

**Keeping Up with the Joneses: Electricity Consumption,
Publicity and Social Network Influence 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 revision, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Mary Elizabeth Deline

Abstract

This study used an exploratory research focus to investigate if making electricity consumption public and subject to social norms and networks resulted in consumption decreases for households in Milton, Ontario. In the first phase, Milton Hydro identified customers who fell within an average annual electricity consumption category and these customers were invited to participate by mail. Due to lack of participant uptake, cold-calling, targeting of service and faith groups and commuters, and snowball sampling were employed to obtain a total participant size of 17. The second phase saw participants grouped according to social network type (occupational, faith group, etc) and exposed to approval or disapproval indicators within their group about their daily electricity consumption rates via an on-line 'energy pool'. There were five main groups: one of neighbours, one of members of a faith group, one of members of a company, one of strangers and one of a control group. Group members saw other members' indicators with the exception of the control group, whose indicators were privately delivered. All group's electricity consumption was tracked through daily smart meter readings. Participants also had the option of commenting on each other's electricity use via an online 'comment box'. In the third phase participants were asked to participate in a questionnaire to assess: 1) the perceived efficacy of the intervention; 2) perceptions of electricity consumption; and 3) the influence of the group on these perceptions. This sequential methodology was chosen for its ability to "...explain significant (or non-significant) results, outlier results, or surprising results" (Cresswell, 2006, p. 72).

The findings of this exploratory research seem to suggest the following:

1. that publicity or group type does not seem to affect electricity consumption in comparative electricity consumption feedback for this study;
2. that participants used injunctive norms to comment on their electricity consumption but directed these comments solely at themselves; and
3. that the stronger the relationships in the group, the more likely participants were to engage with the website through checking it and commenting on it.

This study may be useful to those in the fields of: 1) electricity conservation who wish to leverage feedback technologies; 2) social networks who wish to better understand how tie strength interacts with social norms and; 3) those in social marketing who wish to develop norm-based campaigns.

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“...let’s look at technology as practice. Kenneth Boulding...suggested that one might think of technology as ways of doing something. He pointed out that there is a technology of prayer as well as of ploughing; there are technologies to control fear as well as to control flood.”

Ursula Franklin,
Technology as Practice

1. Introduction

Climate change is one of the most urgent challenges we face. Scientists around the world now believe that “Anthropogenic warming could lead to some impacts that are...irreversible...”(IPCC, 2008, p. 13). Unfortunately, Canadian residential energy consumption contributes in a negative way to climate change: it leads to “...massive emissions of greenhouse gases (GHGs), the increased concentration of these gases in the atmosphere and climatic consequences (IPCC)” (Parker, Rowlands & Scott, 2003, p. 171). Indeed, Canadian “...residential GHG emissions per capita” rank among the highest in the G8 (Statistics Canada, 2008, p. 4) and rather than decreasing, such consumption “...is forecast to continue rising” (Parker et al., p. 172). This makes us part of the climate change problem.

1.1 Residential Energy Consumption

Given that we generate so much GHG from energy consumption, what does this energy consumption entail? Within Canada consumption is usually categorized into six main sectors: residential, commercial, industrial, construction, transportation and agricultural (Cudidhy, Kennedy & Byer, 2005, pp. 2-3). Consumption is led by industry, with residential use coming closely behind at 17%; of this use, 80% serves space and water heating (Cuddihy et al., pp. 2-3).

In Ontario, residential energy consumption is predominated by natural gas consumption (64%) followed by electricity (27%) and then oil and wood (Natural Resources Canada, 2009). The primary uses for energy consumption are space heating (63%) followed by water heating (19%) and appliance use (11%) (Natural Resources Canada, 2009). As detailed above, this consumption is contributing not only to climate change, but also to a host of other negative socio-ecological effects (Natural Resources Canada, 2007).

But are Ontarians necessarily linking their consumption levels to these negative effects? In practice, they may not be able to: energy consumption is both habitual and private (Shove, 2003, p. 46; Stern & Aronson, 1984, p. 36). This has been driven in large part by the structure of the energy system, where “...decision-making was conducted centrally and at a remove from the public” (Devine Wright, 2007, p. 65). And as Fischer (2007) writes:

The invisibility of electricity also means that the consumer usually receives little feedback on her consumption – she does not experience the ‘diminishing stock’ and does not find herself in control of her consumption. Also, electricity’s qualities – including its ecological features – cannot be directly perceived, making it hard for the consumer to develop an emotional involvement. It is hardly a product to be proud of, to show around, or to worry about. (p. 1)

So even if Ontarians wish to somehow link their energy consumption to climate change effects, the system itself prevents such understanding.

It should therefore not be surprising that Ontarians “...don’t see clear evidence of what others are doing” (OPA, 2007b, p. 42), as there is no mechanism or structure in place to know how much they are consuming (or conserving) in comparison to others. This is doubly unfortunate as the OPA has concluded that those who are most likely to respond to conservation appeals will “...demand supporting evidence of effectiveness *or collective action...*” (OPA, 2007a, p. 37, emphasis mine). This suggests a problem - one where conservation uptake may depend in part on the framing of energy consumption as a collective action - yet the current conventional practice of energy consumption is private and individuated.

1.2 Research Problem

Status quo residential energy consumption in Ontario that is habitual and private negatively contributes to global climate change.

What, therefore, can be done to encourage energy conservation? This next section will detail traditional approaches to the problem, followed by new research which may hold promise.

1.3 Traditional Approaches

In discussing traditional approaches to energy consumption, it may be useful to turn to discourse analysis, as energy has multiple discourses around what it is and how it is used. A discourse is a “...shared, structured way(s)

of speaking, thinking, interpreting and representing things in the world” (Webler, Tuler & Krueger, 2001, p. 435). For instance, Stern and Aronson (1984) identified several different energy discourses: energy as a commodity; as an ecological resource; as a social necessity and as strategic material (pp. 15-20). Each of these viewpoints prioritizes ways of understanding energy, its consumption and effective interventions to lower consumption rates. (For instance, by viewing energy as a commodity, an economically rational view of the consumer might be employed (Stern & Aronson, 1984, p. 15) and financial incentives undertaken as a means to change energy consumption (Wilson, 2008, p. 10)).

In 1993 Lutzenhiser noted “A physical-technical-economic model of consumption dominates energy analysis...” (p. 2) and continues this argument in 2007:

Traditional approaches to energy analysis and policy prescriptions in this sector have relied upon constructs from neoclassical economics regarding market prices, technical efficiencies, rational calculation, and so on to formulate analyses and solutions...Unfortunately, these have proven to be of limited value in either explaining or influencing the behavior of the actors involved... (Woolsey-Biggart and Lutzenhiser, p. 1071).

Such an approach sees “...unrealized opportunities in terms of market failures...” due to “...a lack of information...limited access to capital...[and]...imperfect markets...” (Wilson, 2008, p. 6).

Associated with this discourse of energy as commodity are energy conservation strategies, which seek to curtail energy consumption. One tactic associated with conservation strategies is that of feedback technology: “Feedback consists of giving households information about their energy consumption, or energy savings. It can influence behaviour, because households can associate certain outcomes with their behaviour” (Abrahamse, Steg, Vlek & Rothengatter, 2005, p. 278). Feedback efficacy ranges from 0-15% in terms of energy savings, depending on whether it is direct (immediate) or indirect (processed) (Darby, 2006, pp. 3-4). Current solutions on the market tend to fall into three major categories: descriptive feedback, appliance specific feedback and combination

feedback (that is, feedback which combines descriptive feedback with specific appliance feedback) (Hinterbichler, 2008, p. 4).

There are several assumptions associated with this overarching discourse and traditional feedback approaches which are important to detail.

- 1) **We Consume Energy:** this discourse assumes residential consumers as conscious consumers of energy, who, once they are made aware of how much energy they are consuming (via feedback devices which typically give information in kWh) will decrease their consumption. Yet, “Aside from those who deal with the production or transmission of energy, no one really ‘behaves’ in relation to energy (with the exception of someone who inadvertently sticks their finger in the electricity outlet). Devices convert energy into services; people are interested in services, not energy” (Wilhite, Shove, Lutzenhiser & Kempton, 2000, p. 115). It is also important to note that the consumption of services is necessarily mediated by social roles and practices.
- 2) **The Atomic Consumer:** this discourse also sees those who consume energy services as private individuals motivated by cost-savings (the other major form of information given by feedback devices currently on the market). Yet by framing energy consumption in this way, it denies considering consumers as citizens, which can entail “...appeal(ing) to...citizens who take action to serve social or environmental goals” (Van Vliet, 2003, p. 35)
- 3) **Conscious decision making:** Such a rational approach “...presume[s] vigilant, calculating decision makers who assess choice environments with care...” (Weber, Kopelman & Messik, 2004, p. 282, brackets mine), that this is a conscious process and that influences on people’s decisions are both explicit and understood by the person making the decision. However, research has shown that “...non-conscious influences on behaviour...can produce strong and perceptible changes in behaviour” (Nolan, Schultz, Cialdini, Goldstein & Griskevicius, 2008, p. 914) and that people are often unable to correctly identify influences that lead to behaviour change (Nolan et al., p. 914). An example of this was detailed in a recent study which found that “...despite the perception that other people’s behaviour was least influential on their decision to conserve, beliefs of how

often their neighbours tried to conserve showed a strong correlation with respondents' own reported conservation efforts" (Nolan et al., p. 917). This shows that in addition to conscious influence, nonconscious influence can change behaviour.

- 4) Descriptive Feedback: Current feedback solutions tend to favour providing descriptive information about kWh consumption or cost savings (Fischer, 2007, p. 1876). These systems operate from the assumption that merely providing a description of one's energy consumption is sufficient to induce a change in one's consumption levels. However, "Past studies have shown with some certainty that aggregated energy use feedback often has little effect on the motivation to conserve energy unless it is given over the short term and *in combination with some other encouragement to conserve*, whether to spur competition, set a goal, or attain a commitment from the consumer" (McAlley, Midden & Haagdoorens, 2005, p. 2, emphasis mine).

In sum, the traditional approach to energy consumption and feedback dictates a view that: 1) energy is consciously consumed *as energy* instead of services by households; 2) consumers make private decisions about energy which denies collective responsibility for collective resources; and 3) feedback should prioritize description of energy consumption which excludes non-conscious, non-descriptive influences. These assumptions may limit the efficacy of feedback approaches; the question then becomes, are there other areas of research that might contribute to the improved efficacy of feedback as an energy conservation tactic?

1.4 New Approaches

As noted above, traditional "...energy use...[is].....now defined largely by economic reasoning ... [which] ... presupposes an autonomous and rational individual unaffected by others. This simplifying assumption ignores the impact of social relations...In fact, the role of community and any non-individual element is not considered" (Woolsley-Biggart & Lutzenhiser, 2007, p. 1075, brackets mine).

In starting to analyse energy consumption from a social perspective as opposed to a commodity discourse, it may be helpful to turn to the field of social influence. Social influence literature examines the ways in which humans influence each other, either unconsciously or by design: "By a social influence tactic I mean any non-coercive

technique, device, procedure or manipulation capable of creating or changing the belief or behaviour of a target of the influence attempt...By non-coercive I mean those tactics that do not rely on a) outright deception or b)...what is often called power” (Pratkanis, 2007, p. 17). Social influence tactics can range from communications (the way a salesperson frames their ‘pitch’) to the physical (arranging food to influence choice selection) (Thaler & Sunstein, 2008, p. 1).

In applying this field to energy consumption and conservation, several different approaches prove intriguing, especially the use of social norms, social networks and publicity.

Social Norms: These are perceptions about what is normal which influence our actions. “Social norms, which refer to what most people do (descriptive social norms) and what most people approve (injunctive social norms) are remarkably powerful in directing human action” (Cialdini, 2007, p. 1). (Injunctive norms are more fully described in section 2.2.3.1). They often guide our behaviour without our knowledge (Nolan et al., 2008). It is also important to note that norms are inherently social constructs - “Norms are *shared* patterns of thought, feeling and behaviour and in groups, what people do and say communicates information *about norms* and is itself *configured by norms...*” (Hogg & Reid, 2006, p. 8, emphasis in original).

Publicity: One particularly potent form of social influence is to activate one’s sense of being in the public eye: “...either desirable or undesirable behaviour can be increased, at least to some extent, by drawing public attention to what others are doing” (Sunstein & Thaler, 2008, p. 66). Social Identity Theory may prove useful here in understanding why publicity is such a powerful form of social influence; this theory posits that “...people construct group norms from appropriate in-group members and in-group behaviours and internalize and enact these norms as part of their social identity” (Hogg, 2006, p. 113). Making behaviour public makes it subject to these group norms; behaviour that does not fit with the group’s norms might threaten one’s self-identity.

Applying publicity to energy consumption seems to have an effect on both uptake of energy efficiency and energy conservation behaviours (Lutzenhiser, 1993, p. 260; McMakin, Malone & Lundgren, 2002, p. 850) as well as in commitment efficacy (Pallak & Cummings, 1976, referenced in Abrahamse et al., 2005, p. 276). Publicity also

seems to have effects on social norms; research shows that “To be effective the norm must also be visible...” (McKenzie Mohr, 2009). This means that “...establishing social norms works most effectively for technologies or behaviours that are observable by potential adopters” (Wilson & Dowlatabdi, 2007, p. 181).

Social Networks: Social networks are “...the structure of relational ties among actors in an environment...*Actors* can be discrete individual, corporate or collective social units, and *relational ties* are the links between pairs of actors” (Visser & Mirabile, 2004, p. 779, emphasis in original). Tie strength is an important component of social networks, both in defining them and as a unit that can be analyzed. “Strong ties are the people you really trust...Often, they are also the people most like you...Weak ties, conversely, are merely acquaintances. Weak ties often provide access to novel information...” (Gilbert & Karahalios, 2008, p. 2). Both social networks and tie strength can signal (communicate) and influence behaviour (Boer & Westhoff, 2007; Christakis & Fowler, 2008). To this author’s knowledge, there has not been any research into the effects of tie strength on energy conservation, with the exception of Weenig (2002). This study found that tie strength was important for the adoption of energy conservation measures, as positive information about the measures only spread through strong ties, while negative information spread through both strong and weak ties (p. 379).

These focus areas offer important differences from the traditional way of viewing energy consumption and conservation: 1) publicity could subject consumption to collective responsibility for the resource; 2) social norms offer an unconscious form of influence that is normally unrecognized; and 3) social networks offer another important form of influence, countering the notion of the ‘atomic energy consumer’.

All of these forms of influence - social norms, networks and publicity - might have positive effects on energy feedback. Specifically, the findings from these areas lead directly to this study’s three main research questions, which are outlined in the section below.

1.5 Research Questions

Three research questions structure this exploratory research. They are as follows:

R1: Will those who have their energy use made public and subject to social norms decrease their energy consumption?

R2: Will energy consumption decrease more in groups with strong ties as opposed to groups with weak ties?

R3: Do group members use injunctive norms to comment on energy behaviours? If so, do they have an effect on participants, either attitudinally or behaviourally?

R3A: If group members use injunctive social norms to comment on energy behaviour, is there a correlation between tie strength and signaling?

1.6 Thesis Outline

This chapter seeks to lay out the framework for this study by presenting background on energy consumption in Canada and Ontario as well as information on energy feedback, and dominant discourses on energy consumption. It then lays out research in social influence that shows research gaps and provides the basis for the study's four research questions. Chapter two delves more fully into the literature on feedback, social norms and social networks and shows the reader where this study is located in terms of current understandings of energy consumption. The third chapter describes the study's methodology; the fourth describes the study's results. The fifth chapter uses the four research questions to analyse the results. Finally, conclusions and recommendations are outlined in chapter 6.

2. Literature Review

This review was undertaken between January and April 2009 to inform three key areas of this study:

- A) Understand research gaps into energy consumption and conservation practices;
- B) Examine new research directions that held promise for application to energy consumption and conservation practices; and
- C) Provide methodological instruction into research design.

Psychological, sociological and environment databases were searched, as was Google Scholar for search terms such as 'social influence energy conservation'. Canadian, American and European sources were all used, although the language of the articles was only searched in English. The array of secondary sources reflected in this review includes white papers, academic peer-reviewed journals, national statistical information, and provincial public opinion research. In addition the researcher consulted Erin Harvey of the university's Statistical Consulting Services, as well as Dr. Peter Carrington in the Sociology department to inform social network methodology and analysis procedures. Their discussions were greatly appreciated. In April and May 2010 this review saw the addition of other sources based on the recommendations of this researcher's thesis Committee.

This chapter lays out the literature review by first providing more detail on the need for energy conservation by examining negative socio-ecological effects of energy consumption and climate change in Ontario. The second area that this review informed, research gaps, has largely been covered in the introduction and will not be revisited here. The third area, 'new research directions which hold promise', will cover comparative feedback, as well as provide more detail into social network and social norm research. Finally, the review will provide information on egocentric social network generation procedures which were considered for use at the beginning of the study but abandoned due to recruitment challenges.

2.1 Residential Energy Consumption and Socio-Ecological Issues

Although the majority of residential energy consumed within Ontario is natural gas, for space and water heating, this study focused on electricity consumption for two main reasons:

1) "...the burning of fossil fuels...have been the dominant causes of climate changes..." (Natural Resources Canada, 2007). Worldwide, "Electricity generation is by far the largest single source of CO2 emissions." (Pew Centre on Global Climate Change, n.d.). Therefore, electricity generation on a worldwide level is the largest contributor to CO2 emissions which causes climate change. From a Canadian perspective, "Over the same period (1990-2008) emissions from the energy industries...rose by about 130MT, accounting for most of the overall increase. Within these two energy areas, the greatest contributors were...the 24% increase from electricity and heat generation..." (Environment Canada, 2010a, p. 8). And finally, turning to Ontario's electricity generation, "In 2001 the OPG used fossil fuel, nuclear and hydro to produce 33, 26 and 40% of its electric power. In addition to air emissions, there are PCB and radioactive, solid and hazardous waste generation. These by-products...should not be overlooked..." (Cudiddhy et al., p. 3). Overall, then, electricity is a significant contributor to GHG emissions, as well as to other forms of pollution which have negative effects on quality of life and socio-ecological systems.

2) Secondly, as detailed in chapter one, consumers are subject to 'naive' psychology - that is, self-reported behavioural influence may not be the same as actual behavioural influence (Nolan et al., 2008, p. 914). Smart meters are technologies that provide accurate measurements of daily electricity consumption rather than relying on self-reported consumption levels. There are so far no such 'smart meters' available for natural gas consumption.

Because of the global impact of electricity consumption on climate change, the fact that smart meters are available for feedback purposes, and because Milton Hydro graciously agreed to partner with the researcher on this project, a focus on electricity, rather than natural gas, was undertaken.

Following space and water heating (which tends to be fueled by gas), the majority of energy used in Ontario homes is for appliances which falls into the category of 'Other' appliances at 34%: "...microwaves, televisions, cable boxes...and computers" (Natural Resources Canada, 2009). "The 'Other' category has also experienced significant growth. Much of this has likely been driven by the growth in home office equipment with personal

computers being a significant contributor.” (OPA, 2005, p. 6) This is followed by energy consumption for the fridge (19%) and the stovetop (20%) (Natural Resources Canada, 2009). It should be noted that “About 12-14% of our energy use consists of applications that can only be provided with electricity - lighting, small motors and appliances, electronics...” (OPA, 2005, p. 3). On average, Ontario homes boast one fridge per household, one stovetop and sixteen items in the ‘Other’ category (Natural Resources Canada, 2009).

As mentioned in the introduction, consumers do not necessarily think that they are consuming energy, but rather that they are consuming services which energy provides (Wilhite et al., 2000, p. 115). These services in the home include storing food and cooking it and engaging in activities in a comfortable setting. For Ontarians, on average, eating in the home in the evening occurs at least five days a week (Nesbitt et al., 2008). (Canadian homes are heated between 20-22 degrees Celsius during the day) (Statistics Canada, 2008b).

Given these services and the high level of appliances within the home, it is not surprising that Ontario uses much electricity. At the local level, “Environmental impacts associated with the use of coal as an energy source are extensive and include ecosystem degradation, modification of surface and ground water flow patterns, waste and effluent production and air emissions.” (Cuddihy et al., 2005, p. 4). These air emissions are what causes global concern: “Climate change is now the most serious global environmental threat. Its potential impacts include global warming, sea level rise, increased extreme weather events and altered rainfall patterns. Climate change is a direct consequence of elevated GHG concentrations in the atmosphere.” (Conference Board of Canada, 2010).

Unfortunately, “Despite international commitments to drastically reduce GHGs, Canada has not seen an improvement on its per capita GHG emissions.” (Conference Board of Canada, n.d.). In fact, “The Independent Electricity System Operator (IESO) forecasts that without energy conservation strategies, energy consumption will grow from about 157TWh in 2006 to about 170 TWh in 2015, an annual average growth rate of .9%” (Natural Resources Canada, 2007). The negative consequences of this for Ontario’s population are already occurring:

Climate related disruptions to critical infrastructure, including water treatment and distribution systems, energy generation and transmission and transportation have occurred throughout the province and are likely to become increasingly frequent in the future....Climate related events such as extreme weather, heat waves, smog episodes and ecological changes that support the spread of vector-borne diseases all present risks to the health of Ontario residents.(Natural Resources Canada, 2007).

The steps that Ontario has therefore taken in enacting energy conservation targets can be seen as positive both for the people of Ontario and global citizens affected by climate change. “In June 2006 the province established a conservation target...of reducing peak demand by 1350MW by 2010 and 6300MW by 2025 through CDM (conservation and demand management) measures...*the Green Energy and Green Economy Act* adopted May 2009 added the promotion of electricity conservation and demand management to the mandate of the Ontario Energy Board...” (Winfield & Koveshnikova, 2009, p. 14). But what should these conservation efforts look like? What efforts will be most effective? Is there a way to improve the efficacy of current conservation tactics, such as feedback devices?

2.2 New Directions

2.2.1 Comparative Feedback

Comparative feedback (see Fischer 2007 for a review) comprises two main types: “Historic comparison relates actual to prior consumption...Normative comparison compares consumption to that of other households“ (Fischer, 2007, p. 1877). The rationale for such feedback lies in its expectation of “...invoke(ing) some sort of social pressure...” which may decrease consumption (Robinson, 2007, p. 20). “Comparisons are said to stimulate energy conservation, first, by stimulating competition and ambition (motivational aspect) and secondly, by making transparent if consumption...is ‘out of the norm’” (Fischer, 2007, p. 6).

The research into comparative energy feedback is still inconclusive. For instance, in her meta-analysis, Fischer (2007) found that “None of the ten studies dealing with normative comparison could demonstrate an effect on consumption so far” (p. 1880). It is postulated that this is because they create a ‘rebound’ effect whereby

conservation gains from large consumers are negated by low consumers increasing their energy uptake (Robinson, 2007, p. 21). (Schultz et al's 2007 study offers a potential solution to rebound by invoking injunctive social norms.) Other possible causes of comparative feedback's low efficacy have been identified as: participant mistrust of comparisons and delayed feedback in the form of monthly bills (Hinterbichler, 2008, p. 15).

However, two subsequently released studies indicate effects: Schultz et al. (2007) found that "...for people who were initially low in energy consumption the same descriptive norm information combined with an injunctive message of approval led to continued consumption at the desirable low rate..." (p. 433). In addition, the Sacramento Municipal Utility District found that those exposed to comparative injunctive norms about their energy consumption saw a 2% reduction in their electricity use compared to a control group (Aceti, Retrieved April 10, 2010). Finally, as Abrahamse et al. (2007) point out, in one study (Siero, Bakker, Dekker & Van den Burg, 1996) comparative feedback "...has been found to be effective in promoting energy conservation at work....Group feedback may be effective because...it becomes clear that others are actively engaged in energy conservation as well" (pp. 266, 267).

2.2.2 Social Networks

As discussed in the introduction, research indicates that a key way to use social influence tactics is through a 'social network approach'. Social networks, again, are groups structured by relationships (Visser & Mirabile, 2004, p. 779) and "...indicates who communicates with whom" (Weenig, 2002, p. 374). They can be defined and analyzed in a variety of ways ranging from who is in the network, relationship strengths, social or geographic attributes and how often people within the network communicate (Petroczi, Nepusz & Bazso, 2007, p. 39; Weenig, p. 374).

