19.9%	17.4%	16.0%	17.1%
	Δ %	-0.7%	-0.8%	5.4%	0.0%	5.5%	1.0%	-3.9%	-1.4%	-2.8%	0.2%

Table: Average Change in Mid-Peak Consumption (kWh/week) Per Household & Major Appliance for 18 Week Fall/Winter

		1	2	4	5	7	9	10	16	17	18	21	22	23	24	26	AVG
Household	2013	47.1	22.7	51.1	35.3	29.1	26.7	32.2	19.6	17.8	27.2	38.4	18.7	40.3	27.9	33.1	31.1
	2014	28.2	11.8	41.5	39.1	33.5	28.0	34.7	19.8	11.4	18.2	31.0	17.4	29.3	22.8	33.9	26.7
	Δ kWh	-18.9	-10.9	-9.6	3.8	4.4	1.3	2.5	0.2	-6.4	-9.0	-7.4	-1.3	-11.0	-5.1	0.8	-4.4
Furnace	2013	0.7	2.3	8.1	2.7	8.2	7.2	9.1	-	1.4	3.5	2.4	4.4	5.3	0.7	3.1	4.2

Table: Average Change in Mid-Peak Consumption (kWh/week) Per Household & Major Appliance for 18 Week Fall/Winter

	2014	1.3	2.2	10.9	10.1	20.2	10.3	9.1	-	0.6	4.6	1.4	3.9	3.1	0.2	2.9	5.8
	Δ kWh	0.6	-0.1	2.8	7.4	12.0	3.1	0.0	-	-0.8	1.1	-1.0	-0.5	-2.2	-0.5	-0.2	1.6
Washer/ Dryer	2013	2.7	1.6	6.4	0.7	1.6	1.4	4.3	-	0.0	2.3	2.7	0.0	3.9	3.3	0.6	2.3
	2014	1.0	0.0	4.4	2.5	0.0	0.7	3.8	-	0.1	1.4	1.8	0.0	2.6	1.6	3.3	1.7
	Δ kWh	-1.7	-1.6	-2.0	1.8	-1.6	-0.7	-0.5	-	0.1	-0.9	-0.9	0.0	-1.3	-1.7	2.7	-0.6
Dishwash-er	2013	0.3	-	1.5	0.0	0.1	0.4	0.8	-	0.0	8.9	-	0.0	0.3	0.2	0.4	1.1
	2014	0.0	-	1.8	0.0	0.0	0.1	0.3	-	0.0	6.8	-	0.0	0.4	0.1	0.7	0.9
	Δ kWh	-0.3	-	0.3	0.0	-0.1	-0.3	-0.5	-	0.0	-2.1	-	0.0	0.1	-0.1	0.3	-0.2
Refrigera-tor	2013	1.6	-	3.9	5.0	0.2	1.3	3.4	-	4.7	2.3	1.6	3.0	2.0	2.4	1.6	2.5
	2014	1.5	-	4.2	5.6	0.2	1.7	1.7	-	3.9	1.6	1.7	2.4	1.5	2.3	1.7	2.3
	Δ kWh	-0.1	-	0.3	0.6	0.0	0.4	-1.7	-	-0.8	-0.7	0.1	-0.6	-0.5	-0.1	0.1	-0.2
Media Centre	2013	16.8	1.1	4.4	2.4	0.1	3.2	0.0	-	3.4	6.5	4.0	-	3.5	7.0	1.9	4.2
	2014	13.2	0.8	3.9	1.8	0.0	0.6	0.0	-	2.4	3.1	4.0	-	3.5	2.8	1.9	2.9
	Δ kWh	-3.6	-0.3	-0.5	-0.6	-0.1	-2.6	0.0	-	-1.0	-3.4	0.0	-	0.0	-4.2	0.0	-1.3

Table 7b: Average Change in Mid-Peak Share (% of total consumption) Per Household & Major Appliance for 18 Week Fall/Winter

		1	2	4	5	7	9	10	16	17	18	21	22	23	24	26	AVG
Household	2013	14.8%	15.6%	18.5%	15.9%	18.3%	15.4%	18.1%	16.1%	21.9%	17.8%	16.7%	16.1%	18.1%	17.0%	16.3%	17.1%
	2014	14.6%	17.6%	17.7%	16.9%	15.4%	15.8%	19.0%	17.0%	16.9%	15.3%	14.7%	15.0%	17.2%	16.9%	17.8%	16.5%
	Δ %	-0.2%	2.0%	-0.8%	1.0%	-2.9%	0.4%	0.9%	0.9%	-4.9%	-2.5%	-2.0%	-1.2%	-0.9%	-0.1%	1.4%	-0.6%
Furnace	2013	13.4%	17.0%	15.3%	19.9%	17.0%	18.0%	17.1%	-	10.9%	12.6%	18.3%	16.5%	19.0%	18.7%	19.2%	16.6%
	2014	10.8%	13.4%	17.0%	17.8%	17.4%	17.1%	14.0%	-	11.5%	13.7%	10.8%	16.2%	16.2%	11.4%	13.4%	14.3%

Table 7b: Average Change in Mid-Peak Share (% of total consumption) Per Household & Major Appliance for 18 Week Fall/Winter

	Δ %	-2.6%	-3.7%	1.6%	-2.1%	0.4%	-0.8%	-3.1%	-	0.6%	1.1%	-7.5%	-0.3%	-2.8%	-7.4%	-5.8%	-2.3%
Washer/ Dryer	2013	10.3%	12.4%	11.7%	3.0%	20.9%	8.2%	20.9%	-	1.5%	17.7%	9.9%	0.0%	14.9%	21.2%	6.5%	11.4%
	2014	3.7%	0.0%	9.7%	6.3%	0.2%	3.5%	21.1%	-	6.3%	9.2%	8.7%	0.0%	12.8%	13.0%	14.9%	7.8%
	Δ %	-6.6%	-12.4%	-2.0%	3.4%	-20.7%	-4.7%	0.2%	-	4.8%	-8.5%	-1.2%	0.0%	-2.2%	-8.2%	8.4%	-3.5%
Dishwasher	2013	22.7%	-	13.3%	0.0%	4.8%	17.8%	26.9%	-	3.1%	24.4%	-	0.0%	9.2%	11.0%	12.2%	12.1%
	2014	0.0%	-	15.2%	0.0%	0.0%	2.0%	11.5%	-	0.0%	21.6%	-	0.0%	16.4%	2.9%	20.3%	7.5%
	Δ %	-22.7%	-	1.9%	0.0%	-4.8%	-15.8%	-15.4%	-	-3.1%	-2.8%	-	0.0%	7.1%	2.9%	8.1%	-3.7%
Refrigerator	2013	20.0%	-	22.5%	17.9%	24.4%	15.3%	20.7%	-	17.9%	18.7%	17.1%	16.3%	18.8%	18.4%	17.1%	18.9%
	2014	21.5%	-	19.4%	23.2%	16.3%	16.2%	15.2%	-	18.6%	17.4%	18.2%	16.7%	17.3%	17.9%	16.1%	18.0%
	Δ %	1.5%	-	-3.1%	5.3%	-8.1%	0.8%	-5.5%	-	0.7%	-1.4%	1.1%	0.4%	-1.5%	-0.5%	-1.1%	-0.9%
Media Centre	2013	17.9%	17.0%	20.0%	21.6%	11.0%	17.1%	0.0%	-	21.8%	18.6%	20.3%	-	19.1%	17.9%	15.9%	16.8%
	2014	17.3%	15.0%	17.8%	21.9%	0.0%	3.6%	0.0%	-	17.5%	18.6%	20.1%	-	16.0%	13.6%	16.7%	13.7%
	Δ %	-0.6%	-2.0%	-2.2%	0.3%	-11.0%	-13.6%	0.0%	-	-4.2%	0.0%	-0.2%	-	-3.0%	-4.3%	0.9%	-3.1%