Tie strength (the strength of the relationships within the network) is important to analyse because it can indicate homogeneity and associated social cohesion: "Formation of strong ties is more likely in cases of homogeneity in norms and...demographic characteristics" (Weenig, 2002, p. 375). This might therefore indicate that strong ties are more likely to think and express norms in similar fashions, which is important to influence attempts. In addition,

research has found that tie strength is correlated to social norm signaling (interpersonal communications) -
“...strong ties are influential on social norms but weak ties are not” (Boer & Westhoff, 2006, p. 87).

Tying this together, social network structure and formation can influence both group norms and the efficacy of social influence attempts.

...people...exert pressure on each other to behave more or less uniformly (normative influence). Several studies into group behaviour have shown that such pressure towards uniformity is stronger in cohesive groups than non-cohesive groups...Thus, the strength of ties tells us something about the potential for social influence, at least at the group level (Weenig, 2002, p. 376).

It should be noted that these pressures are just as likely to occur in on-line social networks as ‘real-world’ ones: “Although it is yet to be decisively proven, it is believed that virtual communities mirror those in the ‘real world’ in many ways - cyber communities also share values, beliefs, norms and expectations regarding the appropriate behaviour and have a sense of identity, commitment and association” (Petroczi et al., 2007, p. 39). Applying this to the question of energy consumption then, this research indicates that social networks and tie strength affect behaviour, and that these effects may be communicated in virtual as well as face-to-face communications.

2.2.3 Social Norms

Social norms, as discussed in the introduction, are “...an implied social consensus and thus carries (sic) both informational influence...and social pressures...” (Pratkanis, 2007, p. 39). In addition, they are “...social phenomena and they are propagated among group members through communications” (Lapinski & Rimal, 2005, p. 127). Norms affect behaviour through both compliance and conformity pressures:

In compliance, individuals alter behaviour to receive a reward, to provoke a favorable reaction from others or to avoid being punished...In contrast, conformity that occurs due to individuals observing the behavior of others in order to determine how they should behave can have long-lasting effects” (McKenzie Mohr, 2009).

Social norms use these pressures to “...serve the function of restricting egoistic impulses in favour of collective outcomes” (Biel & Thøgersen, 2007, p. 94).

Norms are an important form of social influence: “...social influence (true persuasion) is described by the internalization of a contextually salient in-group norm, which serves as a basis for self-definition, and thus attitude and behaviour regulation” (Hogg and Reid, 2006, p. 14). Their use as a way to ‘frame’ issues has also been identified as “...probably the most important for pro-environmental behaviour in the population at large” (Lindenberg & Steg, 2007, p. 128). Some important differentiations of norms in the literature include descriptive versus injunctive norms, as well as personal versus collective norms. These will be examined below.

Descriptive versus Injunctive

Descriptive norms are essentially a belief about what other people do: “...individuals use their perceptions of peer norms as a standard against which to compare their own behaviour” (Schultz et al., 2007, p. 429). An injunctive norm, on the other hand, “...refers to perceptions of what is commonly approved or disapproved within the culture. Focus theory predicts that if only one of the two types of norms is prominent in an individual’s consciousness it will exert the stronger influence on behaviour” (Schultz et al., 2007, p. 430). For example, the ‘rebound effect’ in energy conservation is thought to occur when the descriptive norm (the average level of consumption) is prominent in either messaging or communications about consumption instead of having an injunctive norm (an approval or disapproval message about the consumption levels) prominent in communication about the consumption. One of the perceived strengths of using descriptive norms in communications efforts is that they are readily available to individuals to process and understand, whereas communications containing injunctive norms may require some cognitive processing which might make their activation harder (Goldstein & Cialdini, 2007, pp. 171, 172). However, the use of descriptive norms in social influence attempts may inadvertently increase the undesired behaviour, whereas the use of injunctive norms has been shown to exclude potential rebound effects (Schultz et al., p. 429).

Personal versus Collective

Because norms are social constructs, they are also differentiated in the literature as personal or collective. Norms are held by individuals but are also held by groups. (An interesting phenomenon known as pluralistic ignorance occurs when the individually held norm does not match what is actually occurring (Cameron & Campo, 2006, p. 277)).

Rather than focusing on mismatches between individual norms and collective activities, this review will focus instead on social identity theory and the importance of collective social norms. Social identity theory posits that “...collective phenomena cannot be adequately explained in terms of isolated individual processes...” (Hogg, 2006, p. 111). Hogg (2006) goes on to argue that “...conformity is not surface behavioural compliance but a deeper process whereby people’s behaviour is transformed to correspond to the appropriate self-defining group prototype” (p. 124). Essentially, “...people strive for a positive self image, and their membership in a group is itself perceived as part of their identities” (McMakin, Malone & Lundgren, 2002, p. 850). This contrasts with a rational-utility view of norms which sees them as ways to “...achieve...goals...” (Opp, 2001, p. 236) and is implicit in theories such as Value-Belief-Norm theory (Wilson & Dowlatabdi, 2007, p. 182).

Group strength and closeness with the group have been described as important to both the activation and salience of norms. Cook and Hardin (2001) argue that “Norms work best for smaller groups...with long-standing relationships” (p. 327). This may be the case because “...one of the primary factors that appears to influence whether group membership is seen as a salient basis for self-conceptualization is the meaningfulness and level of identification that one has with the group” (Goldstein & Cialdini, 2008, p. 174). This in turn ties into social networks as “...social phenomena cannot be understood solely by individual characteristics (such as socioeconomic attributes) but must also consider the social structure emerging from the interaction among individuals” (Carrasco, Hogan, Wellman & Miller, 2008, p. 963). In conclusion, social norms and social networks are potentially powerful forms of social influence which deserve further inquiry in relation to energy consumption.

2.2.4 Methodology

This literature review was partially undertaken as a way to inform which research methods should be used for this study. A detailed explanation of which methods were chosen is provided in the next chapter. Due to recruitment challenges Egocentric Network Generation was initially studied but not used. It is discussed here, as it helped to inform the study and its purpose (even if it was not actively utilised in the final product).

Egocentric Network Generation

Social network analysis in general “...consists of a body of qualitative measures of network structure...” (Scott, 2000, p. 3). These analyses tend to be defined as ‘whole’ or ‘egocentric’ designs: “Whole network studies examine sets of interrelated objects or actors...as bounded social collectives. Egocentric studies focus on a focal actor or object and the relationships in its locality” (Marsden, 2005, p. 8). Egocentric network sampling is predicated on findings (not uncontested) that show “...respondents are able to recall and correctly report relations in general and have a fairly accurate picture about the social relations surrounding them” (Petroczi et al., 2007, p. 42). For an example of what an egocentric social network looks like, please see **Figure 2.1**.

Egocentric network generation was chosen over whole network generation because it would allow for investigation of differing tie strength effects, which related directly to research question R2 (investigating whether stronger ties will see more of a decrease in energy consumption). As Weenig (2002) argues “Social influence is stronger in tightly knit groups than in groups with few strong contacts. Thus, the strength of ties tells us something about the potential for social influence, at least at the group level” (p. 376).

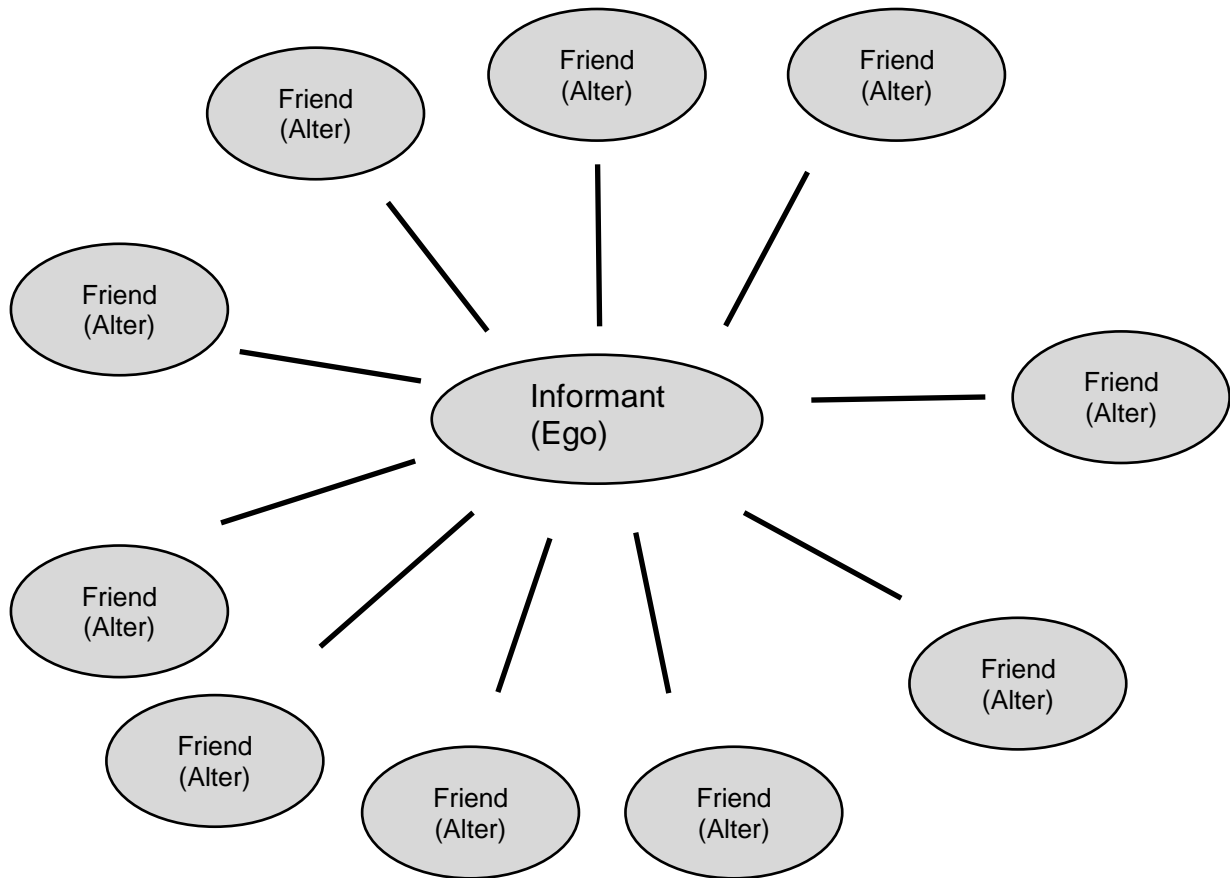


FIGURE 2.1: Egocentric Social Network Based on Friend Name Generator.

Determining an egocentric social network usually consists of “...determin(ing) membership...via one or more name generators then to obtain additional data via name interpreters...” (Marsden, 1990, p. 441). A name generator is “...a free recall question that delineates network boundaries. Name interpreters elicit data about alters...” (Marsden, 2005, p. 11). (An ‘alter’ is a friend or acquaintance within the network). It was proposed at the beginning of the study that a common name generator be used: the General Social Survey (GSS) standard. Specifically, the question would have asked potential participants: “Many people have some good friends they feel close to. Who are your good friends (other than your spouse?) Just tell me their first names. Probe: Is there anyone else?” (Marsden, 2003, p. 4). Two additional questions were proposed for reliability and validity purposes - they were: Do you have any good friends in Milton that you didn’t previously mention that you discuss

important matters with? and Who are the people in Milton you really enjoy socializing with? (Carrasco, et al., 2008, p. 966; Marin & Hampton, 2007, p. 185).

It was proposed that participants would then be asked to rank these names using a name indicator tool to indicate tie strength. (Specifically, the name indicator would ask participants: How strong is your relationship with this person, with 1 meaning that you barely know them and 7 meaning that (you) are very close) (Gilbert & Karahalios, 2008, p. 2). This indicator measures emotional closeness, which has been shown to be “...the most usual and accepted...” indicator of tie strength (Carrasco et al., 2008, p. 965). In order to qualify for the ‘friends’ group, names would have had to be ranked within 5-7 on this scale.

Unfortunately, “Many name generator instruments do not elicit weak ties that are crucial in extending network range” (Marsden, 2005, p. 18). For this reason, in order to generate the acquaintance group, the GSS name generator was revised to read: Many people have some acquaintances. Who are your acquaintances in Milton? In addition, two other questions were to be asked, based on the ‘friend’ questions above: Do you have any acquaintances in Milton that you didn’t previously mention that you discuss matters with? and Who are the acquaintances in Milton you socialize with? These names were to be recorded by the interviewer, and then participants were to be asked to rank these names using the same name indicator tool as above. In order to qualify for the ‘acquaintances’ group, the names were to rank within 1-3 on the name indicator scale. Although not used in the end, these methods informed the study and were crucial to its early development.

This literature review writ large allowed for research gaps to be identified, new approaches to the research problem to be examined and methodologies to be investigated and chosen. The next Chapter, Methodology, details the final research design.

3. Methodology

This chapter covers all aspects of the study methodology. First it seeks to anchor the study in a theoretical framework and explain the study at a macro level. It then details three aspects of the study: the indicator, group types and content analysis. The project's recruitment sequence and challenges are then laid out, as are issues arising from the study's research design. Finally, this chapter details participants' characteristics and issues that arose during fieldwork.

3.1 Project Design

Broadly, as mentioned in the Introduction, this study falls into the social science tradition of exploratory research. This is research which "...seeks to find out how people get along in the setting under question, what meanings they give to their actions and what issues concern them. The goal is to learn 'what is going on here' and to investigate social phenomenon without explicit expectations" (Schutt, 2008, p. 14). (Although this study started out with clear expectations recruitment challenges prevented the sampling framework that would allow for causal answers to these questions; in all other ways, this study is best described as exploratory).

Specifically, this study is a sequential mixed methods design that uses an Explanatory Format. An Explanatory Format is one where "...qualitative data helps explain or build upon initial quantitative results" (Cresswell & Clark, 2007, p. 71) and has been chosen for its ability to "...explain significant (or non-significant) results, outlier results, or surprising results" (Cresswell & Clark, 2007, p. 72). This is especially important in energy research as "Most studies reveal only to what extent interventions have been successful, without providing insight into the reasons why" (Abrahamse et al., 2005, p. 283).

In order to do this the study was designed in two phases. The first saw a literature review (Chapter 2) undertaken to inform the study design and questions. After the literature review and the research design was established, the research was carried out. Notwithstanding challenges associated with the implementation of the original research plan (described in section 3.7) the research unfolded in the following broad manner: participants were screened through an on-line 'eligibility survey' (see Appendix 2.4). This survey was subsequently shortened due to

recruitment challenges (see Appendix 2.5). Once participants were screened they were asked to sign into a secure, password protected on-line website on a daily basis (see Figures 3.1 and 3.2) from January 26-February 9, 2010. This website showed them daily approval/neutral/disapproval indicators of their electricity consumption as compared to their consumption during the same period last year in 2009. Unless they were put into the control group, all group members were able to see each other's indicators. The website also featured conservation tips. (Although the tips have the potential to act as a confounding variable their use in previous studies is preceded (Schultz et al., 2007, p. 431) and were undertaken from a logistical perspective to reduce potential customer calls to the project partner, Milton Hydro.) If participants were in the control group, only they could see their indicator. The website also allowed comments to be written by group members which could be viewed by the entire group. The indicators were updated on a daily basis, generally in the afternoon, based on participant's real time energy consumption. E-mail reminders were sent to participants on a daily basis, usually around 3 o'clock in the afternoon, reminding them to check the website. Both the indicators and e-mail schedules were reliant on the data being posted by Milton Hydro, and this timing sometime varied.

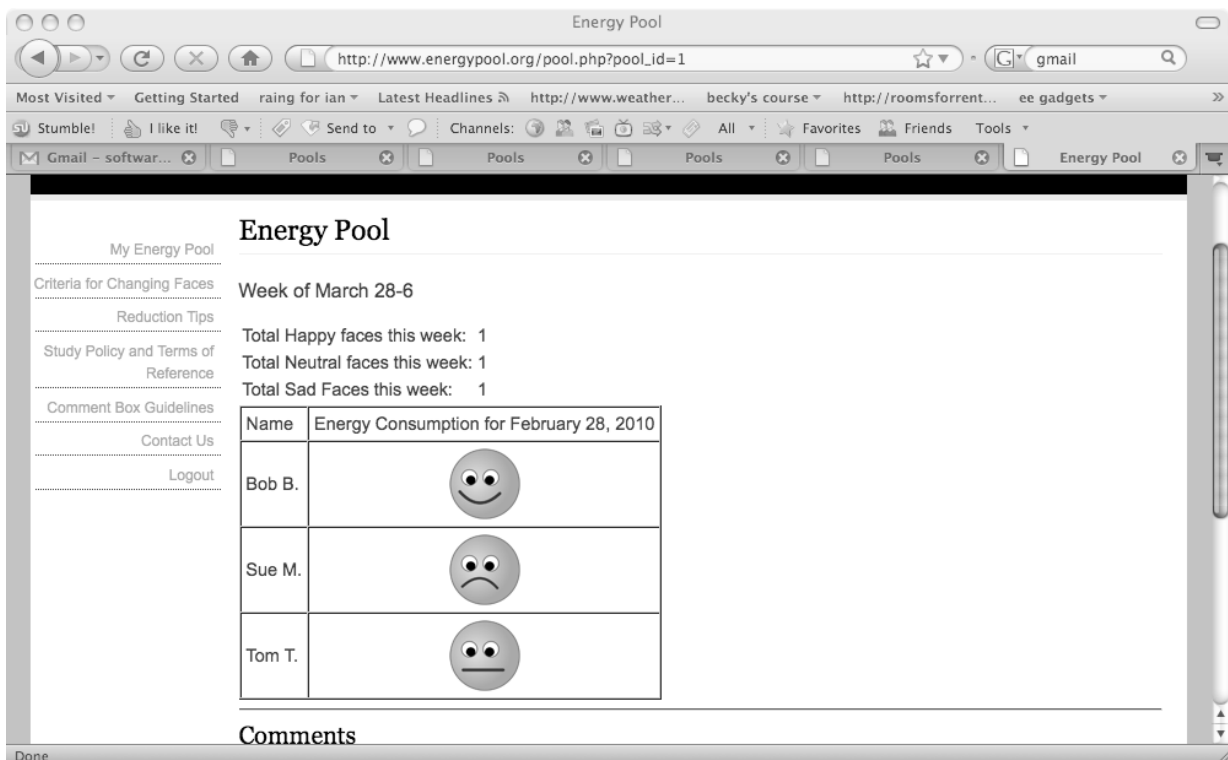


FIGURE 3.1 Screenshot One

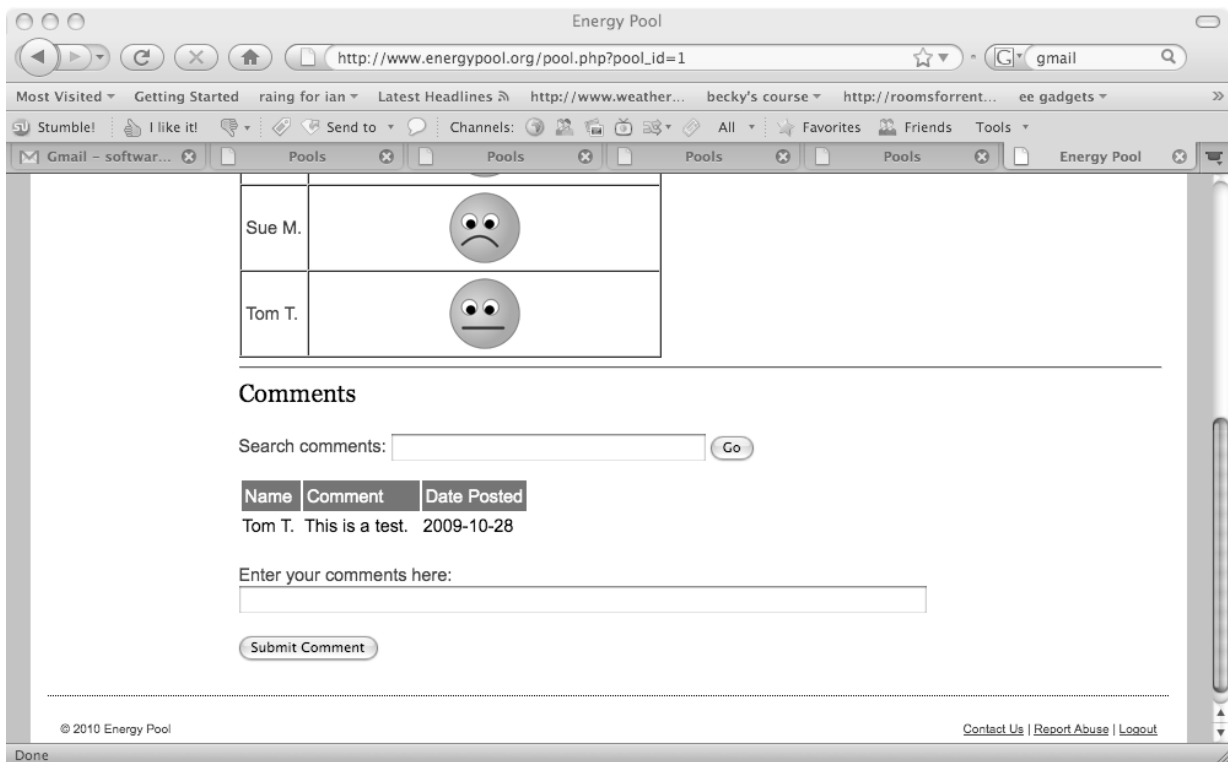


FIGURE3.2 Screenshot Two

Data collected during this period included:

- daily electricity consumption (accessed via participants' smart meter readings as kWh and provided by Milton Hydro);
- frequency of pages viewed, which pages on the website accessed, and duration of site visit via a custom report generated by the website; and,
- comments that participants wrote on the comment boxes.

The second phase of the study saw a questionnaire e-mailed to those who wished to receive it that contained a variety of open-ended and closed item questions. This combined "...the richness of information produced..." from

the open-ended questions to the closed item question's ability "...to quantify data and therefore produce summary statistics, make comparisons...." (Coolican, 2006, pp. 71, 72).

Although this study sought to determine the effects of independent variables (publicity, tie strength and injunctive social norms) on a dependent variable (electricity consumption) this study cannot be called a true experiment because its participants weren't being randomly allocated (Coolican, 2006, p. 54). The proper term for a study of this type is therefore a 'quasi-experiment' where "...there must be an experience, relatively short-term, to which groups of people have been exposed as levels of an independent variable" (Coolican, 2006, p. 55). In addition to being a quasi-experiment, this study employed observation as a technique - that is, "...the researcher observes participants in natural or structured environments. Observation is an important tool because people do not always do what they say they do." (Johnson & Turner, 2003, p. 312). One of the strengths of the observational approach is that "We can get reliable data through observation, even if it may not always be valid" (Coolican, 2006, p. 66). For example, in this study, the participant's daily kWh, their comments and the frequency with which they visited the website were all observed.

Websites were used as 'public spaces' for the purposes of this study for three major reasons. The first relates to project practicalities: "Observing and analyzing on-line social networks has undeniable advantages over face to face methods. Computer mediated communication allows the researcher to overcome difficulties presented from time and distance barriers" (Petroszi et al., 2007, p. 39). The second relates to the fact that findings indicate websites maintain tie strength and social impacts, similar to 'off-line environments' (Haythornewaite, cited in Petroszi et al., 2007, p. 39). Finally, they have been chosen because they are a key way that communities, households and individuals use to both communicate and generate community: "...people not only socialize online, but they also incorporate the Internet into seeking information, exchanging advice and making decisions..." (Boase, Horrigan, Wellman & Raine, 2006, p. ii).

3.2 Study Location:

Milton Ontario was chosen as the study location because all of its residents have smart meters (22,000 of them) as customers of Milton Hydro (Aulakh, 2009). In addition, the utility, Milton Hydro was kind enough to agree to

partner with the author on this research. Milton Ontario is Canada’s fastest growing community - it grew “...71.4% over the past five years.” according to the Census data from 2006, and “...is expected to more than double by 2021” (Milton, 2007, p. 4). Located between Toronto and Waterloo, Milton has seen its median age shift to 34 from 38, and has “...a higher than average proportion of young adults and families with children” (Milton 2007, p. 4). The majority of residents have post secondary education and median earnings are \$87,739 (Milton 2008, p. 3; Milton, 2009).