Off-Peak

Table: Average Change in Off-Peak Consumption (kWh/week) Per Household & Major Appliance for 12 Week Summer

		1	4	5	10	11	17	21	23	26	AVG
Household	2013	207.6	191.1	181.1	144.8	100.6	45.0	189.2	214.1	155.8	158.8
	2014	242.0	167.4	188.5	129.8	85.9	40.4	161.5	168.2	155.6	148.8
	Δ kWh	34.4	-23.7	7.4	-15.0	-14.7	-4.6	-27.7	-45.9	-0.2	-10.0
AC	2013	7.5	71.0	44.1	63.5	37.2	2.8	55.9	105.3	75.4	51.4
	2014	14.1	38.8	63.5	32.1	29.1	0.0	47.3	61.9	69.8	39.6

Table: Average Change in Off-Peak Consumption (kWh/week) Per Household & Major Appliance for 12 Week Summer

	Δ kWh	6.6	-32.2	19.4	-31.4	-8.1	-2.8	-8.6	-43.4	-5.6	-11.8
Furnace	2013	4.7	45.9	17.9	17.8	10.5	3.8	17.1	31.2	22.5	19.0
	2014	2.5	42.5	63.0	46.6	16.1	2.3	15.4	21.3	27.5	26.4
	Δ kWh	-2.2	-3.4	45.1	28.8	5.6	-1.5	-1.7	-9.9	5.0	7.3
Washer/Dryer	2013	16.3	25.3	19.0	7.4	14.6	0.4	18.8	12.7	12.9	14.2
	2014	22.5	33.0	22.4	12.7	18.1	0.3	18.5	12.0	9.8	16.6
	Δ kWh	6.2	7.7	3.4	5.3	3.5	-0.1	-0.3	-0.7	-3.1	2.4
Dishwasher	2013	1.2	8.3	2.2	1.0	2.8	0.1	-	1.6	3.2	2.6
	2014	1.7	7.4	1.8	1.0	3.3	0.3	-	2.0	2.0	2.4
	Δ kWh	0.5	-0.9	-0.4	0.0	0.5	0.2	-	0.4	-1.2	-0.1
Refrigerator	2013	4.8	8.6	15.5	7.1	7.3	20.2	6.6	6.7	6.7	9.3
	2014	3.1	13.5	19.1	12.4	6.8	21.7	6.4	6.3	6.4	10.6
	Δ kWh	-1.7	4.9	3.6	5.3	-0.5	1.5	-0.2	-0.4	-0.3	1.4
Media Centre	2013	59.3	12.4	6.5	0.0	3.5	9.6	11.4	17.2	9.4	14.4
	2014	29.2	13.6	5.6	0.0	0.8	5.9	12.0	16.6	4.5	9.8
	Δ kWh	-30.1	1.2	-0.9	0.0	-2.7	-3.7	0.6	-0.6	-4.9	-4.6

Table 10b: Average Change in Off-Peak Share (% of total consumption) Per Household & Major Appliance for 12 Week Summer

	EHMS	1	4	5	10	11	17	21	23	26	AVG
Household	2013	58.6%	56.1%	65.1%	53.0%	72.3%	57.3%	68.4%	63.4%	72.4%	63.0%
	2014	58.7%	58.9%	67.9%	53.8%	69.6%	64.2%	70.2%	57.9%	74.6%	64.0%
	Δ %	0.1%	2.8%	2.9%	0.9%	-2.7%	6.8%	1.8%	-5.6%	2.2%	1.0%
AC	2013	17.3%	61.5%	52.8%	55.9%	75.7%	3.3%	82.3%	72.0%	71.5%	54.7%
	2014	45.4%	48.0%	73.3%	45.4%	65.2%	0.0%	88.5%	55.6%	79.3%	55.6%
	Δ %	28.1%	-13.5%	20.5%	-10.5%	-10.5%	-3.3%	6.2%	-16.4%	7.8%	0.9%
Furnace	2013	57.3%	67.7%	53.9%	66.4%	76.3%	87.2%	79.4%	70.3%	72.6%	70.1%
	2014	52.6%	66.4%	72.5%	65.0%	68.6%	87.0%	85.3%	59.6%	79.7%	70.8%

Table 10b: Average Change in Off-Peak Share (% of total consumption) Per Household & Major Appliance for 12 Week Summer

	Δ %	-4.6%	-1.3%	18.6%	-1.4%	-7.7%	-0.3%	5.9%	-10.7%	7.1%	0.6%
Washer/Dryer	2013	77.5%	56.3%	80.4%	36.6%	76.9%	78.2%	84.2%	79.2%	82.7%	72.5%
	2014	89.9%	80.3%	91.4%	66.9%	97.0%	75.0%	78.9%	62.1%	75.2%	79.6%
	Δ %	12.4%	23.9%	11.0%	30.2%	20.1%	-3.2%	-5.3%	-17.1%	-7.6%	7.2%
Dishwasher	2013	87.0%	79.6%	86.6%	45.9%	100.0%	18.1%	-	77.8%	87.5%	72.8%
	2014	100.0%	61.8%	93.3%	59.3%	100.0%	31.9%	-	85.0%	66.0%	74.7%
	Δ %	13.0%	-17.8%	6.7%	13.4%	0.0%	13.9%	-	7.2%	-21.4%	1.9%
Refrigerator	2013	66.5%	59.4%	58.8%	65.2%	64.2%	64.4%	64.4%	68.1%	66.0%	64.1%
	2014	61.6%	64.5%	59.8%	70.3%	66.2%	63.6%	65.9%	63.4%	66.0%	64.6%
	Δ %	-5.0%	5.1%	1.0%	5.1%	2.0%	-0.8%	1.5%	-4.6%	0.1%	0.5%
Media Centre	2013	63.6%	58.4%	66.7%	8.3%	76.7%	54.6%	57.6%	67.2%	68.4%	57.9%
	2014	64.5%	62.8%	58.6%	33.3%	68.9%	57.3%	64.3%	67.8%	69.0%	60.7%
	Δ %	1.0%	4.5%	-8.1%	25.0%	-7.8%	2.7%	6.7%	0.6%	0.6%	2.8%

Table: Average Change in Off-Peak Consumption (kWh/week) Per Household & Major Appliance for 18 Week Fall/Winter