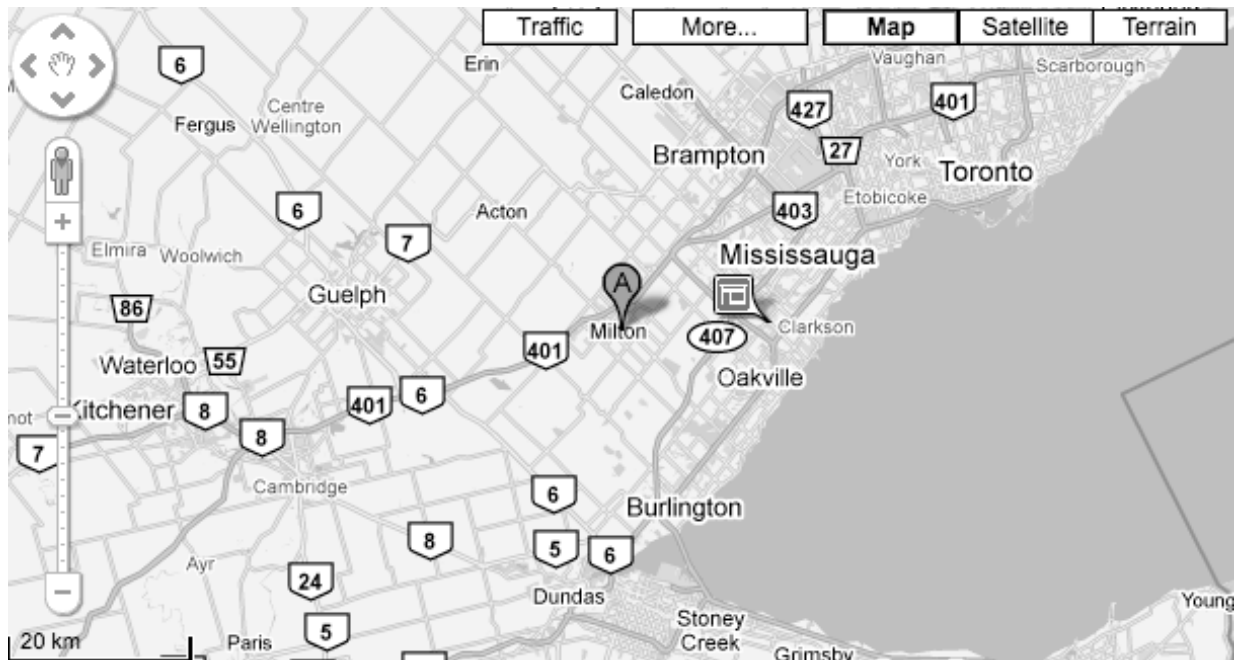


FIGURE 3.3 Map of Milton, Ontario. (Google, 2010).

The post-secondary educational attainment is higher than that of other Canadians (Boothby & Drewes, 2006, p. 2) and the median earnings of Miltonians are nearly double compared to the rest of Canada (Statistics Canada, 2006). Most residents have access to high speed internet and “...rural residents in Milton will soon have access to high-speed Internet under Ontario’s Rural Connections program” (Milton 2007, p. 6).

3.3 Graphic Indicator Switching Criteria

The criteria for the design and for switching the graphic indicator on the websites are based in part on the model that Schultz et al., (2007) put forward. Injunctive social norms were embodied in a happy or sad face which was

drawn on participant's energy bills "...conveying that their energy consumption was either approved or disapproved..." (Schultz et al., 2007 p. 430). Approval was based on the fact that "...households that consumed less than the average received a message displaying a positive valenced emoticon, whereas those that consumed more than the average received a message displaying a negatively valenced emoticon" (Schultz et al., 2007, p. 430).

It was proposed that the same graphic indicator be employed in this study, but with some modifications.

Scale: Rather than basing energy consumption at the community level (Schultz et al., 2007, p. 430), participants 'competed' against their own baseline. This was done to ensure that: 1) even those who had low consumption rates felt able to reduce their rates and reduce the propensity of the 'rebound effect'; and 2) those with high consumption rates would be able to obtain a happy face.

Timeframe sampling for baseline information: In addition, rather than designing the baseline data from "The difference between the two readings..." which were taken "... twice within a two week period..." before the study started, (Schultz et al., 2007, p. 431) the average consumption level was taken from the previous year's two week period. Each participant's daily kWh was then tallied to compile an average baseline. This ensured that the comparison controlled for energy consumption based on seasonality.

Indicator change: In Schultz et al's 2007 study, if participants' consumption was lower than the neighbourhood average, they received a happy face; if higher than average, they received a sad face (p. 431). However, research indicates that low goal setting (which any change above or below, as in Nolan et al's 2008 study would implicitly entail) does not lead to significant conservation, as the goal may be viewed as not worth the effort (Abrahamse et al., 2005, p. 276). For this reason, an implicit goal within this study's indicator was set at 5%.

Timeframe Delivery of the Intervention: Finally, instead of receiving the norm information on a weekly basis (Schultz et al., 2007, p. 431), participants had access to a social norm on a daily basis. This was proposed because findings indicate that "...households in all countries approve more detailed and more frequent feedback" (Fischer, 2007, p. 9).

Although switching the focus of the intervention from energy consumption in general to promoting off-peak energy consumption was considered, it was decided against for several reasons. This included, foremost, the fact that participants would have to have already actively and consciously used their smart meters to shift their energy consumption to off-peak periods. (If they didn't, this study would be attempting to engage consumers in a new behaviour with an injunctive social norm approach rather than, as originally intended, changing an already existing, habitual behaviour.) Although over 15,000 Milton Hydro customers were expected to be on Time of Use (TOU) pricing by the end of 2007 (Ontario Energy Board, 2007, p. 10) whether they are aware of and use TOU pricing within the home is another matter. In addition, it could be argued that the pricing inherent in TOU schemes might be a change driver in and of itself and therefore a possible confounding variable: "We found conclusive evidence that households (residential customers) respond to higher prices by lowering usage" (Faruqui & Sergici, 2009, p. 1). Finally, the efficacy of these programs for lowering energy consumption has not been determined: "Experience with real time pricing programs is mixed, however. With a few noteworthy exceptions, only a few have achieved significant absolute or relative impacts in terms of load reductions achieved" (York & Kushler, 2005, p. iv).

3.4 Boundary Specification for Social Networks

As Hanneman and Riddle (2009) write "There is no simple answer about what the 'right relations' are to examine, and there is no simple answer about who the relevant set of 'actors' are. It all depends upon the purpose of our investigation, the theoretical perspective we're using and the populations to which we would like to be able to generalize our findings." Because one of the main aims of this study was to examine the effect of tie strength on electricity consumption, the first choice for identifying the social network boundaries was a relational approach: "This approach relies on knowledgeable informants or the network actors themselves to nominate additional actors for inclusion..." (Knoke & Yang, 2008, p. 17). The researcher was then planning to ask the informant to

identify tie-strength for each actor using a scale, and test for reliability by asking the nominated actors to also identify tie-strength for the informant. This approach had to be abandoned due to recruiting challenges.

In its stead a positional strategy was used which is where an “...approach uses the attributes of actors, their membership in a formal organization...for inclusion in a network” (Knoke & Yang, 2008, p. 16). The participants in the Faith and Occupation and Neighbour groups fall into this sort of boundary specification. Specifically, the Occupation group was formed by employees of a local business. Members of the Faith group were formed by participants who self-identified as belonging to the same Milton church on the eligibility survey. And members of the Neighbour group were identified as belonging to an on-line message board to whose membership had a “...common interest of knowing what's going on in their neighbourhood”. Unfortunately tie strength among participants in these groups was unable to be verified because of the way the research design was modified as the study proceeded. However, we can make some assumptions about tie strength based on the sort of group that was created and its homophily level.

Homophily is, in a nutshell, the concept that ‘birds of a feather flock together’. Formally, it is “...the principle that a contact between similar people occurs at a higher rate than among dissimilar people.” (McPherson, Smith-Lovin & Cook, 2001, p. 416). In addition, “...patterns of homophily tend to get stronger as more types of relationships exist between two people.” (McPherson et al., p. 418), and “Identification with an attribute increases the likelihood that an individual will have strong ties to people who also share the characteristic” (Reagans, 2007, p. 1375). These points are important to this inquiry because they show that similarity correlates to tie strength, and could therefore function as a proxy for tie strength.

For example, regarding the Occupation group, “Weak ties, on the other hand, are considered to be ties to people who are not within the respondent’s immediate social network, such as acquaintances, coworkers...” (Enns, Malinick & Matthews, 2008, p. 257). In addition, “Occupational homophily is one of the few factors that Verbrugge (1977) found was weaker for best friends than for second and third friends” (McPherson et al., 2001, p. 427). It can be inferred from this research then that occupational ties tend to be relatively weak.

On the other hand, regarding the Faith group, “Ties between people with the same religion are more likely to be close ties of giving emergency help, loaning money, giving trusted advice or even therapeutic counseling...” (McPherson et al., 2001, p. 426).

And turning to the Neighbourhood group, as Robinson (2007) has noted, “Another study supports the notion that neighbourhood-based comparisons may be meaningful, given findings that neighbours, or proximate individuals tended to report similar behaviours and attitudes (Iyer, Kempton, & Payne, 2006, citing Beaman & Vaske, 1995)” (p. 21). So the Faith group might represent, by proxy, stronger ties than say, the Occupation group. The Neighbour group on the other hand contains ties of some type, but whether they are relatively weaker or stronger than the other two groups is unknown.

3.5 Content Analysis for Comments

Content analysis was chosen as a method for analysing participant comments because it “...can be carried out...on materials produced by participants in a study” (Coolican, 2006, p. 98). Data are separated into ‘coding units’: “...the exact ways in which numbers will be generated from the material...” (Coolican, 2006, p. 99). Both frequency (“...whether something occurs in the text and how often...”) and direction (“...the positive/support or negative/opposition direction of messages in the text...”) (Neuman, 2009, p. 209) can be examined, which follows the path that Boer and Westhoff (2006) used when investigating tie strength effects on injunctive social norm signaling. Both frequency and direction for the comments in this study were determined using ‘latent coding’; this is coding where the investigator “...read(s) an entire paragraph or book...and then decide(s) whether it contains certain themes” (Neuman, 2009, p. 210). The researcher who uses latent coding “...is open to the criticism that they invented the coding units in order to ‘get a result’. However, the coding units must be clearly related to the hypothesis to be tested, and, providing no major portions of data are simply omitted from the analysis (because they do not fit) then there is no problem with this approach” (Coolican, 2006, p. 100). In addition, “...latent coding can have greater measurement validity. This is because we communicate meaning in many indirect and implicit ways that depend on the context, not just specific words or actions. Latent coding captures the direct and indirect meanings that may be embedded in a specific text context” (Neuman, 2009, p.

211). In employing this technique, the comments were first read through several times, themes were then identified and the comments were coded.

3.6 Sampling and Social Network Generation

It was initially thought that participants could be sampled from a stringent list of characteristics in order to control for confounding variables. This sampling structure would produce participants for the Control, Neighbour and Stranger groups, and informants would generate participants for the Friend and Acquaintance groups (social networks are *not* samples but populations) (Carrington, Personal Communication, 2009). As a result, the sampling for initial recruitment attempted to follow sampling ‘best practices’. These practices have been described as:

- 1) “The sampling strategy should stem logically from the conceptual framework as well as from the research questions being addressed by the study...
- 2) The sample should be able to generate a thorough database on the type of phenomena studied...
- 3) The sample should at least allow the possibility of drawing clear inferences from the data...
- 4) The sampling strategy must be ethical...
- 5) The sampling plan should be feasible...
- 6) The sampling plan should allow the research team to transfer/generalize the conclusions of the study to other settings or populations...
- 7) The sampling scheme should be as efficient as possible...” (Kemper, Stringfield and Teddlie, 2003, p. 275-276).

In addition to these overarching rationale, it should be noted that operational realities often come into play when developing a sampling strategy, as “Researchers often have to make sampling decisions based on available resources...” (Teddlie & Yu, 2007, p. 86). This is what happened to the project when only six participants were generated from this strategy; consequently, the sampling frame was expanded to the Town of Milton.

3.7 Recruitment

The recruitment strategy had to be modified several times. Table 3.1 provides a brief overview of this timeline, and then more detail on each of the strategies is provided below.

Recruitment Sequence	Rationale	Method	Participant Recruitment Numbers
Targeted Sampling and Social Network Population Recruitment	To control for different energy consumption levels which may have been a confounding variable.	<ul style="list-style-type: none"> -Standardized recruitment package, mailed and e-mailed -On-line consent form and eligibility questionnaire -Standardized name generator for social network identification -Recruitment package for social network participants 	6
Expansion to Town of Milton as Sampling Frame	Not enough participants from previous recruitment method.	-Standardized recruitment script for telephone calls.	0
Targeting of Service and Faith Groups and Commuters	Not enough participants from previous recruitment method.	<ul style="list-style-type: none"> -‘Cold’ telephone calls to service and faith groups and follow-up with standardized information package. -Flyers handed out during rush hour to commuters at Milton GO Transit Station.. 	at least 3

Recruitment Sequence	Rationale	Method	Participant Recruitment Numbers
Snowball Sampling	Not enough participants from previous recruitment method.	-Standardized recruitment package sent out via e-mail to research team, colleagues, acquaintances and friends.	at least 7

TABLE 3.1 - Recruitment Sequence

Stage One - Average kWh Consumption Sample

This stage saw a targeted mail-out to Milton Hydro customers who fell within a range of 8000-15000 kWh per year, with the goal of recruiting for five types of groups: Friends, Acquaintances, Neighbours, Strangers and a Control group. Friends and Acquaintances were to be formed through an initial informant who would agree to be contacted and surveyed with a standardized name generator. This survey was hoped to produce a list of informant’s friends and acquaintances who could then be asked to participate in the study. The Neighbour group was to be formed through address patterns, and the Stranger and Control group were to be formed through random selection of those participants who signed up for the study.

The mail-out was targeted for one major reason: to control for electricity consumption levels which may be considered a confounding variable. This is because research has shown that occupant behaviour is a main driver of energy consumption levels: “It is widely agreed today that occupant energy behavior has a major influence on the amount of energy used in a house (Costanzo,Archer, Aronson, & Pettigrew, 1986; Emery & Gartland, 1996;Fagerson, 1987; Geller, Winett, & Everett, 1982; Kemp ton, Har ris,Keith, & Weihl, 1985; Melasniemi-Uutela, 1992; Rockwell & Rose,1994; Seligman, Darley, & Becker, 1978; Soderlund, 1990; Weihl & Gladhart, 1990)” (Guerin, Yust & Coopet, 2000, p. 53).

Because there was no prior knowledge of the amount of variation for the different groups, mailing to 1,000 customers was determined as a good number based on reach and project budget. The mailout consisted of 1,000 packages sent by Canada Post on October 9, 2009; each package contained an information letter, a consent form, a Self-Addressed Stamped Envelope (SASE), and a link to a standardized on-line consent form and recruitment survey (Appendix 2.1).

Characteristics of those customers who the package was sent to included:

- fell into range of 8000-15000 total kWh per year;
- lived in their house for the past year;
- had interval electricity data available for at least one year;
- went on Time of Use pricing no later than April 2008;
- did not live in an condominium or apartment; and,
- lived in 'Cycles 30, 31, 32 or 33'. (These are areas of Milton, as defined by Milton Hydro's operations).

It was hoped that this recruitment phase would generate fifty to ninety participants. It generated three (see Table 3.1 - Recruitment Sequence).

In an effort to generate more participants, Milton Hydro sent an e-mail to 319 customers on November 11, 2009 for whom they had e-mail addresses who had already been mailed the hard-copy information package. The e-mail contained a reminder letter about the study, as well as a PDF of the information letter and consent form (Appendix 2.2). Thirty-three of the e-mails came back as 'undeliverable'. This effort saw three more participants sign up for the study.

Stage Two - Town of Milton as Sampling Site

Given that only six participants had been recruited, the study expanded its sampling frame to the Town of Milton, as opposed to those customers of Milton Hydro who fell within a certain kWh consumption level. This consisted of cold-calling Miltonians from the phone book in November, and then again in January. A standardized script

was used in November, (see Appendix 2.6) which was then modified in January in an attempt to orally sign people up to the consent form and fill out the eligibility survey with the support of a researcher. The public phone book which was used was <http://www.411.ca/whitepages/Ontario/Milton>; the initial name chosen to start was randomly selected from among all the names from a hat, and was 'Bishops'; and a random skipping pattern of four people was chosen using a random number generator at <http://www.random.org/>.

A total of 372 people were called; 23% of these calls resulted in 'Not interested' feedback; 4% of these calls generated respondents who were interested in the study; and 50% of the callers (up until field notes don't record it) did not answer the phone, had a busy line, were a fax or an office number or were out of service. Of the 4% who were interested (15 potential participants) 9 were sent e-mails. In addition, one hard copy package was sent to a participant in January (it is unclear from notes if the other three packages were sent). Finally, one participant who had requested a hard copy package was not sent it because as a renter he was ineligible for the study and another, while interested in participating in the study, did not have the necessary computer skills. This effort did not generate any participants. Reasons given for not being interested in the study (these were unsolicited) included: going for surgery; going on vacation; living in an apartment; expected duration of study (in November the study was proposed to be a month long); having a newborn baby; lack of a computer in the household; and reticence to making personal information public.

Stage Three - Targeting Faith and Service Groups as well as Commuters

In addition to cold-calling Miltonians, given that there was no uptake, service clubs and faith groups in Milton were identified and contacted via telephone to see if they would be willing to open their memberships up to recruitment efforts. Of these groups, two churches responded positively by either putting information about the study in a church bulletin or by e-mailing parishioners about the study and inviting them to participate. This resulted in three more participants from one of the churches.

Flyers (see Appendix 2.7) were also handed out to commuters at the Milton GO Train Station the week of January 11, 2010, once during the morning rush hour and once during the evening rush hour. Unfortunately there is no

way to tell whether this effort generated participants for the study or not as the eligibility survey did not contain a self-identification tab for this group.

Stage Four - Snowball Sampling

Finally given the low recruitment level, an e-mail (Appendix 2.9) was sent out to members of the research team as well as friends, colleagues and acquaintances of this researcher asking them to forward a standardized information package (which they could modify) about the study to anyone they might know in Milton. This material was also sent to research partners at Milton Hydro by Dr. Rowlands on December 17, 2010. As a result of this effort, eight participants were recruited.

In total, 17 participants were deemed eligible for the study. This is consistent with other comparative feedback studies: “Many model projects and field experiments include no more than 10-44 households” (Fischer, 2007, p. 1876). While not ideal (based on what was originally hoped for), it was nevertheless felt that, for the sake of this exploratory investigation, the number was sufficient to advance learning/understanding.

3.8 Issues that May Have Affected Recruitment Efforts

There are at least three key reasons why recruitment efforts may not have yielded as many positive responses as originally anticipated.

- 1) Respondent burden: The mail-out package for Milton Hydro customers was originally conceived as four pages. After consultations with the University of Waterloo’s Office of Research Ethics, this package grew to a required 13 pages in total, which may have placed a large reading burden on respondents.
- 2) Respondent fatigue: Milton has a history of being used as a study site for energy research at the University of Waterloo - for instance, since 2007 three Masters projects have been conducted there (Mooney, 2008; Robinson, 2007; Schembri, 2008). This may have led to respondent fatigue

on the part of potential recruits who may have fit the study's parameters but elected not to participate.

- 3) Social desirability: When cold calling potential participants, 14 had expressed interest in the study and 10 of these were sent recruitment materials. (Three might have been sent materials but the researcher cannot find confirmatory notes). Of these ten, none signed up for the study. This may have occurred as a result of the 'social desirability' effect, which "...is the wish for individuals to answer survey questions based not on their true feelings but on the desire to present themselves in the most favorable manner possible..." (Smith, 2007, p. 917).

3.9 Limitations and Considered Solutions

Limitations to this study should be taken into account. The main ones are listed below, along with (where appropriate) considered solutions.

Self-selection bias

Many social studies are based on volunteers - that is, people who volunteer to participate in such a study. "This occurs when participants do not start out the same...." and is "...often an issue in designs lacking random assignment..." such as this one. (Neuman, 2009, p. 195). "Hence, it is possible that some findings...are related to the characteristics of the biased sample (e.g. of volunteers)..." (Coolican, 2006, p. 26). This is important to mention as this study's participants were all volunteers, yet as Coolican (2006) points out, "...if a study is designed well then it likely that the effect of these participant variables would be minimal..." (p. 26).

Reliability:

"... [R]eliability measures the extent to which a particular instrument, when applied repeatedly to the same subject, yields an identical result every time" (Knoke & Yang, 2008, p. 38). Reliability was considered in this study through the initial choice of standardized social network generation instruments to procure social networks from participants, such as a name generator. These tools have been tested by others and used in multiple studies. Unfortunately, due to recruitment challenges this approach was abandoned and these instruments were not used.

Another method that can be used for reliability is inter-observer reliability (Knoke & Yang, 2008, p. 38). This is a method where “We...correlat(e) one observer's data with that of another” (Coolican, 2006, p. 66). Unfortunately the study’s budget did not allow for another researcher but in future study designs this might be considered.

Validity

Validity refers to the “Extent to which a test measures what was intended” (Coolican, 2006, p. 280). Threats to this study’s validity are listed below:

- a) Maturation: “This is the threat that a biological, psychological or emotional process within the participants that is not part of the independent variable induces a change in the dependent variable” (Neuman, 2009, p. 195). Although it should be noted that this is not a true experiment, the same principle holds, and given the length of time proposed for the intervention (two weeks) maturation seems possible. However, “Designs with a ... control group help you to detect whether maturation...might be present” (Neuman, 2009, p. 195).
- b) Hawthorne Effect: This is “Effect on human performance caused solely by the knowledge that one is being observed” (Coolican, 2006, p. 271). The traditional strategy for this to employ a Single or Double blind (Coolican, 2006, p. 51). However, given that this knowledge that one is being observed is part of the study’s explicit purpose, no amelioration protocol was used.

Potential Confounds

Confounding variables are ones that “...change with the independent variable and could be an alternative explanation of changes in the dependent variable...” (Coolican, 2006, p. 38).

There are a number of potential confounding variables for this study, listed below with potential solutions:

- a) Static bias: This is an assumption on the part of investigators that external conditions will remain the same, yet they often do not. For the purposes of this study, important determinants of average

electricity consumption included house size and occupancy size - these could have changed in between last year and this year (important considerations for the baseline's development). In order to control for this, participants were asked if their home had been renovated in the past year or during the study period (the same for any household size changes). It was initially thought that if this had occurred participants would be screened out - however due to the difficulty recruiting participants these participants were retained and this detail has been noted in the analysis instead.

- b) Discussion of consumption outside website: There is an implicit assumption on the part of this study design that participants would only discuss electricity consumption using the website, which may not have been the case - other media, such as phones or face-to-face communications may occasion discussion about consumption and invocation of social norms. To account for this possibility, participants were asked through the questionnaire about communication about consumption within their groups that occurred outside of the study. These findings are included in the analysis.
- c) Temperature. Given the historical nature of the indicators (the approval status was a measure of whether your current consumption was better or was worse than your consumption from 2009) large differences in temperature could have been a confounding variable. In other words, if it was extremely cold last year participants might have used more electricity in an effort to keep warm; if this year was milder then the indicator results might have been happier not through the efforts of participants but merely because it wasn't as cold out and less electricity was being used. An analysis of the temperature from January 26-February 9 2009 and 2010 from the Burlington Piers weather station showed that the mean temperature for both periods was -5 degrees Celsius (Figure 4.4). However, more detailed temperature analysis suggest it may have had an effect - this can found in Section 5.5 of this study.
- d) Electricity Consumption Levels: This study aimed to recruit participants who fell into Milton Hydro's kWh range of 8000-15000 kWh per year for two main reasons: the rebound effect, as well as perceived fairness playing into participant motivation. The first concern postulates that providing

information about consumption levels to householders “...may even be counterproductive, for example, when...your consumption is relatively low...signaling that there is space for improvement on comfort” (Fischer, 2007, p. 1877). This is colloquially known as the rebound effect. By ensuring that participants fell within the the level detailed above it was thought that there would be room to improve and show a change. The second rationale for controlling consumption levels went to participant motivation: it was thought that if they all thought that they were from the same sort of consumption level that this might influence their perception of the indicator’s ‘fairness’ and therefore they might be more likely to participate and change their consumption.