		1	2	4	5	7	9	10	16	17	18	21	22	23	24	26	AVG
Household	2013	225.8	101.9	166.7	153.1	102.4	118.1	106.8	81.5	48.8	97.8	157.7	77.8	140.1	109.9	128.0	121.1
	2014	136.2	47.4	151.7	146.2	145.4	117.4	114.6	77.0	45.0	74.7	123.6	79.3	109.1	90.3	125.8	105.6
	Δ kWh	-89.6	-54.5	-15.0	-6.9	43.0	-0.7	7.8	-4.5	-3.8	-23.1	-34.1	1.5	-31.0	-19.6	-2.2	-15.5
Furnace	2013	2.2	7.7	36.5	10.7	29.7	26.9	34.9	-	5.8	23.5	9.9	18.5	17.0	2.8	10.7	16.9
	2014	6.1	10.5	42.1	37.5	75.0	37.9	37.1	-	1.2	21.3	9.3	15.7	11.8	2.0	13.8	23.0
	Δ kWh	3.9	2.8	5.6	26.8	45.3	11.0	2.2	-	-4.6	-2.2	-0.6	-2.8	-5.2	-0.8	3.1	6.0
Washer/ Dryer	2013	20.2	10.1	37.4	20.3	4.5	14.4	8.4	-	0.5	7.7	16.4	4.4	18.4	9.7	11.1	13.1
	2014	22.7	4.9	36.5	13.7	6.0	14.9	9.7	-	0.2	6.1	16.9	6.0	15.4	7.2	14.8	12.5

Table: Average Change in Off-Peak Consumption (kWh/week) Per Household & Major Appliance for 18 Week Fall/Winter

	Δ kWh	2.5	-5.2	-0.9	-6.6	1.5	0.5	1.3	-	-0.3	-1.6	0.5	1.6	-3.0	-2.5	3.7	-0.6
Dishwasher	2013	1.7	-	8.2	1.9	1.2	1.8	1.2	-	0.3	18.0	-	2.1	2.0	1.2	2.8	3.5
	2014	1.9	-	7.3	1.5	2.4	2.2	1.2	-	0.1	16.4	-	2.3	1.3	2.0	2.2	3.4
	Δ kWh	0.2	-	-0.9	-0.4	1.2	0.4	0.0	-	-0.2	-1.6	-	0.2	-0.7	0.8	-0.6	-0.1
Refrigerator	2013	5.1	-	9.8	18.0	0.8	5.7	9.9	-	17.0	7.6	6.3	12.0	6.5	8.3	6.2	8.7
	2014	4.6	-	13.8	14.6	1.0	7.0	6.6	-	13.4	5.7	6.0	9.4	5.5	8.2	7.1	7.9
	Δ kWh	-0.5	-	4.0	-3.4	0.2	1.3	-3.3	-	-3.6	-1.9	-0.3	-2.6	-1.0	-0.1	0.9	-0.8
Media Centre	2013	60.0	4.2	13.1	7.4	0.6	12.2	0.1	-	8.1	22.3	11.5	-	11.3	25.1	8.4	14.2
	2014	50.2	3.5	14.0	4.5	0.0	4.7	0.0	-	8.7	10.6	12.1	-	14.8	0.8	7.4	10.1
	Δ kWh	-9.8	-0.7	0.9	-2.9	-0.6	-7.5	-0.1	-	0.6	-11.7	0.6	-	3.5	-24.3	-1.0	-4.1

Table 11b: Average Change in Off-Peak Share (% of total consumption) Per Household & Major Appliance for 18 Week Fall/Winter

		1	2	4	5	7	9	10	16	17	18	21	22	23	24	26	AVG
Household	2013	70.5%	71.6%	61.3%	69.8%	62.5%	69.7%	60.8%	66.7%	59.2%	63.1%	67.6%	66.0%	63.0%	67.5%	65.6%	65.7%
	2014	69.8%	67.0%	64.8%	66.0%	67.6%	67.8%	62.7%	65.7%	66.1%	67.4%	58.7%	68.3%	64.3%	67.5%	64.9%	65.9%
	Δ%	-0.7%	-4.6%	3.5%	-3.8%	5.1%	-1.9%	1.9%	-1.1%	6.9%	4.3%	-8.9%	2.2%	1.3%	-0.1%	-0.6%	0.2%
Furnace	2013	64.8%	53.6%	69.5%	72.2%	65.6%	64.5%	64.4%	-	75.7%	74.3%	69.2%	66.0%	57.0%	63.3%	69.4%	66.4%
	2014	45.0%	72.6%	65.8%	64.3%	65.0%	65.8%	63.8%	-	38.2%	69.8%	77.1%	67.1%	66.2%	75.7%	74.4%	65.1%
	Δ%	-19.8%	18.9%	-3.8%	-7.9%	-0.6%	1.3%	-0.6%	-	-37.5%	-4.5%	7.9%	1.0%	9.2%	12.5%	5.0%	-1.3%
Washer/ Dryer	2013	86.1%	71.2%	72.4%	97.0%	54.1%	84.9%	50.0%	-	73.6%	67.0%	82.0%	99.9%	74.7%	69.3%	88.3%	76.5%

Table 11b: Average Change in Off-Peak Share (% of total consumption) Per Household & Major Appliance for 18 Week Fall/Winter

	2014	90.7%	75.0%	83.8%	68.5%	97.8%	85.9%	66.0%	-	31.3%	75.0%	79.3%	100.0%	76.0%	70.6%	77.9%	77.0%
	Δ%	4.7%	3.8%	11.4%	-28.5%	43.7%	1.0%	16.0%	-	-42.3%	7.9%	-2.7%	0.1%	1.3%	1.3%	-10.4%	0.5%
Dishwasher	2013	71.5%	-	71.7%	100.0%	70.0%	76.3%	44.2%	-	40.6%	57.0%	-	100.0%	71.8%	77.4%	55.0%	69.6%
	2014	98.3%	-	67.2%	83.3%	96.8%	91.8%	53.6%	-	18.8%	53.1%	-	98.0%	61.6%	83.7%	64.8%	72.6%
	Δ%	26.8%	-	-4.5%	-16.7%	26.8%	15.5%	9.5%	-	-21.9%	-3.9%	-	-2.0%	-10.2%	6.3%	9.8%	3.0%
Refrigerator	2013	63.8%	-	57.1%	66.8%	58.3%	67.9%	61.7%	-	65.6%	62.0%	65.5%	65.5%	62.8%	63.3%	66.0%	63.5%
	2014	65.1%	-	62.6%	55.7%	66.2%	67.3%	63.4%	-	63.3%	65.3%	65.0%	65.7%	64.7%	65.0%	67.8%	64.4%
	Δ%	1.3%	-	5.5%	-11.1%	7.9%	-0.6%	1.7%	-	-2.3%	3.3%	-0.4%	0.2%	1.9%	1.7%	1.8%	0.8%
Media Centre	2013	64.0%	65.0%	59.8%	61.7%	50.8%	66.9%	53.8%	-	53.9%	63.2%	58.7%	-	62.8%	64.2%	68.0%	61.0%
	2014	65.5%	70.0%	64.4%	56.1%	0.0%	30.3%	10.9%	-	63.0%	62.1%	63.0%	-	67.8%	6.6%	65.9%	48.1%
	Δ%	1.4%	5.0%	4.5%	-5.7%	-50.8%	-36.6%	-42.9%	-	9.1%	-1.1%	4.3%	-	4.9%	-57.5%	-2.1%	-12.9%

Total

Table 13: Average Change in Total Consumption (kWh/week) Per Household & Major Appliances for 30 Weeks

		1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26	AVG
Household	2013	318.2	131.4	297.4	238.8	162.8	169.0	220.1	128.7	122.3	80.0	154.7	246.4	117.6	262.8	162.9	204.5	188.6
	2014	241.0	60.6	254.3	244.7	216.3	169.2	211.3	122.9	117.6	66.0	113.5	218.9	116.3	214.1	133.5	197.4	168.6
	Δ kWh	-77.1	-70.8	-43.2	6.0	53.6	0.2	-8.8	-5.9	-4.8	-13.9	-41.2	-27.4	-1.3	-48.8	-29.4	-7.2	-20.0
AC	2013	54.2	-	117.4	80.6	-	-	105.5	49.8	-	7.1	-	67.9	-	148.9	-	106.7	82.0
	2014	31.6	-	80.6	83.5	-	-	73.4	42.9	-	0.0	-	53.3	-	110.8	-	88.1	62.7
	Δ kWh	-22.6	-	-36.8	2.9	-	-	-32.1	-6.8	-	-7.1	-	-14.5	-	-38.1	-	-18.6	-19.3
Furnace	2013	5.0	14.3	58.0	26.5	46.0	41.5	41.5	13.5	-	7.4	30.8	17.4	27.8	33.5	4.1	19.9	25.8

Table 13: Average Change in Total Consumption (kWh/week) Per Household & Major Appliances for 30 Weeks

	2014	7.7	16.9	64.0	79.0	115.4	58.4	63.3	23.3	11.2	2.3	31.3	15.0	23.6	23.9	2.5	23.3	35.1
	Δ kWh	2.8	2.6	6.0	52.5	69.4	17.0	21.8	9.8	-	-5.1	0.5	-2.3	-4.2	-9.6	-1.6	3.4	10.9
Washer/ Dryer	2013	23.1	12.5	50.3	20.2	7.1	17.1	18.3	19.4	-	0.5	12.3	21.7	4.4	22.8	14.5	13.4	17.2
	2014	25.3	4.9	43.0	23.1	6.1	17.1	17.1	18.5	-	0.3	8.9	22.0	6.0	20.3	10.5	17.2	16.0
	Δ kWh	2.1	-7.6	-7.3	2.9	-1.0	0.0	-1.2	-0.9	-	-0.2	-3.4	0.3	1.6	-2.6	-4.0	3.8	-1.2
Dishwash-er	2013	1.9	-	11.1	2.2	1.6	2.4	2.4	2.8	-	0.3	33.0	-	2.1	2.3	1.6	3.6	5.2
	2014	1.8	-	11.3	1.8	2.5	2.3	1.8	3.3	-	0.3	31.0	-	2.3	2.1	2.2	3.0	5.0
	Δ kWh	-0.1	-	0.2	-0.4	0.9	-0.1	-0.5	0.5	-	0.0	-2.0	-	0.3	-0.2	0.7	-0.6	-0.1
Refrigera-tor	2013	7.9	-	16.2	25.7	1.3	8.4	13.6	11.1	-	28.2	11.9	9.9	18.4	10.3	13.1	9.6	13.3
	2014	6.5	-	21.6	29.7	1.5	10.5	13.6	10.4	-	26.6	8.8	9.5	14.3	8.8	12.6	10.3	13.2
	Δ kWh	-1.4	-	5.4	4.0	0.2	2.1	-0.1	-0.7	-	-1.6	-3.6	-0.4	-4.1	-1.4	-0.5	0.7	-0.1
Media Centre	2013	93.5	6.2	21.6	10.2	14.0	18.5	0.1	4.5	-	16.6	31.9	19.7	0.0	19.9	39.2	13.2	20.6
	2014	67.6	4.9	21.8	8.7	13.7	5.8	0.0	1.2	-	12.2	16.9	18.3	0.0	23.5	3.9	10.0	13.9
	Δ kWh	-25.9	-1.3	0.2	-1.5	-0.3	-12.7	-0.0	-3.3	-	-4.4	-16.4	-1.4	0.0	3.6	-35.4	-3.2	-6.8

Total: Normalized

Table: Average Change in Total Consumption (kWh/week) Per Household & Major Appliance for 30 Weeks or 12 Weeks; Normalized by Mean Outdoor Temperature

		1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26	AVG
House-hold	2013	348.5	85.4	303.9	240.7	138.6	127.1	103.3	30.0	89.4	52.2	116.4	121.6	91.2	162.1	105.7	200.6	144.8
	2014	241.0	60.7	254.3	244.7	215.6	169.2	211.3	122.9	117.6	66.0	113.5	218.9	116.3	214.1	133.5	197.4	168.6
	Δ kWh	-107.5	-24.8	-49.7	4.1	77.0	42.1	108.0	92.8	28.1	13.9	-2.9	97.3	25.1	52.0	27.8	-3.2	23.8
AC	2013	53.5	-	120.0	84.8	-	-	101.6	46.0	-	4.7	-	-	-	122.6	-	84.2	77.2
	2014	31.6	-	87.9	83.5	-	-	73.4	42.9	-	0.0	-	-	-	102.1	-	93.1	64.3

Table: Average Change in Total Consumption (kWh/week) Per Household & Major Appliance for 30 Weeks or 12 Weeks; Normalized by Mean Outdoor Temperature

	Δ kWh	-21.9	-	-32.1	-1.3	-	-	-28.3	-3.0	-	-4.7	-	-	-	-20.5	-	9.0	-12.9
Furn-ace	2013	3.9	5.0	58.1	18.1	35.5	28.4	29.6	0.0	-	2.1	14.9	4.0	16.7	13.7	0.8	4.1	15.7
	2014	9.8	9.3	63.5	63.0	117.8	58.4	63.3	23.3	-	2.3	31.3	15.0	23.6	24.6	2.5	26.1	35.6
	Δ kWh	5.9	4.3	5.4	44.9	82.3	30.0	33.7	23.3	-	0.2	16.4	11.0	6.9	10.9	1.7	22.1	19.9
* 30 Weeks used for Household and Furnace * 12 Weeks used for AC																		

Table: Average Change in Total Consumption (kWh/week) Per Household & Major Appliance for 12 Week Summer; Normalized by Cooling Degree Days

		1	4	5	10	11	17	21	23	26	AVG
Household	2013	416.2	348.7	255.6	253.1	132.2	2.8	243.1	329.5	184.7	240.6
	2014	414.3	284.1	276.3	241.4	122.9	62.9	228.1	290.6	208.3	236.5
	Δ kWh	-1.9	-64.6	20.8	-11.7	-9.3	60.1	-15.0	-38.9	23.6	-4.1
AC	2013	46.0	143.1	72.7	112.3	43.5	4.5	62.0	129.7	81.3	77.2
	2014	31.6	87.9	83.5	73.4	42.9	0.0	53.3	102.1	93.1	63.1
	Δ kWh	-14.4	-55.2	10.8	-39.0	-0.5	-4.5	-8.6	-27.7	11.8	-14.1

Table: Average Change in Total Consumption (kWh/week) Per Household & Major Appliance for 30 Weeks; Normalized by Heating Degree Days