- e) House structure and household characteristics may also be confounding factors. For example, if one participant had a house of 1000 square feet versus a participant who had a house with 10,000 square feet, the consumption needed for heating the larger house would automatically put the second participant into a ‘higher consumption’ bracket. This might make it easier therefore to reduce this consumption. The study originally sought to control for these issues by asking participants for their household size, their estimated square footage, household type and education level. Due to recruitment challenges, however, the questionnaire was shortened and only three participants provided such information. This was therefore not made part of the analysis.

3.10 Participant Characteristics

3.10.1 Socio-demographic

All participants were customers of Milton Hydro or lived in households who had a Milton Hydro account (by proxy, this means that they lived in Milton).

- N=17; M=9, F=8
- all over the age of 18;
- owned and resided in own home;
- lived in home since August 2008;

- Average household size: 3 people*
- Minimum household size: 2; Maximum Household size: 5

(*Note: this average excludes participant S3 whose survey was only partially recovered from the server and did not respond to requests to do it again).

In total the study saw 22 participants sign up and a total of 17 qualify. Five participants were disqualified from proceeding: one participant signed up but did not have a Milton Hydro account in January 2009. Two did not own and reside in their own home since August 2008. One potential participant did not sign up in time and the final disqualified participant did not fill out the consent form properly and when asked to redo it via e-mail failed to respond.

Participants have been coded in this study to protect anonymity yet still provide characteristic information helpful to analysis. The code is as follows: the first letter of the type of group the participant was placed in, followed by a numerical identifier. For example, a participant in the Faith group is identified as F1, whereas a participant in the Occupation group would be O1. The first letters for each of the groups are: C(Control); O(Occupation); F(Faith); S(Stranger) and N(Neighbour).

3.10.2 Structural

Two participants (N1 and O2) had undertaken renovations since August 2008. This consisted in both cases of adding a new furnace or hot water heater (because of the question it was not clear which action was taken), and in one case, adding insulation. This information will be accounted for throughout the analysis.

In addition, four participants had their household size change since August 2008; N5, S2, F3 and F2. (Again, given the question's wording it is not clear whether these were increases or decreases in household size). These characteristics will also be accounted for in the analysis.

Finally, of those participants who filled out the original, extended eligibility survey (C1, C2 and C3), all three had post-secondary education and lived in single detached homes. Estimated self-reported square footage of those homes ranged from 1500 - 2999 square feet.

The following groups were organized:

- a group based on occupational ties (from a local business);
- a group based on faith-based ties (from a local church);
- a group based on neighbourhood ties (members of a computer network group dedicated to a neighbourhood in Milton Ontario);
- Three 'control' groups
- a group made up of 'strangers'.

Each of the groups were comprised of three members with the exception of the Neighbourhood group which had 5 members.

3.11 Issues that Occurred During Fieldwork

Several disruptions to the project occurred during fieldwork that may have affected results and will therefore be noted in the analysis.

- 1) The data-stream for participants' daily electricity consumption reports did not work during the weekend, as the Milton Hydro employee was not working on Saturday and Sunday. This resulted in delays for posting indicator data to participant's websites from Friday to Monday for both weeks of the study period. (Specifically, data for January 29 and 30 were not posted till February 1; data for February 5 and 6 were not posted till the 8th). This may have affected interest in the indicator as well as a longitudinal understanding of the indicator on the part of participants.

2) One participant (N5) received the incorrect indicator for their consumption the first three days of the study (specifically, the indicator was calculated using the weekend baseline instead of the weekday baseline). This may have negatively affected the rest of the results as they stated in their questionnaire that they lost interest in the indicators after receiving positive ones at the beginning. (These positive indicators, should, in fact, have been negative).

4. Results

This section of the study will take the reader through the study results. The first section will focus on the baseline calculation; the second will focus on results from the indicators; the third will focus on temperature; the fourth will focus on sign-in frequency and the fifth will focus on comments. Finally, questionnaire results will be detailed.

4.1 Baseline

The baseline was calculated from daily kWh consumption from January 26-February 9 2009 and ranged widely for participants; it was differentiated from weekday and weekend consumption. (This was done because weekend consumption tends to be higher than weekday consumption) (Milton Hydro, Personal Communication, 2010).

Weekday:

-Lowest Range: 15.92 (N1)

-Highest Range: 45.76 (O2)

-Standard Deviation: 8.69

-Average: 27.48

Weekend:

-Lowest Range: 17.89 (F1)

-Highest Range: 57.47 (O2)

-Standard Deviation: 10.92

-Average: 29.33

4.2 Indicators

Indicators were input into the website on a daily basis and recorded through written records and screenshots.

Total Indicators during Study Period

Across the 14 days of the study (January 27-February 9), the 17 participants received, collectively 255 indicators (when signing in on January 27 participants could view their indicator for January 26th). Figure 4.1 reports how those indicators were distributed across the three types. Most participants received happy indicators, followed by sad indicators. Neutral indicators rarely surfaced for participants. Figure 4.2 shows the group distribution of indicators. The group with the largest amount of happy indicators was the Faith group; the lowest was the neighbour group.

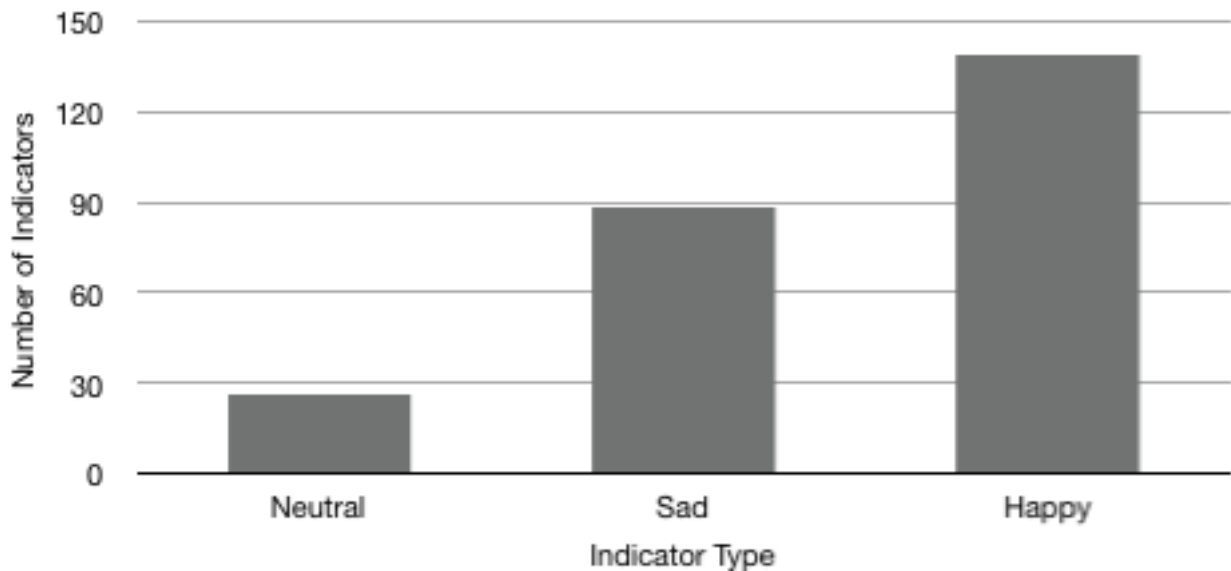


FIGURE 4.1 Total Number of Indicators During Study Period

(Please note, one participant, N5, should have received two sad faces and one neutral face; instead they received three happy faces. The data in this chart and the rest of the report reflects the correct measurements as if the participant had received the sad and neutral faces).

Indicators by Group Type

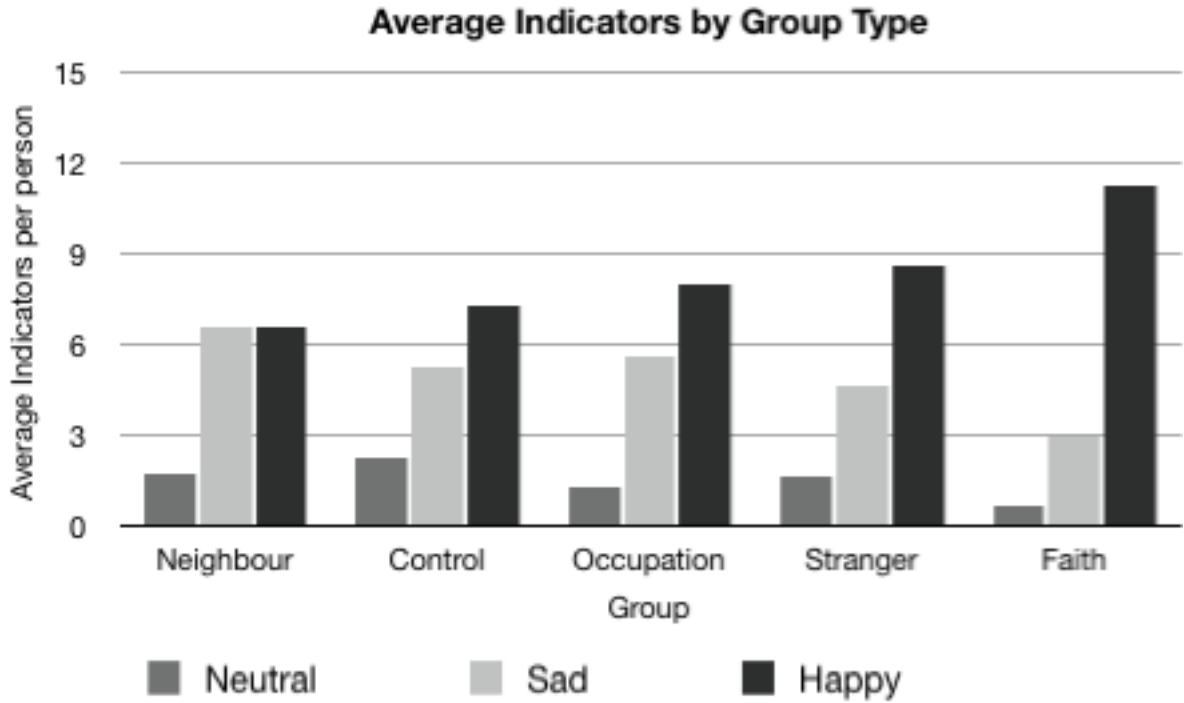


FIGURE 4.2 Average Indicators by Group Type

Weekend/Weekday Indicator Differences

Weekend and weekday indicator differences were pronounced in the Stranger Occupation and Faith groups for the Happy Face indicators. Tables 4.1 and 4.2 reveal the distributions among groups.

	Weekday Happy Indicators	Weekend Happy Indicators	Difference
Neighbour Percentage	48%	45%	-3%
Control Percentage	57%	42%	-15%
Stranger Percentage	73%	33%	-40%
Occupation Percentage	70%	25%	-45%
Faith Percentage	87%	33%	-54%

TABLE 4.1 Happy Indicator Distribution by Weekday/Weekend

For the Sad indicators, the Neighbour group again demonstrated little differences between weekend and weekdays, yet the Control, Stranger Occupation and Faith groups all showed strong differences between weekend and weekday sad indicators.

	Weekday Sad Indicators	Weekend Sad Indicators	Difference
Neighbour Percentage	48%	45%	-3%
Control Percentage	30%	58%	+28%
Stranger Percentage	23%	58%	+35%
Occupation Percentage	27%	75%	+48%
Faith Percentage	17%	67%	+50%

TABLE 4.2 Sad Indicator Distribution by Weekday/Weekend

Total Indicator 'Shifts'

A shift is defined as 'positive' if it moves, from one day to the following day, towards a happy face: these shifts were sad to happy, sad to neutral or neutral to happy. A shift is defined as 'negative' if it moves, from one day to

the following day, the participant toward a sad face: these shifts were happy to sad, happy to neutral or neutral to sad. Table 4.3 reveals that total negative shifts were similar to positive shift numbers overall. Out of 238 total possible shifts, there were only 110 shifts, meaning that there was a majority of no shifts.

	Number of Shifts	Overall Percentage
Happy to Neutral	12	11%
Neutral to Happy	12	11%
Neutral to Sad	10	9%
Sad to Neutral	10	9%
Happy to Sad	34	31%
Sad to Happy	32	29%
Total Negative Shifts	56	51%
Total Positive Shifts	54	49%

I)

TABLE 4.3 Total Indicator Shifts

Indicator Shifts Across Groups

It appears that the group that experienced the most shifts (both negative and positive) was the Control group.

The Faith group experienced the least shifts.

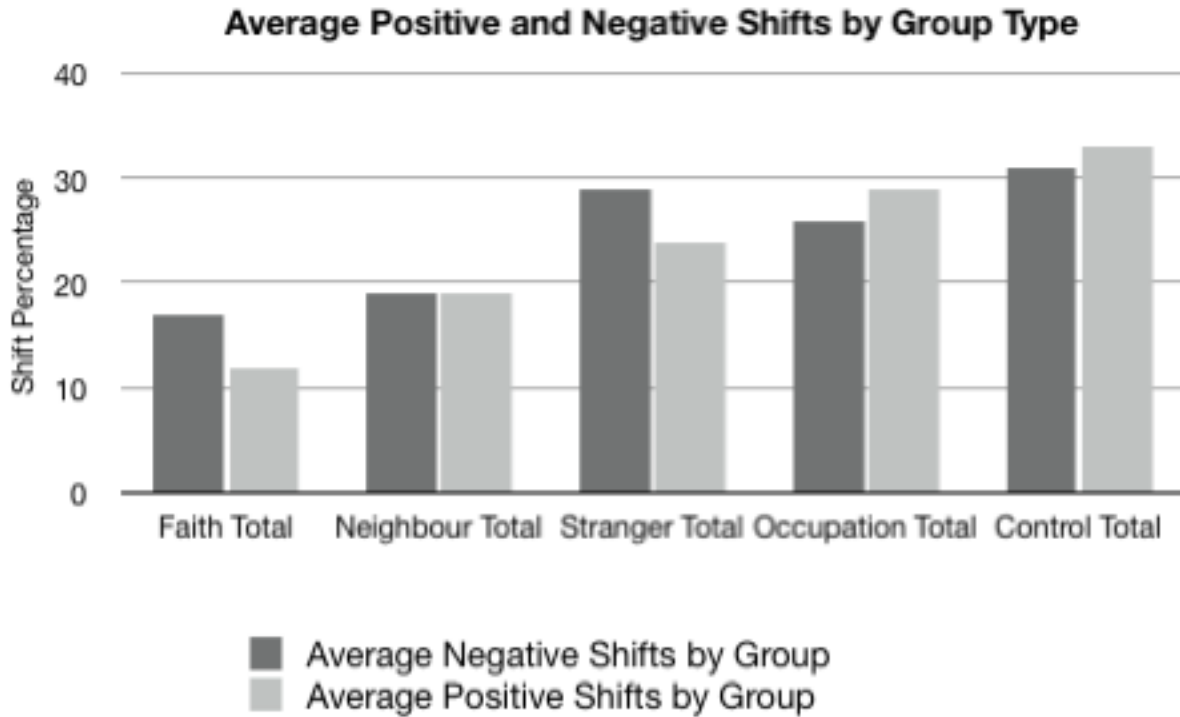


FIGURE 4.3 Average Positive and Negative Shifts by Group Type

4.3 Temperature

Milton does not have a current active Environment Canada weather station. Therefore temperature readings were taken from the nearest station with data for all the dates (January 26-February 9 2009 and 2010): this was the Burlington Piers weather station, which is within 25 km of Milton according to the National Climate Data and Information website run by Environment Canada; this station’s latitude is 43° 18 N. Its longitude is 79° 48 W. This compares to Milton’s longitude and latitude at 43° 30 N with a longitude of 79° 55 W (Atlas of Canada, n.d.).

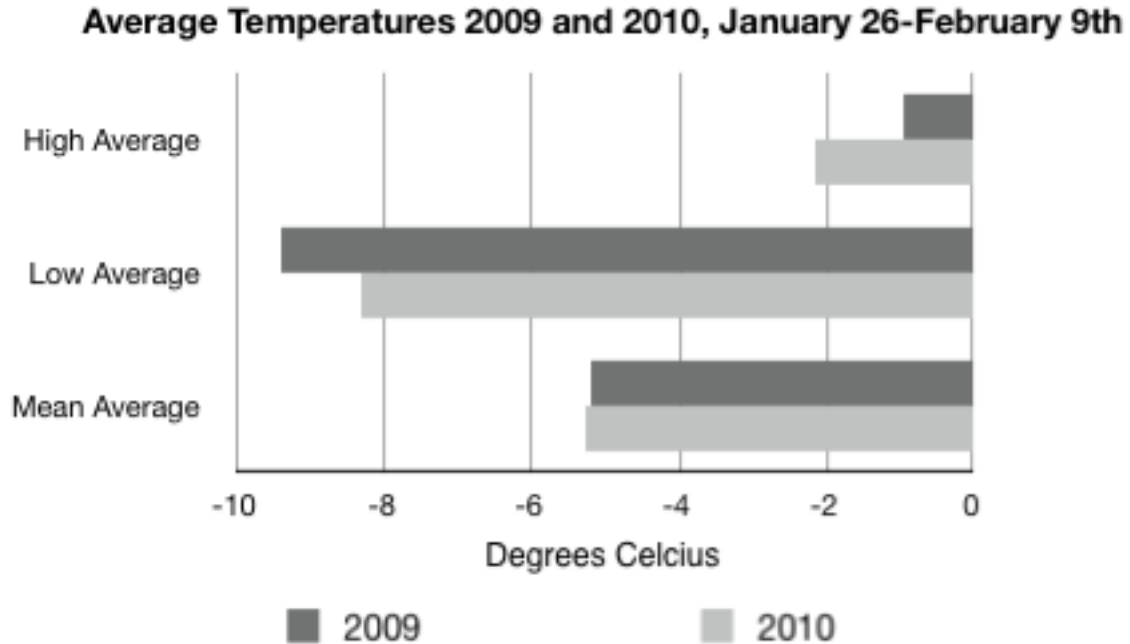


FIGURE 4.4 Average Temperature Comparison 2009-2010 for Intervention Period

Source: Environment Canada, 2009 and 2010 data for Burlington Piers Weather Station

Weather Data for Intervention Period

Of note is that January 29 and 30 2010 saw the mean temperature dip below -10; this might have had an effect on electricity consumption as participants might have increased their heating to deal with this temperature dip (Environment Canada defines their ‘mean temperature’ as: ...”the average of the maximum and minimum temperature during the day.”) (Environment Canada, 2010a). In addition, January 26 saw a temperature above zero, which again may have contributed to participant electricity consumption through a related decrease in heating services. (For example, the furnace’s fan might see an associated increase or decrease in use).

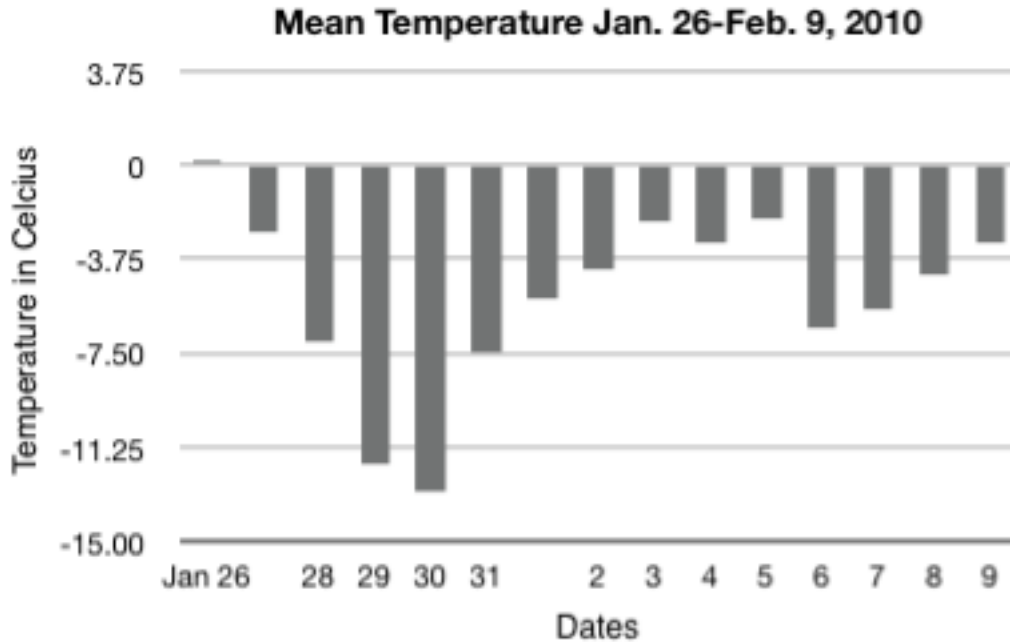


FIGURE 4.5 Mean Temperature for Intervention Period 2010

Source: Environment Canada Burlington Piers Weather Station 2010

4.4 Sign-In Frequency

Website sign-ins were captured by the website, and included which pages participants visited.

Total Participation Rates

The website was equipped with a program which recorded both the log-ins of participants as well as the number of page views by participants. The log-in records were supplemented with this ‘page-view’ function because it was envisaged that participants might sign in and not sign out again for the duration of the study, rendering this an invalid way to evaluate participation rates. Unfortunately, the ‘page-view’ function saw multiple entries for the same time (separated by seconds) when participants seem to have refreshed the web page, rendering this also a less than optimal way to evaluate participation rates. Total participation has therefore been rendered by counting which participants viewed the site on certain dates (see Appendix 3.3). The lowest number of days that a participant viewed the site was 3; the highest was 12. The overall average for all participants was 8 days.

Frequency by Group Type

Figure 4.6 reveals information about the average number of days which groups checked the website. On average participants in the Control group, the lowest value, checked the website half the time - 6 days out of 14. The highest value, meanwhile, was recorded by the members of the Faith group, who, on average, checked the website 9.6 times out of the study's 14 days.

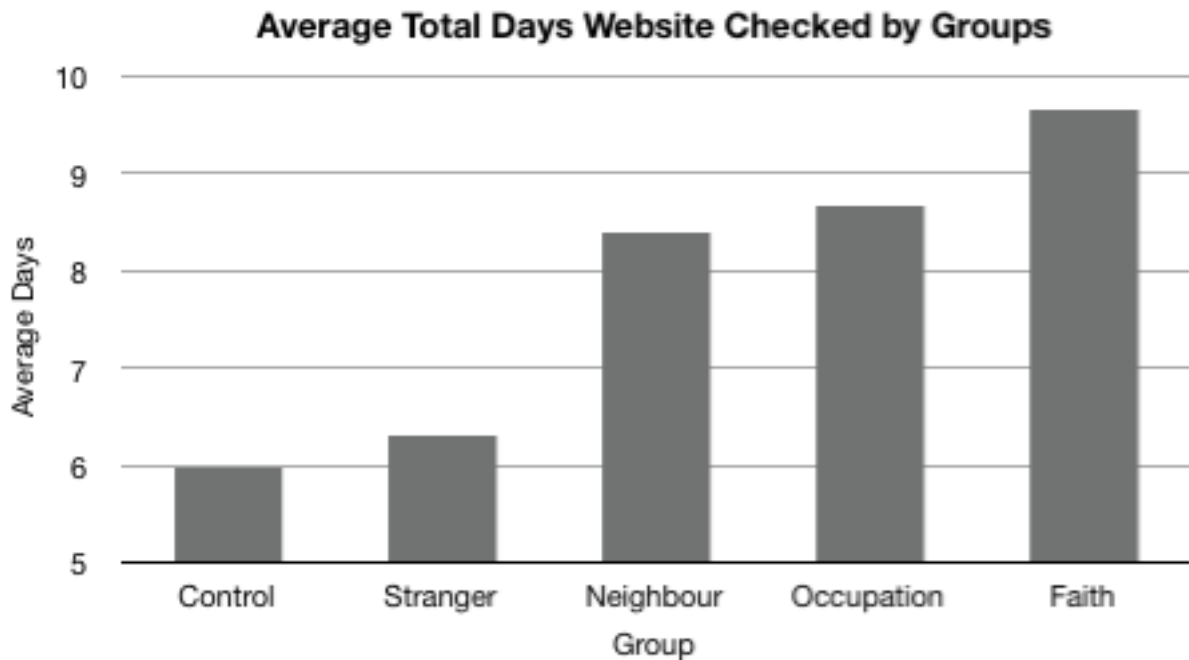


FIGURE 4.6 Average Total Days Website Checked by Groups

Frequency by Time Period

As Figure 4.7 shows, the frequency of checking the site was starting to decrease among participants toward the end of the study period.

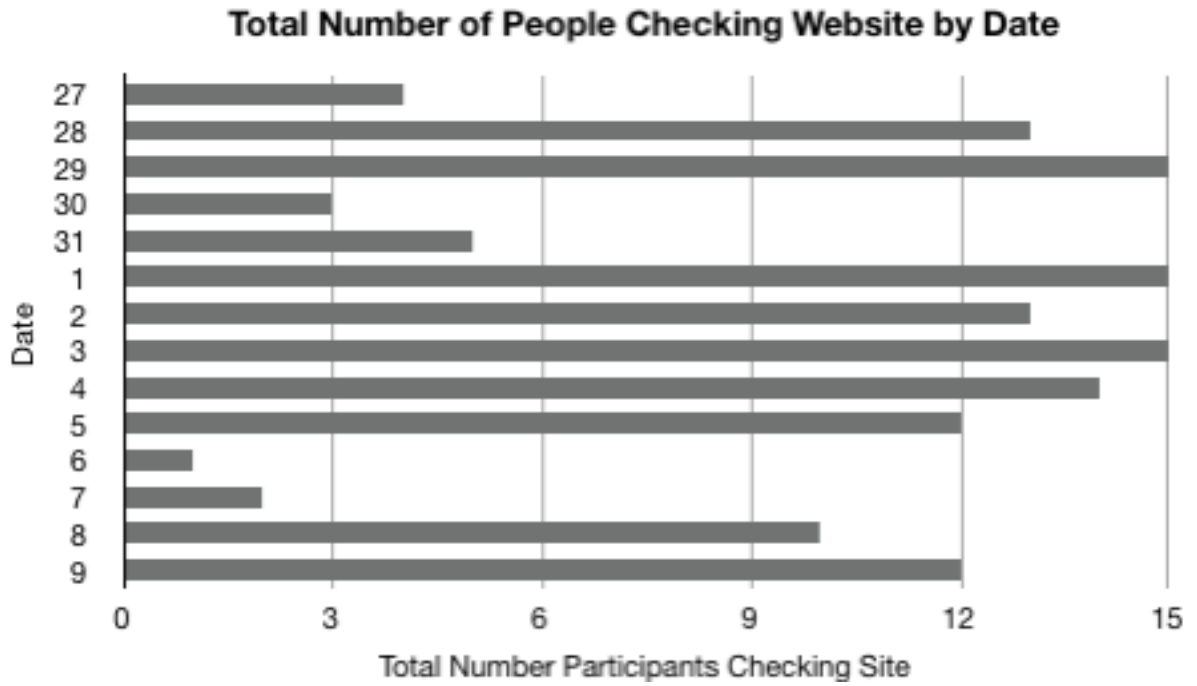


FIGURE 4.7 Total Number of People Checking Website by Date

4.5 Comments

Comment boxes were available for all participants to write comments.

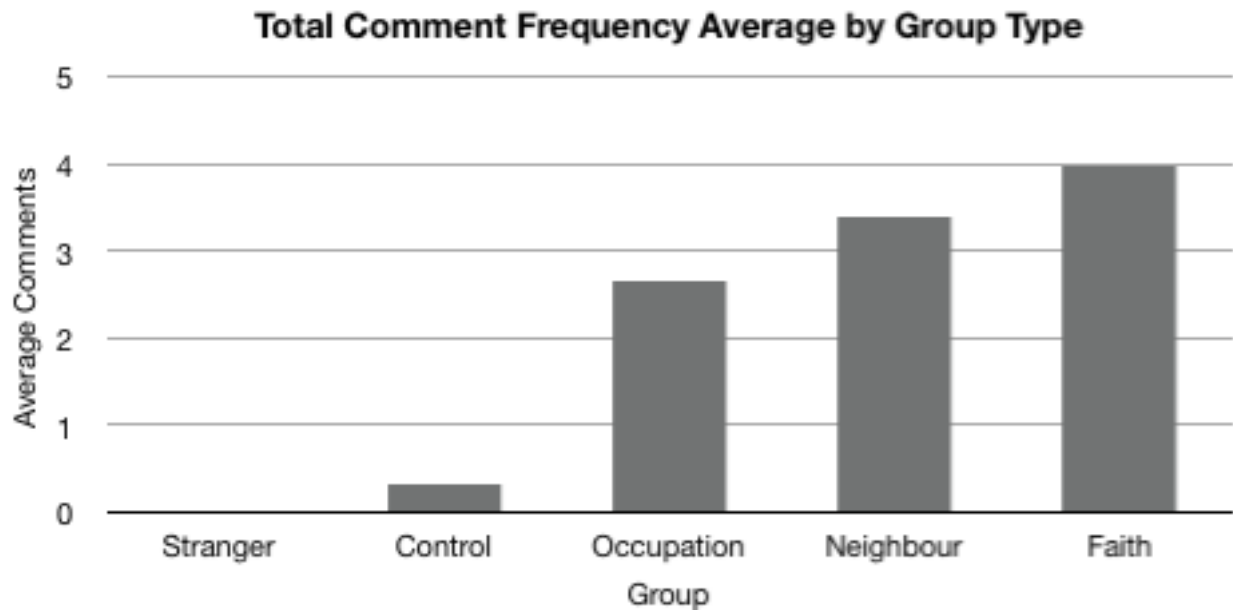


FIGURE 4.8 Total Average Comment Frequency by Group

*Please note that this Figure, as well as the two below, includes one comment from February 10 and two comments from February 11th.

Frequency by Date

As seen below, comments peaked early in the project, then seemed to settle into a low pattern.

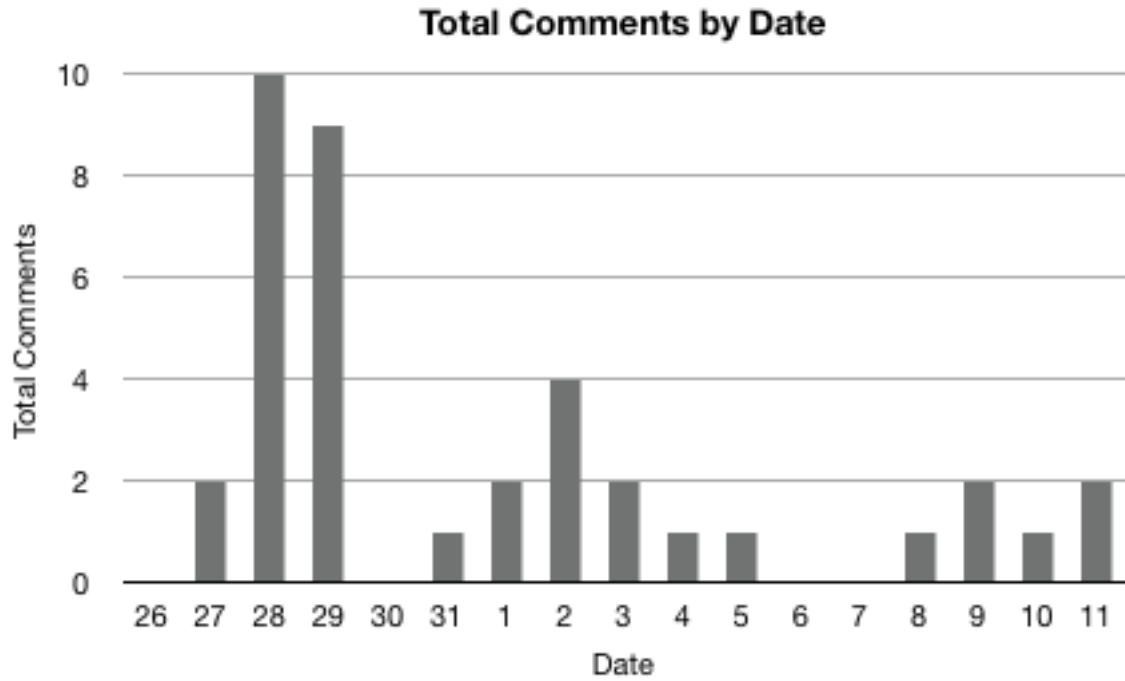


FIGURE 4.9 Total Comments by Date

Comment Type Totals

In section 3.5, the procedure for coding is fully described. Moreover, the comments are reproduced, verbatim, in Appendix 3.2.

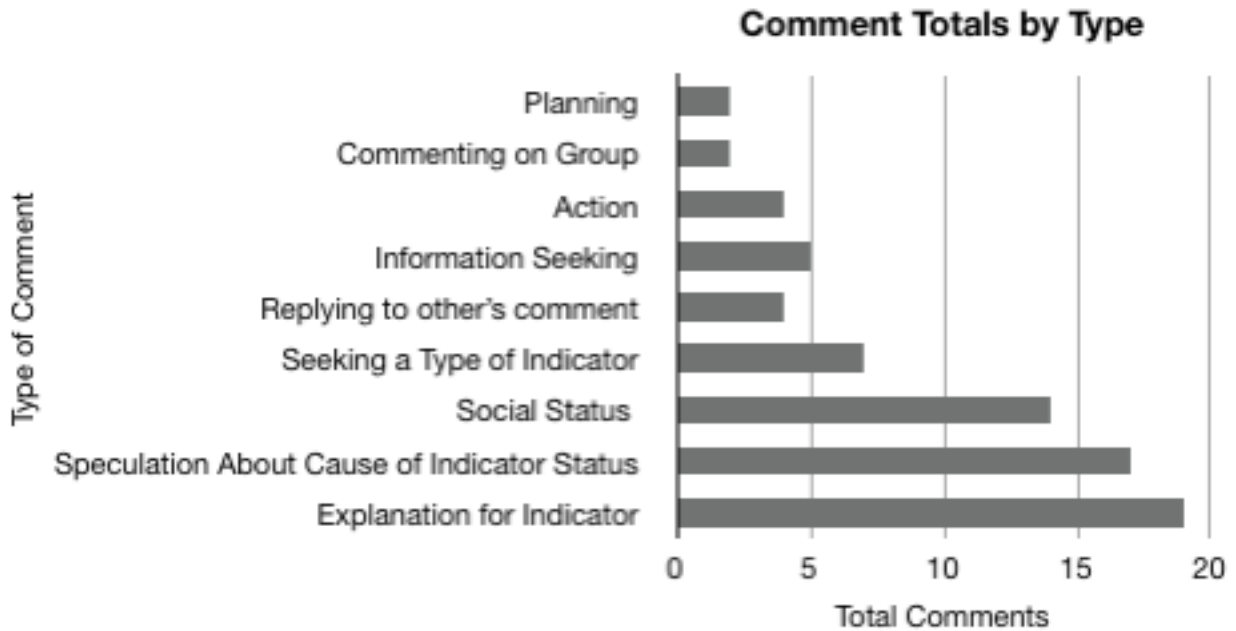


FIGURE 4.10 Comment Totals by Type

It is worth noting here that participants posted a total of 17 comments speculating what was causing their indicator status, and a total of 19 comments excusing their indicator status. This propensity of comments seeking clarification suggests that participants were not aware of what caused their consumption to increase or decrease. Possible causes self-identified by respondents included: baking; cooking; computing; exercising; ironing; laundry, weather and lighting. Only one participant identified structural issues such as the need for new windows and a new front door.

Specific examples of such comments include:

- a) O1: Might have to stop exercising! Treadmill = Sad Face :(No treadmill = Happy Face :)

b) F1: Don't know why our power was up. X (*name removed for privacy purposes*) did some ironing.

4.6 Questionnaires

Questionnaires were filled out by eight participants, N1, O1, F1, C2, F2, N5, C3 and F3, making for a response rate of 47%. The questionnaires combined open-ended questions with scaled questions (see Section 3.1 for a discussion of why this was done) and were designed to obtain participant's self-reported beliefs about the experience of participating in the project as well as beliefs about its efficacy. (Please note that direct quotes from participants in this section are italicized).

Overall Experience

The first question asked participants to describe their overall experience of the study:

1)Overall, thinking about your experience using the website, was the experience: 1) excellent; 2) good; 3) ok; 4) poor; 5) terrible.

All eight respondents answered this question; 13% of respondents indicated that their experience was 'OK' and 88% indicated that their experience was 'Good'.

Perceived Efficacy of Changing Consumption

The second question was designed to elicit self-reports on the efficacy of the study in changing electricity consumption:

1)How effective do you think your participation in the study was in changing your electricity consumption on a scale of 1-7, with 1 not effective at all, 4 somewhat effective and 7 extremely effective?

All eight respondents answered this question; as can be seen in Figure 4.11, the majority of respondents thought that the project was somewhat effective in changing their electricity consumption.

Although this was a numerically-based question instead of an open-ended one, F3 decided to answer more fully. This respondent had answered five (effective) to the question, and stated *“Our selection group was small so the influence of having others give feedback was minimal. However, the desire to do well was a significant overall factor and we did pay attention to our consumption during the survey.”*

Perceived Efficacy of Project in Changing Electricity Consumption

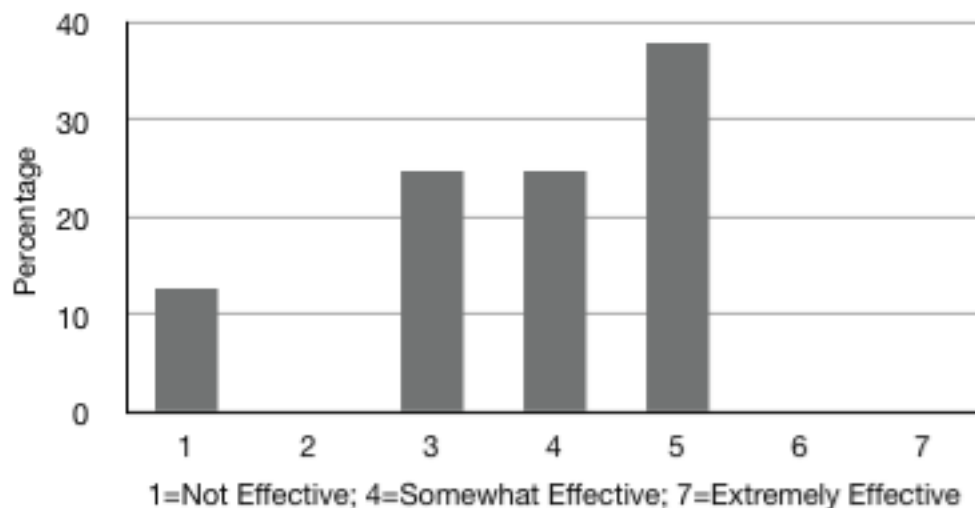


FIGURE 4.11 Perceived Efficacy of Project in Changing Electricity Consumption

Why Did Participation Change (or not) Electricity Consumption?

The third question asked participants to identify *why* their participation did or did not change their electricity consumption:

3) Why do you think your participation in the study did or did not change your electricity consumption?

All respondents answered this question. Two respondents (F1 and F3) explicitly stated that their participation had changed their electricity consumption; four (C2, F2, N5, C3) stated that it explicitly had not. This question generated the most diverse set of responses, yet several themes repeated themselves.

Time of Use pricing: two respondents (O1 and F1) indicated that they attempted to use Time of Use pricing to influence their indicators. For example F1 stated: *“Changed because higher energy appliances were operated in the low rate hours...”*

Consumption awareness: F2, F3 and C2 indicated that the intervention was making them more aware of their electricity consumption. For example, C2 stated: *“I thought about my consumption more but I still had to wash the sheets if my son had an accident in the night etc. So I wasn’t able to change my habits too much.”* . F3 noted: *“The main influence of participation was to assist all members of our household to become focused on the issues. I would share our daily performance with everyone and it would influence their behaviours thus effecting our outcomes.”*

Proposed Modifications to Indicators: N1 indicated that the intervention would have been more effective given some modifications to the indicators. Suggested modifications from this participant included adding numbers and pricing to the indicators - perhaps representing kWh consumption and Time of Use pricing.

Message Effects

This question was designed to elicit information from respondents about group messages:

1)Did you receive messages from group members about your consumption rate changed during the study in the Comment Box? If so, what were the messages like? How did you react to the messages?

All respondents answered this question and indicated (with the exception of respondents from the Control group) that comments occurred in their groups. (This indicates that respondents were aware of the comments). The reports on what the messages were like were similar: three of the participants (N5, F2 and O1) indicated that the comments tended to be explanations for participants’ indicator statuses (indicating cohesion between this researcher’s coding and the participant’s understanding of the comments’ meaning). For example, N5: *“Most comments related to participants questioning why they got a sad face”* or O1: *“2 of the 3 of us entered comments*

as we had more sad faces than the third participant. It helped give reason for the sad faces and informed of similarities and differences in daily life.”

Only three respondents (N1, F1 and N5) explicitly answered the third part of the question, ‘How did you react to the messages?’. All indicated that they did not react to them.

Publicity Effects

This question was asked to determine if participants felt making their information public to others influenced their electricity consumption, as per the discussion on publicity (see section 1.4):

1) Do you think having your consumption rate changes visible to others influenced your consumption rates?

All respondents answered this question. Twenty-five % of respondents (F3 and O1) agreed that visibility influenced their consumption rates, while 75% of respondents (C3, N5, F2, C2, F1 and N1) said that no, this was not the cause of their energy consumption changes.

Of the 25% of respondents who agreed that having their consumption rates visible to others influenced their consumption rates, both respondents agreed that this influence was minimal: F3: *“Only because we all have a somewhat competitive nature and don’t want to be outdone by our neighbours when it comes to conservation ... ”* and O1: *“to a point but we continued to live daily.”*

Those who disagreed that this was a factor identified several possible reasons why it didn’t have an effect, including:

- the belief that they were already doing a good job so there was no need to change;
- lack of detail on the indicators; and,
- the fact that the other household members did not see the website/indicator.

Indicator Fairness

This question was designed to see how fair respondents thought the indicators were.

6) On a scale of 1-7, how fair do you think the ranking system was with the happy, neutral and sad faces? 1 is not fair at all, 4 is somewhat fair and 7 is extremely fair. i) If the system was not fair, why not? ii) If the system was fair, why was this so?

Seven respondents answered this question. Respondents overall thought that the indicator was fair. One of the two respondents (O1 and N5) who answered 4 (somewhat fair) included comments; The comment was: O1: *“Would have been helpful to know what transpired on the day it was compared to.”* Those who answered 6 were N1, F1 and F2 and two of the three respondents who answered 6 (fair) had comments: F2: *“As far as I can tell, it was fair...”* and N1: *“I think it was fair. I kind of knew my usage was steady for the weeks I was on. The day that the oven was used on a mid or peak period hurt my rank that day.”* Finally, those who answered 7 (extremely fair) were both in the Control group (C2 and C3) and had the following comments: C3 *“loved the happy/sad faces and the criteria for each was good...”* and C2: *“I liked the faces it kept it simple but there were days that I wondered how far away from a smile or a neutral face I was.”*

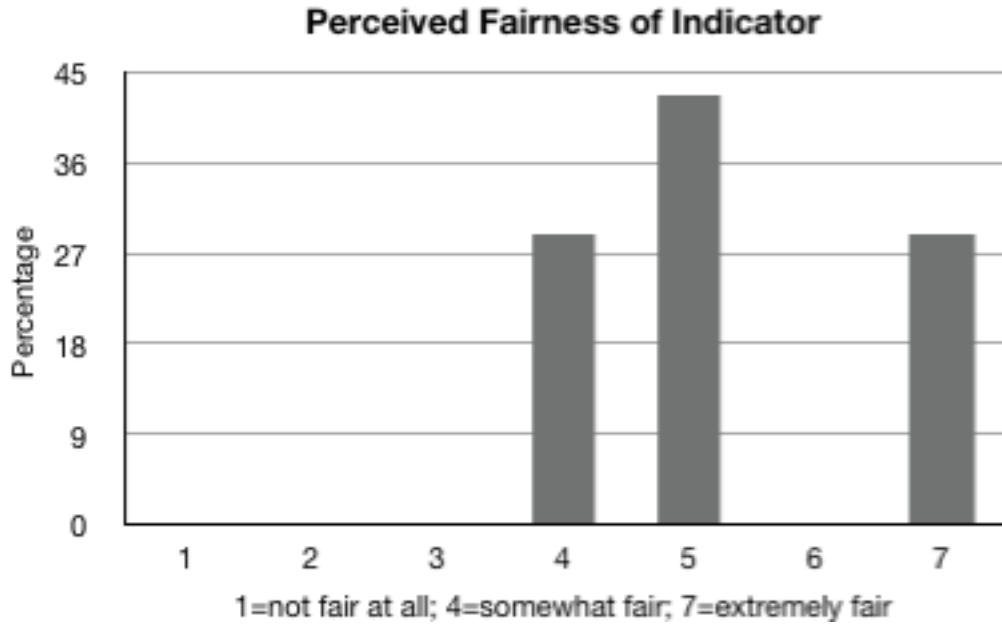


FIGURE 4.12 Perceived Fairness of Indicator

Other Influences on Consumption

Participants reported a variety of events and activities that they believed may have influenced their energy consumption during the intervention period:

1) Were there other things besides the website that influenced your consumption rates during the study period? If so, please list them.

Seven respondents provided responses. Four of the respondents (C3, F2, C2, F1) indicated No. Of the three who indicated positively (N5, N1 and O1), influences they listed included: having a household member at home during the day; the outdoor temperature; increasing the temperature settings at night; installing a plasma television; and changing the dishwasher setting to economy.

Energy Consumption Discussions

Participants were asked to self-report if they had spoken with members of their group outside the website about the study, in an effort to determine if there might have been additional group influence which wasn't captured on the website. All respondents answered this question:

1) Did you discuss this study with members of your website group outside of the website (i.e.: on the phone or in person?)

O1 and F3 indicated there had been occurrences where the study was discussed outside of the website forum. In addition, C3 discussed the intervention with his wife: *"She would interrupt my day at work to ask if we got a happy or sad face..."*

Positives About the Intervention

All eight respondents answered this question:

9) Please write down anything about your experience during the study that you particularly liked.

Social aspect: Three respondents (N5, F2 and N1) mentioned that they particularly liked the social sense of the experience: N5: *"I went to the site almost everyday. Was interested in what others had comments on."* and F2: *"Kind of enjoyed the sense of competition"* and N1 *"I liked that I could see 'neighbours' usages (in this case in the form of a face) to compare with how well or not well my household is doing."*

Indicators: Two participants (C2 and O1) commented positively on the indicators, including their simplicity as well as the fact that O1: *"finally {got} a happy face..."*

Challenges

This question was designed to elicit challenges with the study:

10) Please write down anything that you didn't like about your experience during this study, or anything you found confusing.

Six respondents answered this question. The following themes arose from their answers:

Baseline calculation: Two respondents (N5 and O1) indicated concerns with the baseline method: N5: *"I don't think the baseline method was clear to all participants"* and O1: *"Didn't have details of the daily activities from the past to figure out why we were rated happy, sad, neutral."* Another respondent C2 indicated that it would have been good to have comparisons with others who had similar household and house size.

Website operations: F2 indicated problems logging into the website at the beginning of the study; N1 indicated it would be nice to have an edit function available for participants to edit their own comments if needed.

Awareness of energy saving features

Respondents were asked if they were aware of energy savings features from Milton Hydro.

12) Are you aware of the energy savings features provided by Milton Hydro? If yes, which ones? If yes, were you aware of these before you began the study?

Six people responded. Two (F2 and C2) answered no; the other four indicated that they were aware of Milton Hydro's energy saving features (C3, F1, O1 and N1), and all indicated that they were aware of the programs before the study began. Those named specifically by participants included:

- flyers and energy savings tips;
- Time of Use pricing;
- Refrigerator Round Up; and,
- Peaksaver.