		1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26	AVG
House-hold	2013	314.0	128.3	263.5	197.6	187.9	160.1	166.0	89.1	121.9	77.2	147.2	213.2	113.6	229.8	172.2	205.2	174.2
	2014	241.0	60.7	254.3	244.7	215.6	169.2	211.3	122.9	117.6	66.0	113.5	218.9	116.3	214.1	133.5	197.4	168.6
	Δ kWh	-73.0	-67.6	-9.3	47.1	27.7	9.1	45.2	33.8	-4.4	-11.2	-33.7	5.7	2.7	-15.8	-38.6	-7.8	-5.6
Fur-nace	2013	6.5	6.7	56.5	21.2	49.6	34.9	34.9	0.5	-	4.8	28.9	11.2	23.8	26.7	8.5	11.3	21.7
	2014	9.8	9.3	63.5	63.0	117.8	58.4	63.3	23.3	-	2.3	31.3	15.0	23.6	24.6	2.5	26.1	35.6

Table: Average Change in Total Consumption (kWh/week) Per Household & Major Appliance for 30 Weeks; Normalized by Heating Degree Days

	Δ kWh	3.3	2.6	7.0	41.9	68.2	23.5	28.4	22.8	-	-2.5	2.5	3.8	-0.2	-2.1	-6.0	14.9	13.9

Appendix D: Quintile Consumption

Table 4.4.1: Household Weekly Total Consumption Quintiles

WEEK	1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26	TOTAL
1	5	-	5	3	-	-	4	2	-	1	-	3	-	-	-	1	8
2	5	-	5	4	-	-	3	1	-	1	-	3	-	-	-	2	8
3	5	-	4	5	-	-	3	1	-	1	-	2	-	-	-	3	8
4	5	-	5	4	-	-	4	1	-	1	-	3	-	2	-	2	9
5	-	-	5	5	-	-	3	1	-	1	-	4	-	3	-	2	8
6	-	-	5	4	-	-	3	1	-	1	-	3	-	5	-	2	8
7	-	-	4	5	-	-	3	1	-	1	-	2	-	5	-	3	8
8	-	-	3	5	-	-	5	-	-	1	-	1	-	4	-	2	7
9	-	-	4	5	-	-	1	-	-	1	-	3	-	5	-	2	7
10	-	-	1	5	-	-	4	-	-	1	-	2	-	5	-	3	7
11	-	-	5	4	-	-	2	-	-	1	-	3	-	5	-	1	7
12	-	-	4	3	-	-	3	-	-	1	-	5	-	-	-	2	6
13	-	-	3	2	-	-	5	-	-	1	-	-	-	-	-	4	5
14	-	-	3	4	-	-	2	-	-	1	-	5	-	-	-	3	6
15	3	1	5	5	-	2	3	-	-	1	-	4	-	-	-	-	8
16	4	1	4	3	-	3	5	-	2	1	-	3	-	5	2	-	11
17	3	1	5	3	-	3	-	-	2	1	-	4	-	4	2	5	11
18	3	1	5	5	-	2	-	-	2	1	-	4	-	3	3	4	11
19	4	1	5	4	-	3	-	-	2	1	-	5	-	3	3	2	11
20	4	1	5	4	-	5	-	-	2	1	1	5	-	2	3	3	12
21	5	1	5	4	-	3	2	-	1	1	2	5	-	4	3	3	13
22	4	1	5	5	-	3	4	-	2	1	1	5	-	2	3	3	13
23	4	1	5	4	4	3	3	-	2	1	2	5	1	4	2	3	15
24	5	-	4	4	5	3	3	-	2	1	1	5	2	3	1	3	14
25	3	-	5	5	4	3	2	-	1	1	2	4	1	5	-	3	13
26	5	-	4	5	4	2	3	-	1	1	2	5	1	3	-	3	13
27	5	1	5	4	5	3	4	-	3	1	2	3	2	1	-	3	14
28	5	1	4	4	5	3	2	-	1	1	2	4	2	3	-	3	14

29	5	1	4	4	-	3	-	-	2	1	3	5	2	-	-	3	11
30	-	5	3	4	3	3	2	-	2	1	-	4	2	5	-	1	12

Table 4.4.2: Household Weekly On-Peak Consumption Quintiles

WEEK	1	2	4	5	7	9	10	11	16	17	18	21	22	23	24	26	TOTAL
1	5	-	4	5	-	-	3	1	-	1	-	3	-	-	-	2	8
2	5	-	5	3	-	-	4	1	-	2	-	3	-	-	-	1	8
3	5	-	5	3	-	-	4	1	-	1	-	3	-	-	-	2	8
4	5	-	4	2	-	-	5	2	-	1	-	3	-	4	-	1	9
5	-	-	4	3	-	-	5	2	-	1	-	3	-	5	-	1	8
6	-	-	4	3	-	-	5	2	-	1	-	3	-	5	-	1	8
7	-	-	5	3	-	-	4	3	-	1	-	2	-	5	-	1	8
8	-	-	4	3	-	-	5	-	-	1	-	2	-	5	-	1	7
9	-	-	4	3	-	-	5	-	-	1	-	2	-	5	-	1	7
10	-	-	5	2	-	-	5	-	-	1	-	1	-	4	-	3	7
11	-	-	4	3	-	-	5	-	-	1	-	2	-	5	-	1	7
12	-	-	4	3	-	-	5	-	-	1	-	3	-	-	-	2	6
13	-	-	4	3	-	-	5	-	-	1	-	-	-	-	-	2	5
14	-	-	5	3	-	-	4	-	-	1	-	3	-	-	-	2	6
15	3	1	4	5	-	2	5	-	-	1	-	3	-	-	-	-	8
16	4	1	5	4	-	3	2	-	2	1	-	3	-	3	5	-	11
17	3	1	5	3	-	2	-	-	3	1	-	4	-	4	2	5	11
18	2	1	5	5	-	3	-	-	2	1	-	3	-	4	3	4	11
19	4	1	5	4	-	3	-	-	2	1	-	5	-	3	2	3	11
20	3	1	5	4	-	5	-	-	2	1	1	5	-	2	3	4	12
21	5	1	5	3	-	2	2	-	1	1	3	5	-	4	4	3	13
22	4	1	5	5	-	3	4	-	1	1	2	5	-	3	2	3	13
23	4	1	5	4	4	3	3	-	2	1	2	5	1	5	2	3	15
24	4	-	5	3	5	3	3	-	2	1	2	4	1	5	1	3	14
25	4	-	5	5	3	2	2	-	3	1	1	4	1	5	-	3	13
26	5	-	4	3	4	2	3	-	2	1	1	5	1	5	-	3	13

27	5	1	5	4	4	3	5	-	3	1	2	3	2	1	-	3	14
28	4	1	4	3	5	3	3	-	2	1	2	4	1	5	-	2	14
29	5	1	4	5	-	3	-	-	3	1	2	3	2	-	-	4	11
30	-	2	3	5	3	4	4	-	2	1	-	3	1	5	-	2	12

Table 4.4.3: Number of Households in each Quintile Per Week

Week	Q1	Q2	Q3	Q4	Q5	Total # of Households
1	2	1	2	1	2	8
2	2	1	2	1	2	8
3	2	1	2	1	2	8
4	2	2	1	2	2	9
5	2	1	2	1	2	8
6	2	1	2	1	2	8
7	2	1	2	1	2	8
8	2	1	1	1	2	7
9	2	1	1	1	2	7
10	2	1	1	1	2	7
11	2	1	1	1	2	7
12	1	1	2	1	1	6
13	1	1	1	1	1	5
14	1	1	2	1	1	6
15	2	1	2	1	2	8
16	2	2	3	2	2	11
17	2	2	3	2	2	11
18	2	2	3	2	2	11
19	2	2	3	2	2	11
20	3	2	2	2	3	12
21	3	2	3	2	3	13
22	3	2	3	2	3	13
23	3	3	3	3	3	15
24	3	3	2	3	3	14
25	3	2	3	2	3	13
26	3	2	3	2	3	13
27	3	3	2	3	3	14

28	3	3	2	3	3	14
29	2	2	3	2	2	11
30	3	2	2	2	3	12

Appendix E: Tip Response

Table: Average Change in Consumption (kWh/week) for the Week Following a Tip Per Appliance & Household

	EHMS	1	2	4	5	7	9	10	11	17	18	21	23	24	26	AVG
AC	Week Before	30.0	-	81.1	96.1	-	-	84.2	29.4	0.0	-	49.6	91.2	-	96.4	62.0
	Week After	27.3	-	81.1	93.3	-	-	89.5	24.3	0.0	-	41.7	102.2	-	94.2	61.5
	Δ kWh	-2.7	-	0.0	-2.8	-	-	5.3	-5.1	0.0	-	-7.9	11.0	-	-2.2	-0.5
Furnace	Week Before	-	16.2	63.2	48.8	134.3	62.3	71.9	-	0.0	-	19.5	-	-	21.1	48.6
	Week After	-	18.3	64.6	43.5	122.2	60.9	68.4	-	0.0	-	16.1	-	-	22.1	46.2
	Δ kWh	-	2.1	1.4	-5.3	-12.1	-1.4	-3.5	-	0.0	-	-3.4	-	-	1.0	-2.4
Washer/ Dryer	Week Before	28.3	-	52.7	27.6	-	22.2	17.6	21.7	0.0	12.9	23.2	20.5	17.5	18.4	21.9
	Week After	19.1	-	50.1	22.1	-	13.1	17.4	12.2	0.4	8.0	25.1	22.6	14.0	17.0	18.4
	Δ kWh	-9.2	-	-2.6	-5.5	-	-9.1	-0.2	-9.5	0.4	-4.9	1.9	2.1	-3.5	-1.4	-3.5
Dishwasher	Week Before	1.7	-	11.7	1.5	-	-	0.8	-	-	-	-	2.6	0.7	6.2	3.6
	Week After	1.8	-	12.5	1.6	-	-	2.0	-	-	-	-	2.6	3.1	6.2	4.3
	Δ kWh	0.1	-	0.8	0.1	-	-	1.2	-	-	-	-	0.0	2.4	0.0	0.7
Media Centre	Week Before	75.0	2.5	63.2	9.3	0.0	16.9	-	-	15.0	20.0	14.4	21.6	-	13.3	22.8
	Week After	68.5	0.0	64.6	8.5	0.0	0.0	-	-	14.7	20.1	11.6	24.2	-	12.4	20.4
	Δ kWh	-6.5	-2.5	1.4	-0.8	0.0	-16.9	-	-	-0.3	0.1	-2.8	2.6	-	-0.9	-2.4

Table: Average Change in Peak Share (% of total consumption) for the Week Following a Tip Per Appliance & Household

	EHMS	1	2	4	5	7	9	10	11	17	18	21	23	24	26	AVG
AC	Week Before	30.9%	-	23.8%	0.6%	-	-	32.8%	29.3%	0.0%	-	3.8%	25.8%	-	5.7%	17.0%
	Week After	44.7%	-	24.8%	0.2%	-	-	31.6%	22.2%	0.0%	-	0.3%	29.7%	-	0.7%	17.1%
	Δ Peak %	13.8%	-	1.0%	-0.4%	-	-	-1.2%	-7.1%	0.0%	-	-3.5%	3.9%	-	-5.0%	0.2%
Furnace	Week Before	-	19.1%	18.4%	11.1%	17.6%	18.5%	17.8%	-	0.0%	-	17.2%	-	-	15.2%	15.0%

Table: Average Change in Peak Share (% of total consumption) for the Week Following a Tip Per Appliance & Household

	Week After	-	15.3%	15.6%	12.6%	16.1%	17.7%	15.5%	-	0.0%	-	15.8%	-	-	18.1%	14.1%
	Δ Peak %	-	-3.8%	-2.8%	1.5%	-1.5%	-0.8%	-2.3%	-	0.0%	-	-1.4%	-	-	2.9%	-0.9%
Washer/ Dryer	Week Before	6.8%	-	12.2%	4.6%	0.0%	2.4%	19.6%	0.0%	0.0%	18.1%	18.0%	13.0%	29.5%	11.6%	10.4%
	Week After	12.6%	-	11.5%	4.9%	0.0%	5.6%	9.6%	0.0%	0.0%	48.1%	12.2%	9.0%	0.0%	4.3%	9.1%
	Δ Peak %	5.8%	-	-0.7%	0.3%	0.0%	3.2%	-10.0%	0.0%	0.0%	30.0%	-5.8%	-4.0%	-29.5%	-7.3%	-1.4%
Dish-washer	Week Before	0.0%	-	26.1%	0.0%	-	-	0.0%	-	-	-	-	0.0%	71.4%	35.2%	19.0%
	Week After	0.0%	-	28.1%	10.3%	-	-	25.0%	-	-	-	-	0.0%	6.5%	1.7%	10.2%
	Δ Peak %	0.0%	-	2.0%	10.3%	-	-	25.0%	-	-	-	-	0.0%	-64.9%	-33.5%	-8.7%
Media Centre	Week Before	17.5%	0.0%	20.0%	20.8%	-	21.3%	-	-	17.8%	17.8%	15.1%	16.4%	-	15.9%	16.3%
	Week After	16.4%	0.0%	15.2%	20.0%	-	0.0%	-	-	19.3%	17.9%	12.2%	23.6%	-	15.7%	14.0%
	Δ Peak %	-1.1%	0.0%	-4.8%	-0.8%	-	-21.3%	-	-	1.5%	0.1%	-2.9%	7.2%	-	-0.2%	-2.2%

Table: Average Change in Consumption (kWh/month) for the Month Following a Tip Per Appliance & Household