5. Analysis

This chapter provides an analysis of the three major research questions (detailed in Chapter 1) that were developed based on gaps in the academic research. It also provides analysis on a potential confounding variable, temperature effects, and seeks to examine whether it played a part in research findings. Finally, an issue that surfaced from both the literature and the data has also been included in this analysis - the rebound effect.

An important note on the analysis:

The original research design would have allowed for causal findings in this study, and the research questions reflect this focus. However, recruitment challenges to this design have precluded this possibility and causal findings *cannot be drawn from the data*. It is therefore especially important to keep in mind that these are *observational* findings, and that conclusions from comparisons between groups cannot be made, but the differences between groups can be remarked upon, which is what this analysis has attempted.

5.1 Research Question One

R1: Will those who have their energy use made public and subject to social norms decrease their energy consumption?

Background: Given new technological advances in residential energy consumption feedback, this speaks to whether feedback techniques should be used in a private or public manner to effect change. (It was not realized until after the study that social norms, embodied within the indicator as happy, neutral or sad faces, were given to all groups including the Control, and therefore cannot be analysed as the original question suggests).

As laid out in the literature review (Chapter Two) while research shows publicity effects on commitments and norms (Abrahamse et al., 2005, p. 276; McKenzie Mohr, 2009), findings from comparative feedback research is mixed and inconclusive (Fischer, 2007; McKenzie Mohr, 2009; Schultz et al., 2007). In addition, this author has been unable to find any research which specifically examines making energy consumption public in a group format, and therefore an exploratory approach to analysis has been chosen.

Findings: In order to examine Research Question 1, the analysis occurred between the Control group and all other participants. This was done because the Control group did not receive their energy consumption in a public fashion. Given general findings on public commitment and social norms, it might therefore be expected that the Control group's consumption would remain steady while all other participants (who were subjected to making their electricity consumption public) would evidence a minor decrease in their consumption levels.

Two analyses were done to examine this factor. The first (Figure 5.1) specifically compares the Control group to all other participants two weeks before the intervention and during the intervention period. This means that all participants were subject to the same weather patterns and other external factors. Findings from this analysis indicate that during the intervention period the Control group actually seem to have lowered their electricity consumption. (Before the intervention they had 1 day in the 25-30 range, 8 days in the 30-35 kWh range and 5 days in the 35-40 kWh range. In contrast, during the intervention they had 6 days in the 25-30 kWh range; 5 days in the 30-35 kWh range and 3 days in the 35-40 kWh range. This might be caused by the Hawthorne Effect: this is a confounding variable that is an "Effect on human performance caused solely by the knowledge that one is being observed" (Coolican, 2006, p. 271). In other words, the Control group may have thought that their consumption was being made public solely by virtue of being involved in the study.

The Other Participants (all others besides the Control) did not seem to experience such a shift. The two weeks before the intervention they had 8 days in the 20-25 kWh range; 4 days in the 25-30 kWh range and 2 days in the 30-35 kWh range. This distribution remained the same during the intervention. This lack of effect may have partly been caused by Self Selection bias:

Researchers also studied conservation programs and recognized limitations in conservation programs because energy use data are based on volunteer families. Self-selection bias may result in the measured savings being a function of the participant characteristics and not the program design. Participants might reflect a strong bias toward energy conservation and thus not be representative of energy use patterns of "typical families" (Keating, 1989; Turner & Gruber, 1988)" (Guerin, Yust & Coopet, 2000, p. 54).

This interest may have already led these participants to enact conservation activities, leaving them with not much room to decrease their consumption. “Hence, it is possible that some findings...are related to the characteristics of the biased sample (e.g.. of volunteers)...” (Coolican, 2006, p. 26).

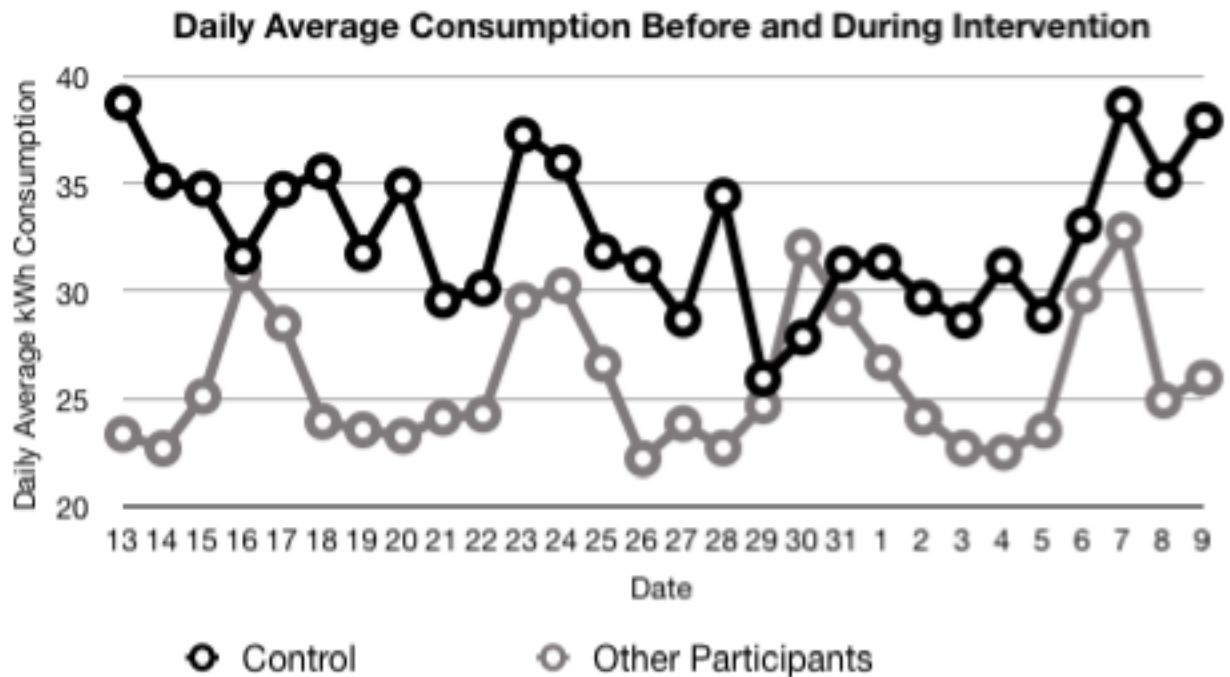


FIGURE 5.1 Publicity Effects

Control N=3

All Other Participants N=14

Average Control kWh Consumption: 32.78

Average All Other Participants kWh Consumption: 25.9

Figures 5.2 and 5.3 examine the Control group and the Other Participants from 2009 to 2010; there does not appear to be a large difference in consumption between 2009 and 2010 for either of the two sets of groups, perhaps indicating again that making consumption public did not have an effect on its levels. This is consistent with Fischer's (2007) findings that normative comparative feedback did not have significant effects on consumption levels (p. 1880).

In addition, analysis was also done on each participant's daily consumption levels, (looking at the difference between the intervention period and the baseline period). This analysis also suggests a lack of effect.

mean	-0.76952941
stdev	9.204919304
sterror	0.576434407
upper limit	0.360282025
lower limit	-1.89934085
minimum	-24.05
maximum	33.59

TABLE 5.1 Difference Between Intervention Period and Baseline Period By Participant by Day

(Of note is that changes to household size and home improvement projects (adding a furnace or insulation) occurred for several participants, which may be a potential confounding variable in analysing the data this way. Household size had changed for the following participants: N5, S2, F3 and F2. Renovations had occurred for participants O2 and N1. The only group therefore which may not have been affected by this as a confounding variable was the Control group).

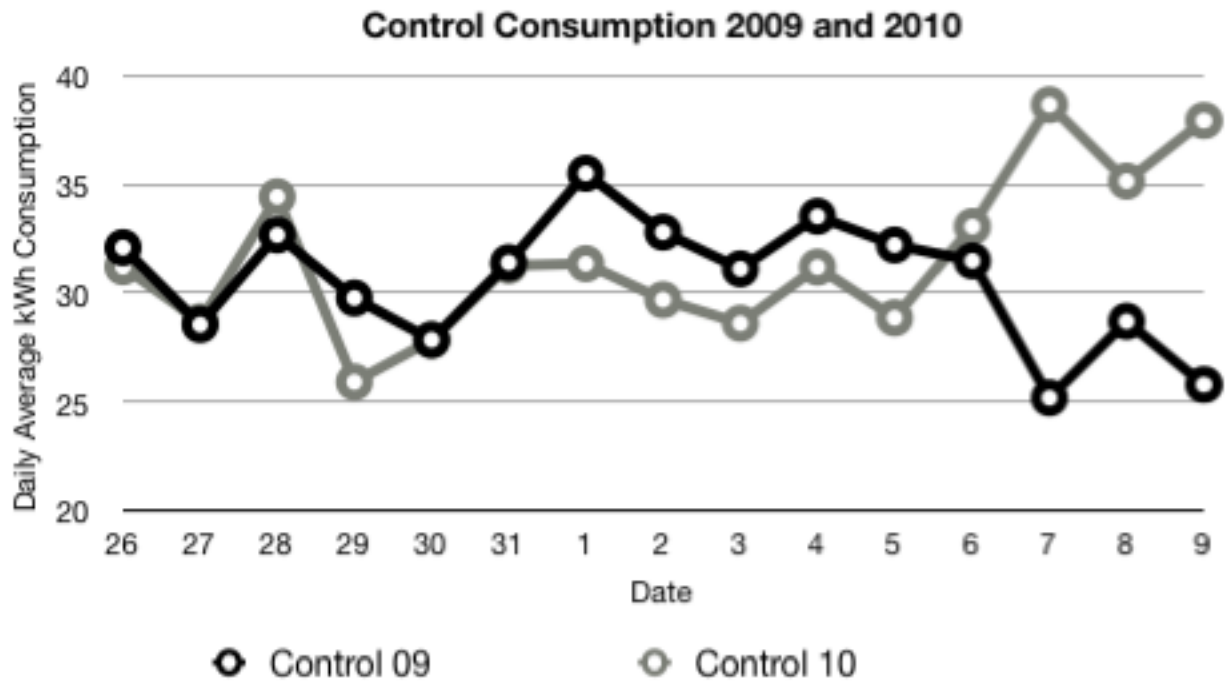


FIGURE 5.2 Publicity Effects 2009-2010 Control

Control N=3

2009 Overall Average: 30.66 kWh

2010 Overall Average: 31.66 kWh

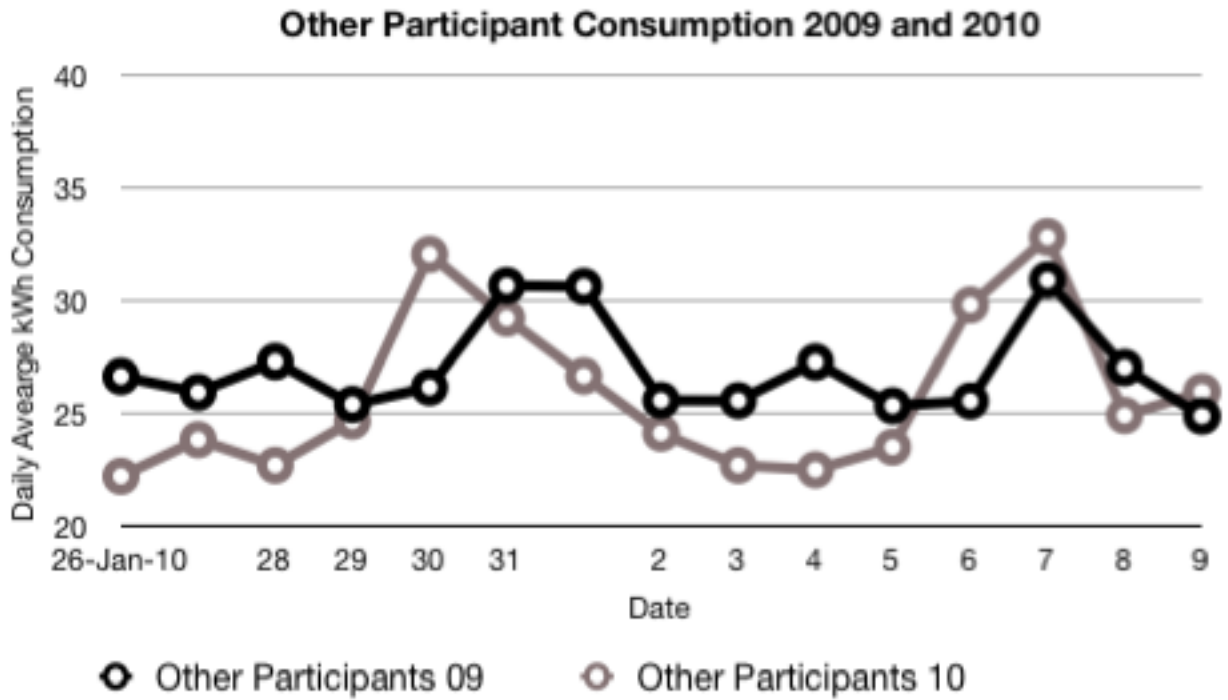


FIGURE 5.3 Publicity Effects 2009-2010 All Other Participants

Other Participant N=14

2009 Overall Average: 27.05 kWh

2010 Overall Average: 25.9 kWh

5.2 Research Question Two

R2: Will energy consumption decrease more in groups with strong ties as opposed to groups with weak ties?

As noted in chapter three, the groups with strong ties in this study have been identified as the Faith and Neighbour groups; the groups with weak ties in this study have been identified as the Occupation and Stranger groups.

Findings: When the average kWh consumption is broken out by day and group, it appears that the groups with strong ties were more likely to consume less electricity than those groups with weak ties. However, this does not appear to be an effect of the intervention, as Figure 5.4 shows similar consumption patterns before the intervention. When comparing 2009 to 2010 figures for strong and weak ties, it appears that the weak ties had 9 days where the groups consumed less than 2009 levels; the strong ties also had 9 such days. Again, there does not appear to be a large difference in consumption between 2009 and 2010 for either of the two sets of groups, perhaps indicating that tie strength did not have an effect on consumption levels. (Had a group been comprised using self-identified strong ties rather than a positional strategy this might have evidenced different findings; more research is needed).

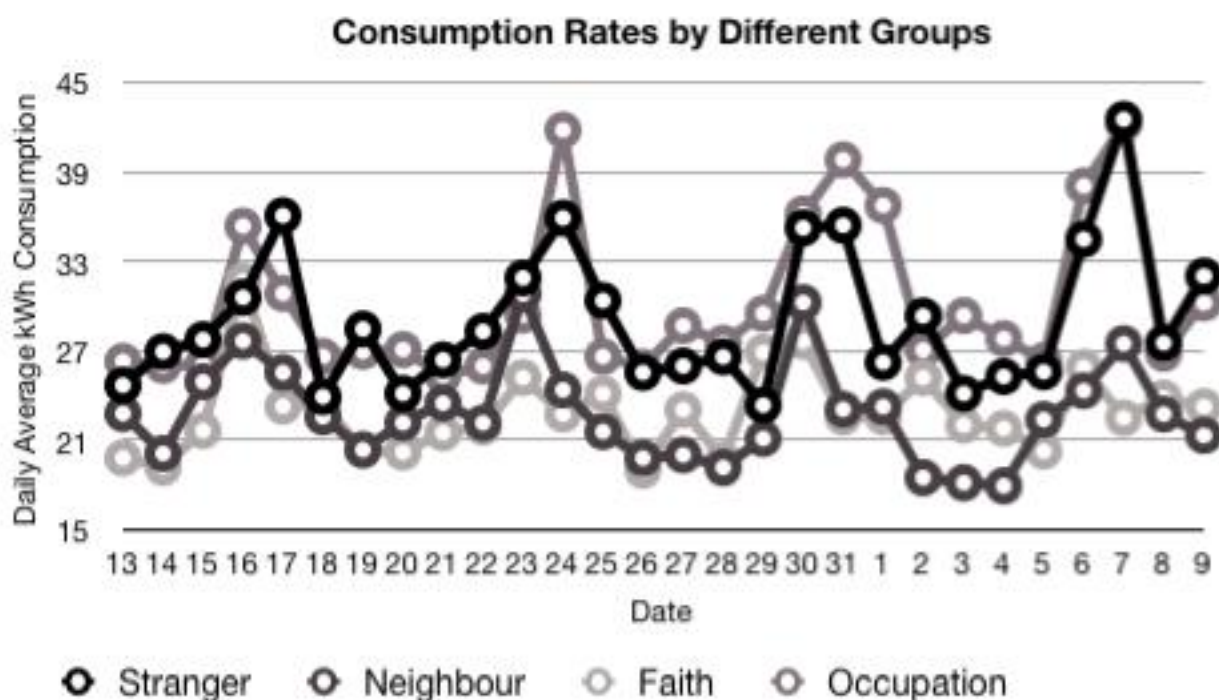


FIGURE 5.4 Strong and Weak Tie Effects on Consumption

Faith Average kWh consumption during period: 22.99

Neighbour Average kWh consumption during period: 22.88

Stranger Average kWh consumption during period: 29.18

Occupation Average kWh consumption during period: 30.32

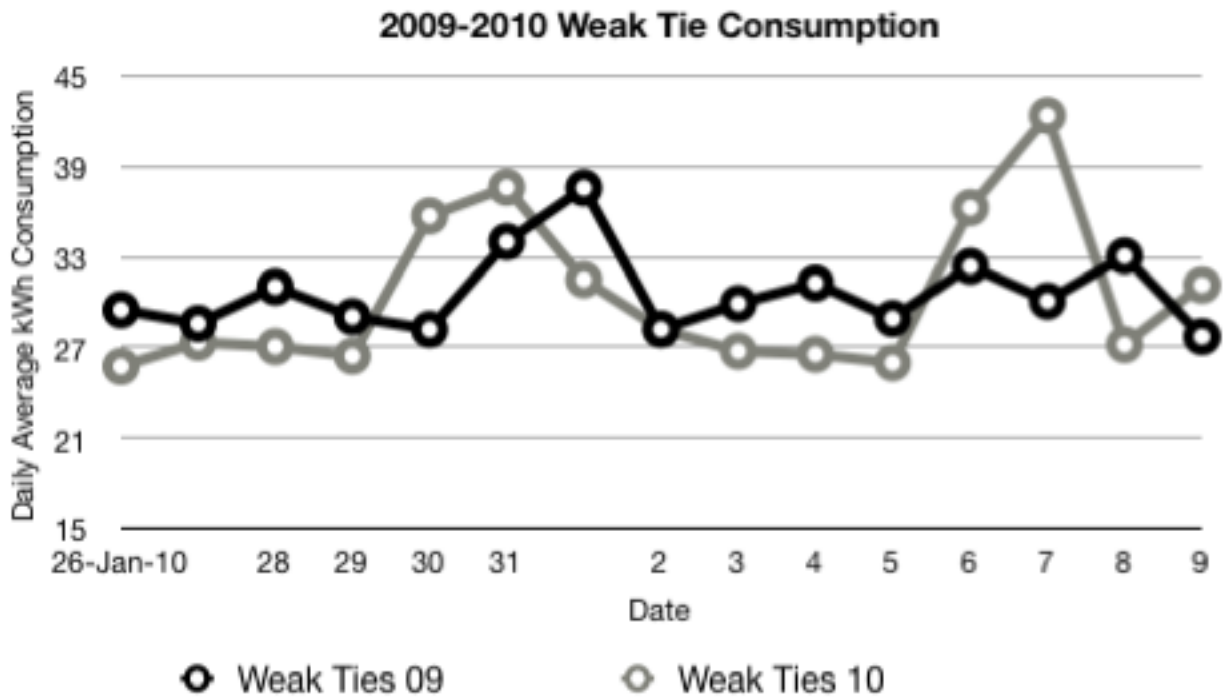


FIGURE 5.5 Weak Tie Comparison Between 2009 and 2010

2009 Overall Average: 30.71 kWh

2010 Overall Average: 30.47 kWh

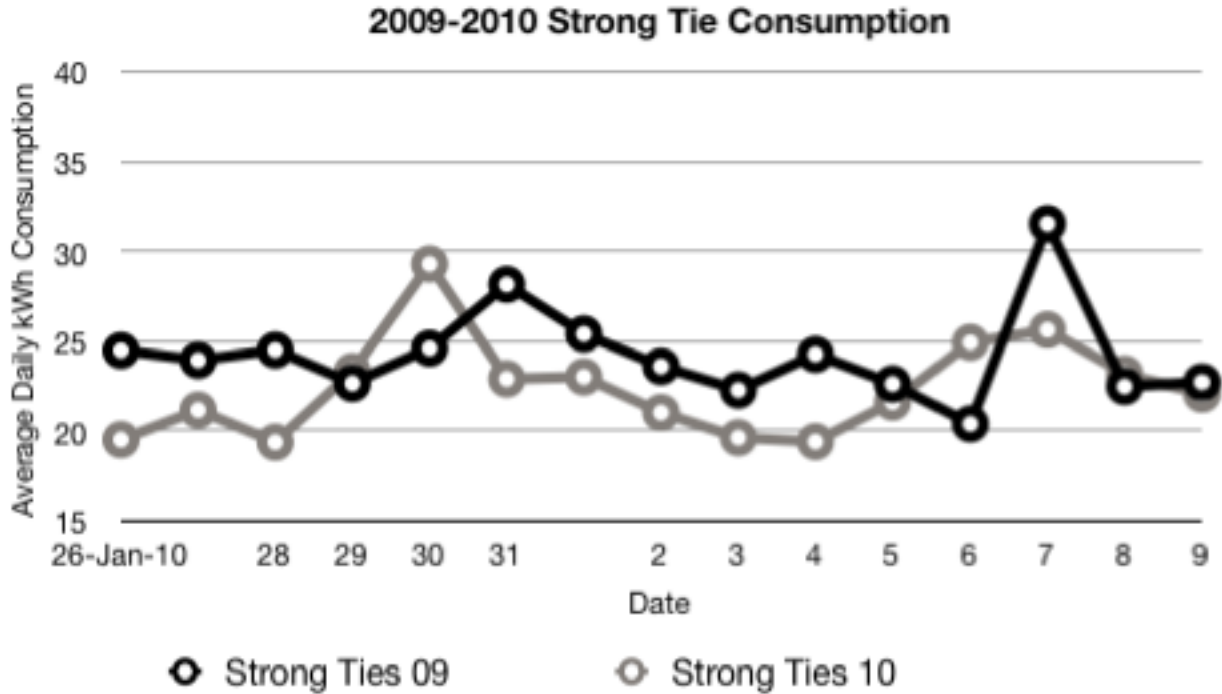


FIGURE 5.6 Strong Tie Comparison Between 2009 and 2010

2009 Overall Consumption: 24.31 kWh

2010 Overall Consumption: 22.47 kWh

5.3 Research Question Three

R3: Do group members use injunctive social norms to comment on energy behaviours? If so, do they have an effect on participants, either attitudinally or behaviourally?

As detailed in chapter two, injunctive social norms are defined as “...perceptions of what is commonly approved or disapproved within the culture” (Schultz et al, 2007, p. 430). They were coded in the Comment boxes using latent coding techniques (see section 3.5 for a full explanation of this). Comments were labeled as using injunctive social norms if they communicated an approval or disapproval message.

Findings: The finding in response to the first part of this question indicates that while injunctive social norms were used (a total of 29 injunctive norm comments as recorded by on-line comment boxes) they were directed by participants to *themselves* instead of others in the group (See Appendix 3.2 for a full chart of the comments - injunctive comments were designated as type A or E). Examples of such comments include: 1) N3: “*apparently I suck at this ... I can't imagine that we're using more - the same maybe, but not more.*” 2) O1: “*My excuse is baking valentine cookies. Baking is a rare occasion.*” 3) “*O3: Might have to stop exercising! Treadmill = Sad Face :(NO Treadmill = Happy Face :)*” This self-directed messaging appeared in *all* groups except for the Strangers and were only directed at the self. (However, it is important to note that due to recruitment challenges this study was not able to specifically recruit a group of self-identified friends with strong ties. Perhaps with the closeness of these sorts of ties other-directed injunctive norm comments would have appeared. More research is needed).