	EHMS	1	2	4	5	7	9	10	11	17	18	21	23	24	26	AVG
AC	Month Before	28.7	-	379.7	422.0	-	-	320.9	66.9	0.0	-	169.8	220.7	-	338.9	216.4
	Month After	20.3	-	359.3	361.0	-	-	284.0	213.9	0.0	-	168.9	138.6	-	383.4	214.4
	Δ kWh	-8.4	-	-20.4	-61.0	-	-	-36.9	147.0	0.0	-	-0.9	-82.1	-	44.5	-2.0
Furnace	Month Before	40.2	53.9	288.9	206.9	346.5	282.7	-	-	2.8	92.4	54.6	-	-	96.1	146.5
	Month After	49.9	82.1	304.6	280.5	265.7	285.6	-	-	6.2	114.6	78.9	-	-	135.7	160.4
	Δ kWh	9.7	28.2	15.7	73.6	-80.8	2.9	-	-	3.4	22.2	24.3	-	-	39.6	13.9
Washer/ Dryer	Month Before	89.2	-	216.3	105.1	-	61.3	84.5	77.1	1.4	25.6	105.0	64.6	35.1	69.9	77.9
	Month After	72.7	-	188.8	98.2	-	70.9	74.1	80.1	1.0	23.2	86.2	58.0	30.6	68.7	71.0
	Δ kWh	-16.5	-	-27.5	-6.9	-	9.6	-10.4	3.0	-0.4	-2.4	-18.8	-6.6	-4.5	-1.2	-6.9

Table: Average Change in Consumption (kWh/month) for the Month Following a Tip Per Appliance & Household

Dish-washer	Month Before	1.9	-	55.5	7.9	-	-	6.1	-	-	-	-	5.6	1.5	10.6	12.7
	Month After	0.8	-	48.5	6.7	-	-	6.5	-	-	-	-	5.1	2.6	11.7	11.7
	Δ kWh	-1.1	-	-7.0	-1.2	-	-	0.4	-	-	-	-	-0.5	1.1	1.1	-1.0
Media Centre	Month Before	232.2	7.2	97.2	39.3	0.0	54.8	-	-	67.6	58.1	72.7	28.3	-	41.8	63.6
	Month After	227.9	8.3	92.3	42.8	0.0	0.0	-	-	63.0	62.4	65.5	31.2	-	39.5	57.5
	Δ kWh	-4.3	1.1	-4.9	3.5	0.0	-54.8	-	-	-4.6	4.3	-7.2	2.9	-	-2.3	-6.0

Table: Average Change in Peak Share (% of total consumption) for the Month Following a Tip Per Appliance & Household

	EHMS	1	2	4	5	7	9	10	11	17	18	21	23	24	26	AVG
AC	Month Before	30.0%	-	23.4%	0.6%	-	-	40.0%	25.6%	0.0%	-	2.2%	42.8%	-	6.6%	19.0%
	Month After	60.1%	-	27.0%	0.6%	-	-	31.6%	19.4%	0.0%	-	2.3%	49.3%	-	6.2%	21.8%
	Δ Peak %	30.1%	-	3.6%	-0.0%	-	-	-8.4%	-6.1%	0.0%	-	0.0%	3.4%	-	-0.4%	2.5%
Furnace	Month Before	26.4%	14.1%	16.7%	12.4%	8.4%	17.3%	-	-	0.0%	33.2%	16.8%	-	-	15.6%	16.1%
	Month After	21.2%	15.3%	14.2%	16.1%	11.5%	16.3%	-	-	98.4%	13.9%	15.2%	-	-	14.7%	23.7%
	Δ Peak %	-5.1%	1.2%	-2.5%	3.7%	3.1%	-1.0%	-	-	98.4%	-19.4%	-1.6%	-	-	-0.9%	7.6%
Washer/Dryer	Month Before	6.2%	-	9.4%	7.5%	-	2.6%	18.2%	0.0%	0.0%	7.7%	12.5%	12.3%	35.9%	8.6%	10.1%
	Month After	9.6%	-	9.6%	16.4%	-	8.2%	13.5%	0.0%	0.0%	20.0%	13.8%	14.9%	2.3%	6.4%	9.6%
	Δ Peak %	3.1%	-	0.2%	8.9%	-	5.6%	-4.7%	0.0%	0.0%	12.3%	1.3%	2.6%	-33.6%	-2.2%	-0.5%
Dish-washer	Month Before	0.0%	-	17.0%	3.3%	-	-	20.8%	-	-	-	-	0.0%	33.3%	3.5%	11.1%
	Month After	0.0%	-	23.1%	3.8%	-	-	11.7%	-	-	-	-	3.7%	26.9%	0.0%	9.9%
	Δ Peak %	0.0%	-	6.0%	0.5%	-	-	-9.1%	-	-	-	-	3.7%	-6.4%	-3.5%	-1.3%
Media Centre	Month Before	26.0%	12.5%	17.9%	19.1%	0.0%	-	-	-	16.0%	27.2%	16.2%	69.1%	-	19.1%	22.3%
	Month After	20.4%	12.0%	16.1%	18.7%	0.0%	-	-	-	16.6%	14.2%	12.7%	30.3%	-	19.6%	16.1%

Table: Average Change in Peak Share (% of total consumption) for the Month Following a Tip Per Appliance & Household

	Δ Peak %	-5.6 %	-0.5 %	-1.9 %	-0.4 %	0.0 %	-	-	-	0.6 %	-12.9 %	-3.5 %	-38.7%	-	0.4 %	-6.3 %

Table: Average Change in Total Tip Consumption between Years (2013 & 2014)

		EHMS	1	4	5	7	9	10	11	17	18	21	23	24	26	AVG.
LAUNDRY		# of Tips	7	13	6	-	3	8	2	1	2	13	12	2	6	
	Week Following	AVG Δ	-12.9	-10.8	3.1	-	-6.3	-1.2	-10.3	0.0	-9.0	6.1	-0.4	4.7	4.7	
		SUM Δ	-64.5	-129.2	18.6	-	-18.8	-8.5	-20.6	0.0	-18.0	79.9	-4.8	9.4	28.4	-10.7
	Month Following	AVG Δ	-19.1	-23.7	3.4	-	-2.6	-1.8	-11.5	-0.8	-6.5	9.5	-5.7	-9.8	12.1	
		SUM Δ	-57.4	-236.7	20.2	-	-7.7	-12.5	-22.9	-0.8	-13.0	124.1	-62.8	-19.6	72.7	-18.0
DISH-WASH-ER		# of Tips	1	4	3	-	-	2	-	-	-	-	2	1	1	
	Week Following	AVG Δ	0.9	1.3	0.4	-	-	-0.8	-	-	-	-	0.6	1.2	3.7	
		SUM Δ	0.9	5.0	1.1	-	-	-1.5	-	-	-	-	1.2	1.2	3.7	1.7
	Month Following	AVG Δ	-	0.4	-4.6	-	-	-2.2	-	-	-	-	-	4.5	7.9	
		SUM Δ	-	1.2	-13.9	-	-	-4.4	-	-	-	-	-	4.5	7.9	-0.9
MEDIA CENTRE		# of Tips	2	4	-	1	1	-	-	3	3	3	1	-	4	
	Week Following	AVG Δ	-22.0	-3.9	-	33.4	-17.6	-	-	-0.5	-14.6	-6.6	-	-	-0.9	
		SUM Δ	-44.0	-15.5	-	33.4	-17.6	-	-	-1.5	-43.8	-19.8	-	-	-3.7	-14.1
	Month Following	AVG Δ	-67.3	-6.9	-	37.5	-41.8	-	-	3.0	-35.5	-13.0	-	-	0.2	
		SUM Δ	-134.6	-27.6	-	37.5	-41.8	-	-	9.0	-70.9	-26.1	-	-	0.8	-31.7
AC		# of Tips	2	9	4	-	-	9	1	1	-	6	4	-	3	
	Week Following	AVG Δ	-57.7	-33.1	-25.2	-	-	-31.0	5.9	0.0	-	-22.5	1.5	-	27.7	

Table: Average Change in Total Tip Consumption between Years (2013 & 2014)

		SUM Δ	-115.3	-298.0	-100.8	-	-	-278.9	5.9	0.0	-	-112.5	4.5	-	83.1	-90.2
	Month Following	AVG Δ	-238.5	-101.3	-69.5	-	-	-76.6	-15.3	0.0	-	-53.4	-120.0	-	14.9	
		SUM Δ	-476.9	-810.3	-278.1	-	-	-689.5	-15.3	0.0	-	-266.8	-359.9	-	29.9	-318.5
FURNACE		# of Tips	1	1	-	1	1	1	-	1	-	2	-	-	1	
	Week Following	AVG Δ	2.4	21.4	-	66.7	-5.1	-0.8	-	-2.9	-	-5.8	-	-	-5.1	
		SUM Δ	2.5	21.4	-	66.7	-5.1	-0.8	-	-2.9	-	-11.5	-	-	-5.1	8.2
	Month Following	AVG Δ	-	-	-	69.5	-	-21.5	-	-	-	-14.2	-	-	-	
		SUM Δ	-	-	-	69.5	-	-21.5	-	-	-	-	-	-	-	24.0

Appendix F: Monthly Certificate

Table: June Interannual Change in Consumption

EHMS	June 2014	June 2013	Change (kWh)	Change (%)
1	1637.2	1226.1	411.1	33.5%
2	-	-	-	-
4	1317.5	1361.4	-43.9	-3.2%
5	1244.2	1083.7	160.5	14.8%
7	-	-	-	-
9	-	-	-	-
10	1027.3	978.1	49.2	5.0%
11	517.4	530.6	-13.2	-2.5%
16	-	-	-	-
17	271.4	299.3	-27.9	-9.3%
18	-	-	-	-
21	1056.1	1053.8	2.3	0.2%
22	-	-	-	-
23	255.2	289.0	-33.8	-11.7%
24	-	-	-	-
26	892.6	786.4	106.2	13.5%

Table: July Interannual Change in Consumption

EHMS	July 2014	July 2013	Change (kWh)	Change (%)
1	-	-	-	-
2	-	-	-	-
4	1200.7	1547.4	-346.7	-22.4%
5	1245.0	1346.9	-101.9	-7.6%
7	-	-	-	-
9	-	-	-	-
10	1033.9	1440.9	-407.0	-28.2%
11	293.8	403.2	-109.4	-27.1%
16	-	-	-	-
17	283.2	431.5	-148.3	-34.4%

Table: July Interannual Change in Consumption

18	-	-	-	-
21	982.3	1252.0	-269.7	-21.5%
22	-	-	-	-
23	1208.8	1644.7	-435.9	-26.5%
24	-	-	-	-
26	919.1	1013.3	-94.2	-9.3%

Table: August Interannual Change in Consumption

EHMS	August 2014	August 2013	Change (kWh)	Change (%)
1	-	-	-	-
2	-	-	-	-
4	1206.4	1644.1	-437.7	-26.6%
5	1159.7	1077.1	82.6	7.7%
7	-	-	-	-
9	-	-	-	-
10	1179.0	1095.6	83.4	7.6%
11	-	-	-	-
16	-	-	-	-
17	266.9	283.4	-16.5	-5.8%
18	-	-	-	-
21	659.1	668.4	-9.3	-1.4%
22	-	-	-	-
23	486.8	499.7	-12.9	-2.6%
24	-	-	-	-
26	1006.0	869.5	136.5	15.7%

Table: September Interannual Change in Consumption

EHMS	September 2014	September 2013	Change (kWh)	Change (%)
1	735.2	1199.8	-464.6	-38.7%
2	217.2	431.3	-214.1	-49.6%

Table: September Interannual Change in Consumption

4	1207.8	1322.5	-114.7	-8.7%
5	927.5	819.5	108.0	13.2%
7	-	-	-	-
9	533.2	496.2	37.0	7.5%
10	479.6	476.6	3.0	0.6%
11	-	-	-	-
16	226.3	221.2	5.1	2.3%
17	288.7	288.8	-0.1	-0.0%
18	-	-	-	-
21	1015.7	975.8	39.9	4.1%
22	-	-	-	-
23	410.8	371.6	39.2	10.5%
24	298.7	293.3	5.4	1.8%
26	616.2	394.4	221.8	56.2%

Table: October Interannual Change in Consumption

EHMS	October 2014	October 2013	Change (kWh)	Change (%)
1	767.4	1569.7	-802.3	-51.1%
2	248.5	558.5	-310.0	-55.5%
4	848.1	1155.4	-307.3	-26.6%
5	683.0	775.7	-92.7	-12.0%
7	81.5	62.8	18.7	29.8%
9	565.0	550.7	14.3	2.6%
10	236.1	277.1	-41.0	-14.8%
11	-	-	-	-
16	437.5	495.2	-57.7	-11.7%
17	258.7	378.7	-120.0	-31.7%
18	131.1	187.3	-56.2	-30.0%
21	924.8	890.9	33.9	3.8%
22	44.0	39.7	4.3	10.8%
23	530.8	664.4	-133.6	-20.1%
24	689.1	776.4	-87.3	-11.2%

Table: October Interannual Change in Consumption

26	623.5	1385.0	-761.5	-55.0%

Table: November Interannual Change in Consumption

EHMS	November 2014	November 2013	Change (kWh)	Change (%)
1	908.2	1070.2	-162.0	-15.1%
2	-	-	-	-
4	984.8	1050.8	-66.0	-6.3%
5	1037.3	909.2	128.1	14.1%
7	997.5	746.9	250.6	33.6%
9	701.7	803.1	-101.4	-12.6%
10	723.6	724.0	-0.4	-0.1%
11	-	-	-	-
16	544.7	557.1	-12.4	-2.2%
17	322.6	393.5	-70.9	-18.0%
18	526.5	635.4	-108.9	-17.1%
21	961.3	912.8	48.5	5.3%
22	488.8	497.3	-8.5	-1.7%
23	868.9	1020.9	-152.0	-14.9%
24	-	-	-	-
26	570.6	559.2	11.4	2.0%

Table: December Interannual Change in Consumption

EHMS	December 2014	December 2013	Change (kWh)	Change (%)
1	566.4	749.5	-183.1	-24.4%
2	279.1	820.6	-541.5	-66.0%
4	999.8	1104.1	-104.3	-9.4%
5	865.2	1028.0	-162.8	-15.8%
7	673.1	528.1	145.0	27.5%
9	855.9	820.2	35.7	4.4%

Table: December Interannual Change in Consumption

10	539.7	433.5	106.2	24.5%
11	-	-	-	-
16	591.4	587.7	3.7	0.6%
17	358.1	391.0	-32.9	-8.4%
18	399.0	504.9	-105.9	-21.0%
21	845.8	1208.6	-362.8	-30.0%
22	571.9	559.4	12.5	2.2%
23	413.0	535.5	-122.5	-22.9%
24	-	-	-	-
26	728.8	653.0	75.8	11.6%