Given that injunctive social norms were used by participants, the second set of findings examine whether the injunctive social norms had attitude or behavioural effects. Behavioural effects were examined three ways. The first way (Figure 5.7) looks at the total number of participant’s injunctive comments associated with their average kWh consumption. This examines the propensity to make injunctive comments and consumption during the intervention period. The second (Figure 5.8) looks at the total number of participant’s injunctive comments associated with their change in consumption from 2009-2011. The final figure (5.9) looks at the total number of injunctive comments and the total number of happy face indicators.

In Figure 5.7, it appears that those who made more injunctive comments had lower average kWh consumption rates during the study period, as those with no injunctive comments ranged from 20-50 kWh while those with two or more comments ranged from 20-30 kWh.

However, in Figure 5.8, it appears that those who made more injunctive comments did not evidence more or less consumption differences than those who did not make any injunctive comments. And in Figure 5.10, more injunctive comments do not appear to be associated with an increase or decrease in the number of happy faces.

This suggests for Figure 5.7 that there may be a association between the average overall consumption level and the amount of injunctive social norms used by participants during the study period. For the latter Figures 5.8 and 5.9 an association between injunctive norms and consumption differences and happy faces does not seem to occur and suggests that: 1) self-disclosing injunctive norm transmission does not seem to influence these behaviours; or, 2) there are confounding variables with these measures which need to be controlled in further research such as whether group members *read* the comments; or 3) that other measures need to be chosen. Further research will be needed to explore these points.

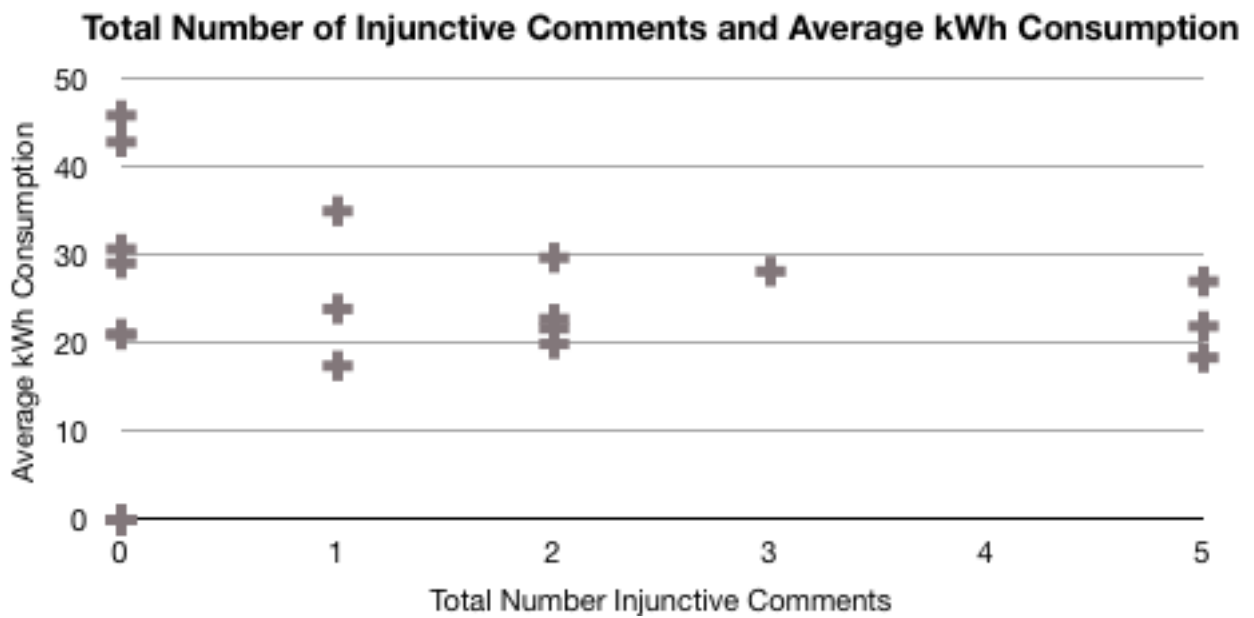


FIGURE 5.7 Injunctive Comments and Energy Consumption

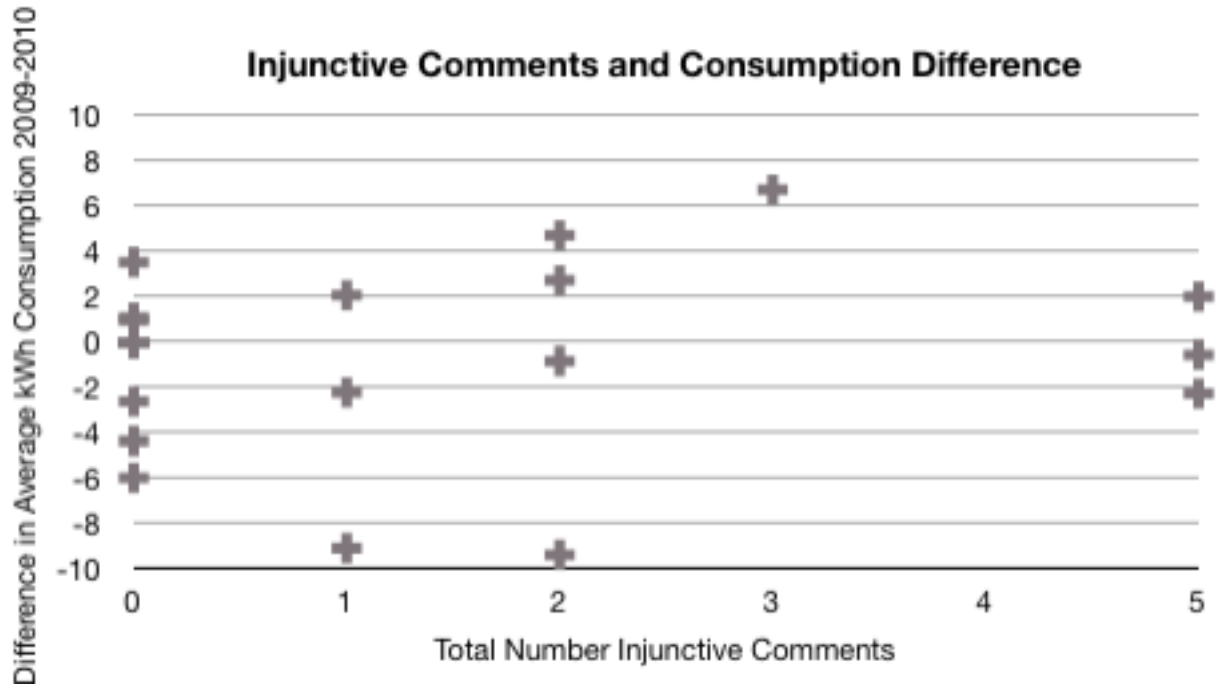


FIGURE 5.8 Injunctive Comments and Average Difference in 2009-2010 kWh Consumption

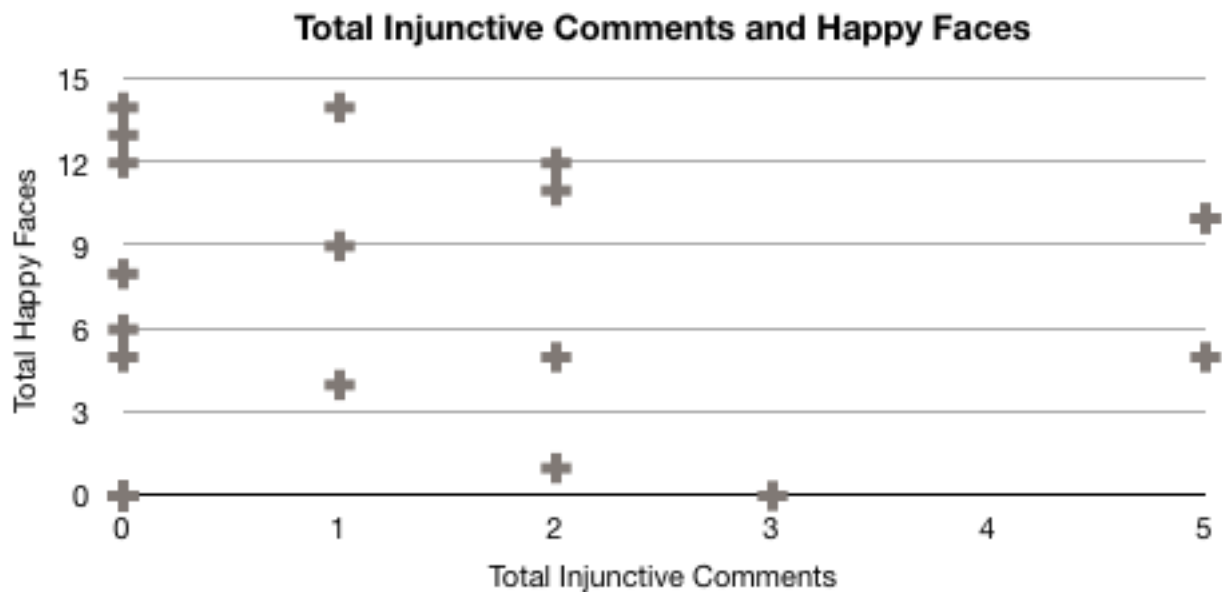


FIGURE 5.9 Injunctive Comments and Happy Faces

Attitudinal analysis was examined by looking at responses to Question #3 of the questionnaire which asked: “Why do you think your participation in the study did or did not change your electricity consumption?” Four respondents indicated in their answers that they thought more about their consumption as a result of their participation in the study: C2, C3, F2 and F3. Of these participants, C3 had not expressed any injunctive comments; C2 and F2 had expressed one injunctive comment each and the final participant F3 had expressed four injunctive comments. More research is needed with more participants to discern if there is a relationship between attitudes and injunctive comments.

5.4 Research Question Three A

R3A: If group members use injunctive social norms to comment on energy behaviour, is there a correlation between tie strength and signaling?

Background: This question is a sub-question of the third question and attempted to examine whether there might be a relationship between tie strength and signaling about energy behaviour.

Findings: Figure 5.10 seems to reveal that the closer the ties in the group the more injunctive comments there were. A possible explanation lies in the function of ‘self-disclosure’ in groups which have stronger ties: “More strongly tied pairs include in their exchanges..more self-disclosure...” (Haythornthwaite, 2002, p. 386).

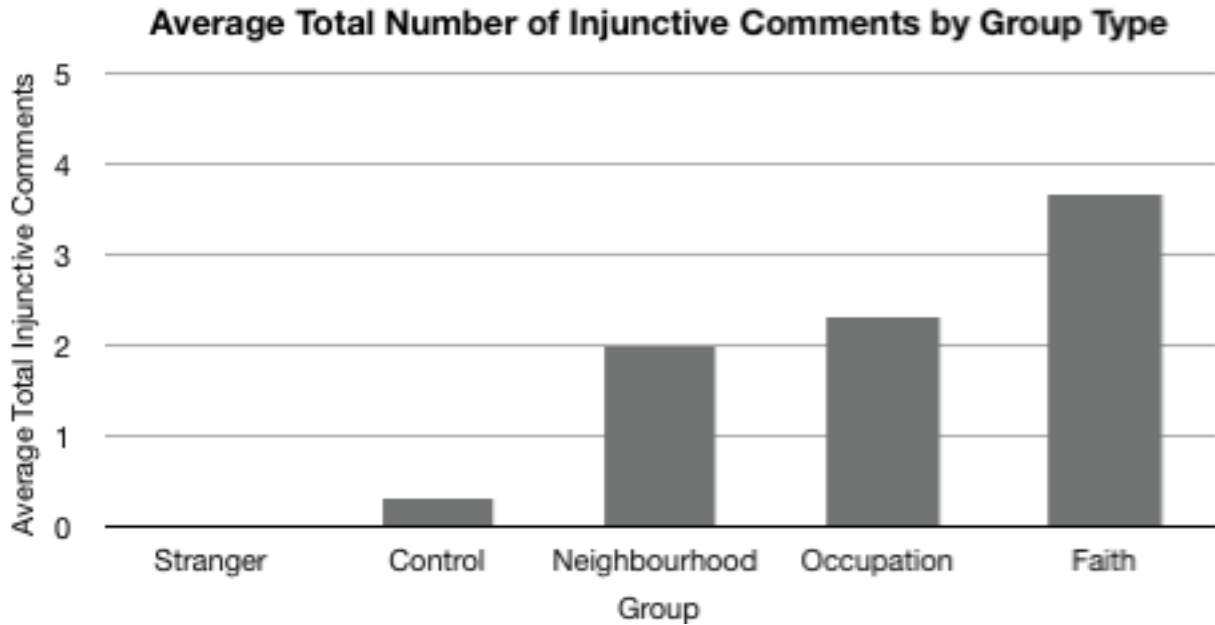


FIGURE 5.10 Injunctive Comments by Group

Maximum Number Injunctive Comments by Any Individual: 5

Minimum Number Injunctive Comments by Any Individual: 0

Average per participant: 1.67

5.5 Temperature as a Potential Confounding Variable

Although this was not explicitly a research question, the question of outdoor temperature influence on energy consumption has been a concern for this study. Weather correction in the data analysis was considered but not possible due to time and budget constraints. In addition, “The month of February 2010 had a monthly Ontario demand of 11,753 GWh. This is the lowest Ontario demand for electricity of any February since the market opened in 2002...the result of the economic recession, conservation efforts and milder temperatures...” (IESO, Retrieved April 16, 2010).

Although the average temperatures during the 2009 and 2010 periods were similar (see Figure 4.4), this does not give the full story. The baseline was calculated over January 26-February 9, 2009. This represents energy consumption levels during the average temperature for this time period, which was -5.17 degrees Celsius. The difference between daily temperatures in 2010 and the average 2009 temperature implicitly captured in the

baseline might effect indicator status. For example, if the 2010 temperature fell to -15 degrees Celsius one night, this might result in more sad indicators as this would represent a difference of -10 degrees between the baseline temperature and the 2010 temperature. Given that people might be more inclined to turn up their heat the colder it got, this might have an effect of more sad faces. Therefore a reasonable assumption might be that the greater the difference between the 2009 average temperature and the actual daily 2010 temperature the more of an effect this would have on indicator status. Specifically, the colder it was in 2010, the more sad faces participants would obtain, while the warmer it was the more happy faces participants would obtain in the absence of any factor changes, such as household size or renovations across the two years.

As per Figure 5.11 below, this may have occurred on a minimal basis. Results show that for below 0 degree differences, happy faces occurred between 3-6 times on one occasion, between 6-9 times on two occasions and between 9-12 times on four occasions. However, when looking at above 0 degree temperature differences, happy faces occurred twice in the 12-15 time range, four times in the 9-12 range and once in the 6-9 range.

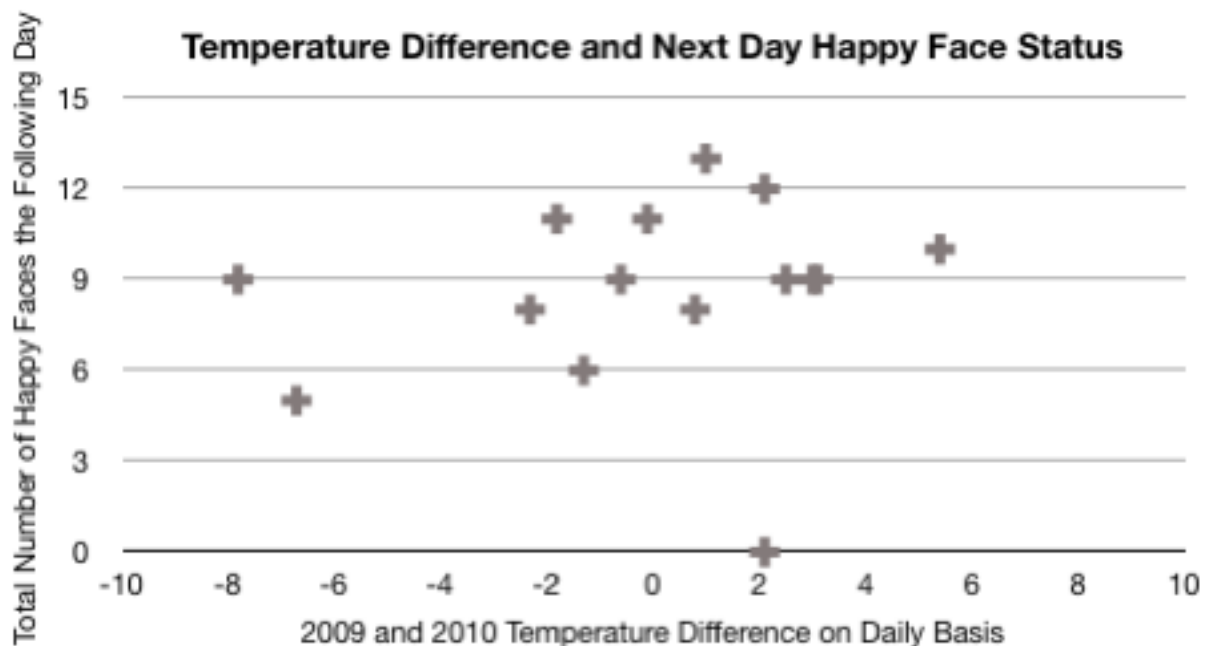


FIGURE 5.11 Temperature Effects on Happy Face Status

5.6 Rebound Effect

The rebound effect occurs when low energy consumers perceive that they have room to improve their energy comfort as a result of feedback measures and therefore increase their energy consumption as a result of these feedback measures (Fischer, 2007, p. 1877). Initial results from this study seem to indicate that those who obtained happy faces did not rebound: of seven participants who obtained at least five happy faces in the first week (F1, F2, N2, N4,, O2, S3 and C1), they obtained five or more happy faces the next week. If a rebound effect were to occur, these participants might have received more sad faces the second week as they realized they had room to increase their consumption levels. For example, F2 opined “*It made me aware of how I was doing (which was quite well) so I didn't feel the need to change much. I did however feel motivated to keep up the good work...like I was in a competition or something!*””. (It is however, important to note that two of these participants - O2 and F2- had experienced either a household renovation or a change to household size between 2009 and 2010 which may have been a confounding variable).

6. Conclusions and Recommendations

Having examined electricity consumption from an exploratory, social influence perspective, two main foci emerge for conclusions and associated recommendations: one linked to the original research questions and one linked to new directions that arose from the data.

6.1 Research Question Conclusions

A) Following Question R1, the data suggests publicity did not seem to be related to electricity consumption decreases. Possible reasons for this include, as mentioned in earlier sections, the mild temperature in February impacting consumption levels, or the potential self-selection bias of the participants.

B) Following question R2, the data suggests that tie strength does not appear related to electricity consumption decreases. Possible reasons for this, as mentioned in earlier sections, includes the fact that the groups were constructed through a positional social network strategy.

C) Following question R3, it appears that injunctive norms were used by the participants to comment on electricity behaviours, but that these comments were only directed at the self. Moreover, the research suggests it is unclear whether attitudes or behaviour are linked to the expression of these injunctive comments.

D) Following question R3A, data seems to indicate that the closer the ties in a group, the more injunctive comments there are. As previously mentioned, this may be a function of ‘self-disclosure’ in groups with stronger ties.

6.2 Other Conclusions Arising from the Data

A) As detailed in section 4.5, participants did not seem to know what behaviour was driving their electricity consumption.

B) It appears that several participants were unaware of how the indicator was structured (see section 4.5). For instance, one participant thought it was based on pricing rather than consumption; others seemed to think it was based on the previous two weeks prior to the intervention.

C) Associated with B above, two participants tried to use TOU pricing to influence their indicators (see section 4.6). In addition, respondents seemed aware of TOU pricing and in some cases sought to use it as a tactic to influence their indicators. For example, in response to the questionnaire N1 stated: *“I think it was fair. I kind of knew my usage was steady for the weeks I was on. The day that the oven was used on a mid or peak period hurt my rank that day.”*

D) Participants lived in households which may have had impacts on study results. For example, C3’s wife *“...would interrupt my day at work to ask if we got a happy or sad face (we got more sad faces than happy faces).”* Another participant (F3) noted that *“The main influence of participation was to assist all members of our household to become focused on the issues. I would share our daily performance with everyone and it would influence their behaviours thus effecting our outcomes.”*

6.3 Recommendations

Recommendations fall into two main areas; methodological recommendations related to study design, and secondly, new directions for research arising from the findings.

6.3.1 Methodological

This research laid out a framework for inquiry - for those who might wish to pursue the framework further, suggestions for improvements are detailed below.

6.3.1.1 Link Indicators to Aggregated Feedback

As mentioned above in 6.2A, participants did not seem aware of what behaviours were driving their electricity consumption and therefore how they could decrease that consumption. Their comments also indicate that they had their own understanding of how electricity is used and what causes most

electricity consumption. This is generally referred to as ‘folk knowledge’ in the literature, and tends to differ from established ‘expert’ knowledge. For example, the majority of Ontarians think that the best way to conserve energy is by turning off lights and buying energy efficient appliances. Only 3% of these respondents thought that using a smart meter or timed thermostats would considerably conserve energy (OPA, 2007, p. 25). This corresponds to conservation behaviours that took place during California’s 2001 brownouts (Lutzenhiser Gossard & Bender, 2002, p. 158) and may relate to the way that people process information. (For example, lights are the most visible and tangible symbol of electricity in many households).

Questionnaire responses indicated that participants would have welcomed more detail. For example, one participant (O1) stated regarding fairness of the indicator that it “ *Would have been helpful to know what transpired on the day it was compared to.*”

This is consistent with other research findings. As Fischer (2007) writes:

Kempton and Layne (1994) equate consuming electricity to shopping in a grocery store in which no individual item has a price marking, and the consumer receives a monthly (or, in many countries, even annual) bill on an aggregate price for “food consumption”. She has no idea how, when, or by which appliances electric current was used. Nor is she informed whether her consumption is relatively high or low (which could stimulate a search for reasons), or whether it has increased or decreased (and thus, whether her actions had any effect) (p. 1874).

Providing feedback which is disaggregated by appliance type may be useful (see Google’s PowerMeter for a case in point). This sort of feedback “...is almost the only way of establishing consciousness of the relevance of *individual* actions” (Fischer, 2007 p. 1876, emphasis in original). Incorporating such a breakdown with a public social norm based indicator might be more effective in lowering consumption rates. In addition, “Reliable data for the effectiveness of appliance specific breakdown, again, is difficult to find” (Fischer, 2007, p. 1880); pursuing such research would certainly fill a research gap.

6.3.1.2 Use a Relational Social Network Strategy

Possible reasons for the findings in 6.1.B related to R2 included the use of a positional social network strategy, which saw the identification of group tie strength based on secondary research rather than participant's self-reports. It is therefore recommended that future iterations of a study use the social network generation tools identified in the introduction (Section 2.2.4.1) to produce a group with self identified strong ties. Such a group might behave differently in a study and produce results that would help to answer R2.

6.3.1.3 Correct for Temperature

Temperature correction was not possible for this study due to budget restrictions. However, as detailed in Section 5.5, data suggests temperature may have influenced electricity consumption. This, coupled with the fact that this was the lowest February for electricity consumption on record may have contributed to the results that initially seem to indicate a lack of relationship between publicity and electricity decreases (in other words, the temperature may have acted as a confounding variable). Weather correction is therefore advised for future studies in order to separate out temperature as a possible confounding variable.

6.3.1.4 Make Households Part of the Study Design

Although single households are an increasing trend in Canada (Statistics Canada, 2008c), "...most homes have multiple occupants, and systems will need to account for multiple users and all the complexity this creates...." (Davidoff, Lee, Zimmerman & Dey, 2006, p. 2). This was reflected in Section 6.2D which details how some participants interacted with their households in the study.

In addition, research indicates differences in energy consumption based on household composition: "Ritchie, McDougall, and Claxton (1981) showed that the age of the household head was positively

related to energy consumption. Morrison et al. (1978) found that house holds in the middle life-cycle stage used more energy than younger or older families” (Guerin et al., 2000, p. 61).

Given that participants did not necessarily live alone, and all members of the household contributed to the electricity consumption, it would make sense to:

- a) expand the pool of participants to all household members; or
- b) build in a function of the study which sees some sort of communication mandated to all members of the household to ensure consistency in indicator effects. (i.e.: via an in-home indicator status).

6.3.1.5 Ensure Participants Understand Rationale for Indicator

Participant comments and answers to the questionnaire (section 6.2B) indicated that some were not aware of how the indicator operated. For instance, one participant thought the indicator was based on pricing rather than consumption; others seemed to think it was based on the previous two weeks prior to the intervention.

A potential mitigation strategy for this would be to have participants read a short paragraph and fill out a short (2-3 questions) questionnaire on the indicator as a pre-participation requirement.

6.3.2 New Directions for Research Emerging from Findings

6.3.2.1 Research Cultural Expressions of Injunctive Norms Related to Electricity

Cross cultural research into energy consumption is important because it speaks to how different cultures understand and use energy (for a start, see Wilhite, Nakagami, Masuda, Yamaga and Haneda,(1996); also Lenzen, Wier, Cohen, Hayami, Pachauri and Schaeffer, (2006). However, this field is underrepresented and “Another research gap is the lack of international comparative studies....there may be wide cultural and national differences not only in preferences *but also in the kind of information* that is effective in stimulating conservation.” (Fischer, 2007, p. 1882, emphasis mine).

Findings from this study, as outlined in Section 6.1C indicated that injunctive norms were consistently directed at the self as opposed to others. These norms are a form of communication that transmits information not only about a topic but how to act or think in relation to that topic; they represent "...perceptions of what is commonly approved or disapproved *within the culture*." (Nolan et al., 2007, p. 430, emphasis mine). The question then becomes, do these findings represent a specific cultural expression of injunctive norms related to energy? (Canadians are notorious the world over for their politeness). Do other cultures have different ways of expressing injunctive norms about energy consumption in group settings? (For example, would a similar study run in another country yield other-directed injunctive comments?) Are these expressions more or less effective at reducing energy consumption?

The use of injunctive social norms in a comparative international study to examine the type of information which stimulates conservation might therefore be useful. More research is needed.

6.3.2.2 Research Efficacy of Indicator to Encourage TOU Pricing

This study did not engage with TOU pricing (see Section 3.3 for a full discussion of the decision to proceed in this fashion). In fact, the original sampling structure sought to exclude those who had gone on TOU Pricing after April 2007, as it was thought that this would be a confounding variable. (Pricing is a known incentive (Faruqui and Sergici, 2009, p. 1)).(Because the first sampling structure had to be abandoned this exclusion was not completed). Nevertheless, as outlined in Section 6.1.6.1 participants seemed aware of TOU pricing and in some cases sought to use it as a tactic to influence their indicators.

This indicates that some participants were willing to cognitively link the indicator to TOU pricing and that further research into this area may hold promise. The efficacy of a public, norm-based indicator used to provide feedback to participants on TOU pricing might be advantageous to those in the energy conservation fields.

6.4 Final Comments

This study realized a gap in energy consumption research and attempted to examine this gap from an exploratory social influence perspective. Findings have indicated that participants thought the indicator used was fair and that engagement with the project increased among groups with strong ties. These are findings which may prove useful to those attempting to leverage normative, public, comparative feedback for energy consumption decreases.

The findings also point to more questions. Would a larger and more consistent sample have yielded indications that publicity and tie strength impact electricity consumption in normative feedback comparisons? Would adding appliance specific information about electricity consumption to the indicator result in more electricity consumption decreases? Would the indicator influence people to switch to TOU pricing strategies? These would all be fruitful areas for future research.

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Appendices

Website

Energy Pool Comment Box Community Guidelines

The following guidelines have been created for the study regarding use of the Comment Box feature.

What to do

There will be various types of people on your website and everyone should feel comfortable taking part. Not everyone will think what you think or believe what you believe. Please be polite and respectful in your comments and postings with other members.

What not to do

- Don't post or link to content that is illegal or is prohibited.
- Don't harass, abuse, impersonate or intimidate others.
- Don't use the Comment Box for commercial purposes.

The Energy Pool Comment Box is for personal use only. Do not sell products or services through the Comment Box.

Play Safe

Don't post or link to any information or material which contains a virus, cancelbot, trojan horse, worm or other harmful component.

Here are some other things to keep in mind:

You may see all sorts of comments in the Energy Pool Comment Box. If you are offended by a comment you can either click away or report this to the research team by contacting Mary Beth Deline via the 'Report Abuse' link at the bottom of the page. You can also reach Mary Beth by phone at 226.868.1414 or e-mail at

medeline@uwaterloo.ca

Recruitment

Mailout Package

A) Information Letter to Customers:

Dear Customer:

You are invited to participate in a study that Milton Hydro is undertaking in collaboration with Professor Ian Rowlands and Mary Beth Deline, a graduate student in the Department of Environment and Resource Studies at the University of Waterloo. This research will help us to better understand factors that support electricity conservation efforts.

Participation in the study is voluntary and will require less than half an hour of your time between now and the middle of December. To participate in the study, you will be asked to:

- Complete a consent form and fill out an on-line eligibility questionnaire;
- View a website daily for one month. The website will either be a group website with up to nine other members or a single website which only you will be able to view;
- Answer a questionnaire about your experience viewing the website.

Additional details about the study are described in the attached information letter.

If you wish to take part in this study, please go to the on-line consent form at <http://energypool.org/consentform.html> or fax the attached form to the researchers at (519) 746-0292.

Please read the qualifying criteria in the information letter as participation in this study cannot be guaranteed. Once you have completed the consent form you will be directed

to an eligibility questionnaire.

Please note that in order to participate in the study you must consent to allow Milton Hydro to release your named electricity consumption information from 2008 up until, and including, the study period to the researchers. The researchers will then use this information to create an 'electricity indicator' for the website which will display the level of your daily electricity consumption compared to your own consumption in 2008 via happy, sad or neutral faces. If you are placed in the group website then this indicator will be displayed to yourself and other group members; if you are placed in the single website only you will be able to view this indicator. (An image of what the website will contain can be found in the letter from the researchers.) Only with your permission will Milton Hydro provide this to the researchers.

The final decision about participation in the study is yours alone and your decision regarding participation in this study will not impact your relationship with Milton Hydro in any way. If you have any questions about Milton Hydro's involvement in the study please contact 905-876-4611 (phone) or customerservice@miltonhydro.com (e-mail). This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo.

I thank you for your time and hope you will consider participating in this interesting study. Enclosed please find more information about the study from the researchers.

Sincerely,

Frank Lasowski

CEO

B) Information Package from Researchers

Dear Milton Hydro Customer:

Please allow me to introduce myself; my name is Mary Beth Deline and I'm a Masters student in the Department of Environment and Resource Studies at the University of Waterloo conducting research under the supervision of Professor Ian Rowlands on residential electricity conservation. We would like to provide you with more information about a study we are conducting within the Town of Milton and what your involvement would entail if you decide to take part.

Study Overview

We are investigating ways to encourage electricity conservation. In Canada, opportunities are now available through emerging technologies to make residential electricity consumption visible and group oriented, yet research is scarce on the potential effects of doing so. We are also investigating what clusters of groups are more likely to encourage electricity conservation - close friends, acquaintances, neighbours or a random group of individuals. By using websites to make electricity consumption differentials visible and group oriented we hope to better understand what factors will encourage people to conserve electricity. Participation in this study is voluntary, and in total will take less than half an hour of your time. You may decline to answer any questions presented during the study if you so wish. Further, you may decide to withdraw from this study at any time by advising the researchers, and may do so without penalty.

Phase 1 - Eligibility Questionnaire

After filling out the consent form you will be asked to complete a brief questionnaire hosted on a Canadian website called fluidsurveys.com to determine if you are eligible for the study. Completion of this questionnaire should take no more than 5 minutes. To

participate in this study, you must :

- **be 18** years of age or older;
- **own** and reside in **your own home**;
- **provide your name, address, phone number and e-mail address** to the research team for purposes of contacting you throughout the study period;
- **provide information** to the researchers about whether you have had or are **planning any major home renovations**;
- **provide information** to the researchers about whether you have had or are **planning to change the size of your household**.

In addition, you will need to:

- **agree to be assigned to an online social network** that may consist of either your friends and/or acquaintances, a random group of other participants involved in the study, or a group where you will be the only person in the network. A group of neighbours may also be formed if there are enough participants to do so.

The neighbourhood groups would be identified by entering all participants' addresses who have successfully completed the eligibility survey into Google Maps by the researchers. Those who fall within 1 kilometer of each other will be grouped together into neighbourhood 'clusters' and would form a neighbourhood group.

- **agree to allow Milton Hydro to provide the researchers with your electricity consumption readings from your Smart Meter beginning from the year 2008** to create an "electricity indicator" consisting of a happy, neutral or sad face as shown on page four. The indicators will be created based on changes in your average daily electricity consumption. In order to facilitate accurate Smart Meter data from Milton Hydro we ask that you include, if you know it, your Milton Hydro account number on the consent form, or the number which is written on the right upper hand corner of the label of the envelope in which this package arrived. In

addition, if you are not the official Account Holder with Milton Hydro but live in the Account Holder's household and would like to participate in the study, the

Account Holder must indicate their consent to this via the consent form;

- agree to have your "electricity indicator" updated and posted daily on a password protected Canadian website hosted on Zenutech.com. Electricity indicators will be visible to other study participants in your network group as well as the research team; and,

- **agree to receive a daily e-mail** from the research team to remind you to view the online social network website.

If you are eligible for the study and agree to the points above you will be contacted by the researchers regarding the next phase of the study. That phase is outlined in the section entitled 'Phase 2' below.

When you complete the eligibility questionnaire you will see that there is a question that asks if you would be interested in taking part in a second questionnaire. This questionnaire asks you to identify friends and/or acquaintances who may also wish to take part in the study. If you do not wish to complete this questionnaire you can still participate in the rest of the study. However, if you choose to complete this second questionnaire, you will be asked to complete it via the telephone with one of the researchers. Completion of this questionnaire will take approximately 10 minutes. The researchers will ask you to list the first name and last initial of friends and/or acquaintances who live in Milton. You will then be asked to send these friends and/or acquaintances information about the study by email to ask if they would be interested in participating in the study with you.

If your friends and/or acquaintances agree to participate, they can either go to the website provided to indicate their consent or print off the consent form and fax it to the

researchers. They can also provide verbal consent to you to provide the researcher with their information who will then contact them about the study.

Depending on the number of friends and/or acquaintances identified we will attempt to form a friends only group or an acquaintances only group. If not enough friends or acquaintances are interested in taking part in the study we may need to place you in one of the other groups such as the random group or the group where you will be the only person in the network. (There is also the possibility of the neighbours group which you may be placed into.) You can still participate in the study even if your friends and/or acquaintances do not wish to take part in the study. You can also choose to withdraw from the study.

Phase 2 - Electricity Use Website

This phase of the study involves asking you to view an electricity use website daily, for a period of one month. The viewing timeframe, instructions on how to obtain your user name and password and what type of group you will be in will be e-mailed to you before this portion of the research begins. You will also receive a daily reminder e-mail during the viewing period. Viewing this website can take as little as 30 seconds but you can spend as much time as you wish viewing the website and its related pages. This website is confidential and as outlined above will only be accessible to those with a valid user name and password.

As outlined above, each participant in the study will have their own 'electricity consumption' indicator. This will be created through the use of an electricity consumption baseline, calculated by the researchers by averaging your overall electricity consumption for 30 days in November and December 2008. Milton Hydro will then provide the researchers with your daily electricity consumption figures which will be compared to the baseline. If you increase your consumption by 5% or more over the

baseline on any particular day, then your indicator will display a sad face on the website for that day. If you decrease it by 5% or more, your indicator will display a happy face. If you stay within your normal range (5% increase or decrease), your indicator will display a neutral face. Although your first name and last initial will be displayed next to your “indicator”, no other personal information will be posted on the website. With the exception of being in the group where you will be the only person in the network, you and approximately nine other households will be able to view your own and each other’s indicators. On the next page, please find a sample of what the website will contain. Along with the indicators, the website also provides a place to write comments. Please feel free to write anything you like but please note that the researchers request that all group members follow the Comment Box guidelines posted. The guidelines are attached with this information letter. The comments posted by group members will be reviewed daily by the researchers. You are encouraged to write as many comments as often as you wish.

Activity on the website will be documented for the purposes of this study. This includes when group members visit the site, how long they spend on the site, and which pages of the site are viewed. **Please note that if you do not activate your user name and password, the researchers will still assume you are participating in the study unless you contact them via e-mail or telephone to request your withdrawal from the study.** If you choose to withdraw from the study, your name and electricity indicator information will be removed from the website within 24 hours of receiving the request.

Energy Pool

Criteria for Changing Faces

Week of November 16-23
Total Happy faces to date: 6
Total Neutral faces to date: 9
Total Sad Faces to date: 14

Reduction Tips

Name	Yesterday's Energy Consumption
Bob M.	😊
Susan S.	😐
Usha C.	😞

Comment Box

Susan S., Today, 12:43 pm: I can write comments here.

Bob M., Yesterday, 6:45pm: The comment box is for comments.

[Study Policy and Terms of Reference](#) [Report Abuse](#)
[Contact Us](#)

Phase 3 - End of Study Questionnaire

After the month in which you participate in the study is over, you will be invited to answer questions about the study by a written response to an email questionnaire.

Questions will explore, for example: Overall, thinking about your experience on the website, was it: a) excellent; b) ok; c) poor; d) terrible.

Answering the questions can be as brief or as detailed as you wish and will take 5 to 10 minutes of your time. Excerpts from your responses may be included in the researcher's thesis and/or publications, with the understanding that any quotations will be anonymous. There will also be a checkbox for you to indicate if you agree to having a

member of the research team contact you to clarify your responses if needed. You can choose not to complete this questionnaire if you wish.

Benefits and Risks

Although there are no personal benefits to participation in this study, you will learn about research in environmental issues in general and residential electricity conservation in particular. In appreciation of your time, you, along with Milton Hydro, will receive a summary report of the study results by email along with a link to the full report which is expected to be available on-line by August 2010.

Given the group format of this study, we will ask you to keep in confidence information that could potentially identify another participant and/or his/her comments. You should also be aware that there is a small possibility that your name and consumption indicator could be viewed by unauthorized parties such as computer hackers because this information is being entered and stored on the internet via an “http” server. This is also the case for the information that you provide for the recruitment survey which is being hosted on fluidsurveys.com. Other risks associated with this study include visiting any websites that may be posted in the ‘Comment Box’ section. Visiting any such website is done at your own risk and it is your responsibility to ensure that protective measures to guard against viruses and other destructive elements are up to date on your computer. Please also note that if you use the website for purposes other than as outlined for the study you will be contacted by a member of the research team and will be withdrawn from the study.

Confidentiality and Data Retention and Storage

You will not be personally identified in any way in any written reports arising from this research. In any presentations, publications or reports you would be referred to as, for example, Participant J. Data collected during this study will either be printed and/or

stored on computer flash drives and erased from the web server as soon as the study period is finished. These printouts and flash drives will be retained for two years, in a locked cabinet in the Department of Environment and Resource Studies at the University of Waterloo and only researchers associated with this study will have access.

Questions or Concerns about Participation

I would like to assure you that this study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes, Director, Office of Research Ethics at 519-888-4567 Ext. 36005 or ssykes@uwaterloo.ca.

If you are interested in participating in this study, please either:

A) visit <http://energypool.org/consentform.html> to complete the consent form

OR

B) fill out the attached form and fax it back to Mary Beth Deline at the University of Waterloo, c/o Dr. Ian Rowlands at (519) 746-0292.

Thank you for your interest in this study and for your assistance with this project.

Sincerely,

Mary Beth Deline

C) Consent Form

I have read the information presented in the information letter about a study being conducted by Mary Beth Deline and Dr. Ian Rowlands of the Department of Environment and Resource Studies at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I am consenting to the release of my named electricity consumption information from 2008 up until, and including, the study period from Milton Hydro to the researchers. I am also aware that some of this information, consisting of my average daily consumption for thirty days in November and December 2008 and the daily changes in that consumption in November and December 2009, will be used by the researchers to create an electricity indicator that will be posted on a website hosted by Zenutech.com and that this will be visible to other study participants in my network group as well as the researchers.

I am also aware that there is a possibility the websites used for this study (hosted on fluidsurveys.com and Zenutech.com) could be viewed by unauthorized parties (e.g., computer hackers) although several precautions have been taken to limit the possibility of unauthorized access.

I am aware that during the study my electricity consumption will be recorded by Milton Hydro and shared with the researchers, and that my interactions with the study website will also be tracked.

I agree to keep the website address that I am given by the project confidential and that I will not allow others to view the website. I also declare that I will keep in confidence information that identifies or could potentially identify a participant and/or his/her electricity indicator and comments.

I am aware that a portion of the study involves the use of a 'Comment Box' on the study website. I have read the 'Comment Box' guidelines (attached) and agree with them.

I am aware that any answers I provide to the questionnaire at the end of the study (which I do not have to answer to participate in the rest of the study), as well as any

clarifications I provide to these answers over the telephone to the researchers, will be used for study purposes only.

I am aware that excerpts from my responses may be included in the thesis and/or publications to come from this research, with the understanding that quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researchers.

I am also aware that if I do not activate my user name and password, the researchers will assume I am participating in the study unless I contact them via email or telephone to request withdrawal from the study. If I choose to withdraw from the study, my name and electricity indicator information will be removed from the website within 24 hours of the researchers receiving the request.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact the Director, Dr. Susan Sykes, at the Office of Research Ethics at 519-888-4567 Ext. 36005 or ssykes@uwaterloo.ca.

Please circle Yes or No:

1. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

YES / NO

2. I agree that Milton Hydro can provide the researchers with my electricity consumption data.

YES / NO

3. I agree to complete a recruitment survey hosted on fluidsurveys.com

YES / NO

4. I agree to have my electricity consumption recorded and made visible via an indicator to other study participants via a website hosted by Zenutech.com, along with my first name and last initial for a period of one month.

YES / NO

5. I agree to have my interaction with the study website recorded.

YES / NO

6. I agree to accept and abide by the guidelines for the study website's 'Comment Box'.

YES / NO

7. I agree that if I visit any linked site posted in the 'Comment Box' I do so at my own risk and it is my responsibility to take all protective measures to guard against viruses and other destructive elements.

YES / NO

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

YES / NO

9. I am aware that if I do not activate my user name and password, the researchers will understand that I am participating in the study unless I contact them via e-mail or telephone to request withdrawal from the study.

YES / NO

Participant Name: _____(Please print)

Witness Name: _____(Please print)

(If Known) Milton Hydro Account Number: _____

Participant E-mail: _____

Participant Phone Number: _____

Participant Street Number: _____

Participant Street Name: _____

Participant Postal Code: _____

Participant City: _____

Participant: I am the account holder with Milton Hydro.

YES / NO

If the participant is NOT the account holder with Milton Hydro, then the account holder must sign their name here to signify that they agree to all of the above, that the person named above lives in their household and that they will allow the named Participant to represent them and their Milton Hydro account in this study:

Account Holder Name:

Account Holder Signature:

Please either:

1) fax this consent form to Mary Beth Deline, c/o Dr. Ian Rowlands at (519)

746-0292; OR

2) if you prefer, fill out this consent form on-line at

<http://energypool.org/consentform.html> here.

E-mail Package to Customers

From: Milton Hydro Distribution Inc.

Sent: November 10, 2009 9:44 AM

To: (NAME REMOVED FOR PRIVACY)

Subject: University of Waterloo/Milton Hydro Electricity Conservation Study Recruitment

Dear Customer,

A couple of weeks ago, we sent you a package inviting you to participate in a University of Waterloo study on factors that support electricity conservation efforts. I would like to invite you, if interested, to sign up for this study at <http://www.energypool.org/consentform.html>. The recruitment period will close on November 13, and I wanted to ensure that you had the opportunity to participate, should you wish.

Participation in the study is voluntary and will require less than half an hour of your time between now and the end of January. To participate in the study, you will be asked to:

- Complete a consent form (at <http://www.energypool.org/consentform.html>) and fill out an on-line eligibility questionnaire;
- View a website daily for thirty consecutive days. The website will either be a group website with up to nine other members or a single website which only you will be able to view;
- Answer a questionnaire about your experience viewing the website. (If you don't want to answer the questionnaire you can still participate in the rest of the study).

Additional details about the study are described in the attached information letter. If you have specific questions about the study, please feel free to contact the researchers: Mary Beth Deline, a graduate student in the Department of Environment and Resource Studies at the University of Waterloo, and her supervisor, Prof. Ian Rowlands in the same department. You can contact Mary Beth by e-mail (medeline@uwaterloo.ca) or telephone (226) 868-1414. If you would prefer to fax in a consent form, it is also attached and can be sent to the researchers at (519) 746-0292. Once you have completed the consent form, you will be directed to an eligibility questionnaire.

The final decision about participation in the study is yours alone and your decision regarding participation in this study will not impact your relationship with Milton Hydro in any way. If you have any questions about Milton Hydro's involvement in the study please contact 905-876-4611 (phone) or customerservice@miltonhydro.com (e-mail). This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo.

I thank you for your time and hope you will consider participating in this interesting study.

Sincerely,

Frank Lasowski

CEO

[Information Letter](#)

[Consent Form](#)

On-Line Consent Form

The final, on-line consent form looked like this:

Consent Form

I have read the information presented in the [information letter](#) about a study being conducted by Mary Beth Deline and Dr. Ian Rowlands of the Department of Environment and Resource Studies at the University of Waterloo in collaboration with Milton Hydro. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I am consenting to the release of my named electricity consumption information from 2008 up until, and including, the study period from Milton Hydro to the researchers. I am also aware that some of this information, consisting of my average daily consumption for two fourteen-day periods -- one between November 2008 and January 2009, and the other between November 2009 and January 2010 -- will be used by the researchers to create an electricity indicator that will be posted on the study website and that this will be visible to other study participants in my network group as well as the researchers.

I am also aware that there is a possibility the websites used for this study could be viewed by unauthorized parties (e.g., computer hackers) although precautions have been taken to limit this possibility.

I am aware that during the study my electricity consumption will be recorded by Milton Hydro and shared with the researchers, and that my interactions with the study website will also be documented for purposes of the study only.

I agree to keep the website address that I am given confidential along with information that could potentially identify a participant and/or his/her electricity indicator and comments.

I am aware that a portion of the study involves the use of a 'Comment box' on the study website. I have read the '[Comment Box](#) [guidelines](#)' and agree with them.

I am aware that a portion of the study involves the use of a 'Comment box' on the study website. I have read the '[Comment Box](#) [guidelines](#)' and agree with them.

I was informed that I may withdraw my consent at any time without penalty by advising the researchers by e-mail or telephone. If I choose to withdraw from the study, my name and electricity indicator information will be removed from the website within 24 hours of the researchers receiving the request.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact the Director, Dr. Susan Sykes, at the Office of Research Ethics at 519-888-4567 Ext. 36005 or ssykes@uwaterloo.ca.

Please complete the following:

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study. No Yes

I agree that Milton Hydro can provide the researchers with my electricity consumption data. No Yes

I agree to complete a recruitment survey. No Yes

I agree to have my electricity consumption recorded and made visible via an indicator to other study participants via the study website, along with my first name and last initial for a period of two weeks. No Yes

I agree to have my interaction with the study website documented for purposes of the study No Yes

I agree to accept and abide by the guidelines for the study website's 'Comment box'. No Yes

I agree that if I visit any linked site posted in the 'Comment Box' it is my responsibility to take all protective measures to guard against viruses and other destructive elements. No Yes

I agree to the use of anonymous quotations in any thesis or publication that comes of this research. No Yes

Participant Name

(If Known) Milton Hydro Account Number

Participant E-mail

Participant Phone Number

Participant Address

Participant City

Participant Postal Code

Participant: I am the account holder with Milton Hydro. Yes No

If the participant is NOT the account holder with Milton Hydro, then the account holder must click on the button below and write their name below to signify that they agree to all the above, that the Participant named above lives in their household and that they will allow the named Participant to represent them and their Milton Hydro account in this study.

Participant: I am the account holder with Milton Hydro. Yes No

If the participant is NOT the account holder with Milton Hydro, then the account holder must click on the button below and write their name below to signify that they agree to all the above, that the Participant named above lives in their household and that they will allow the named Participant to represent them and their Milton Hydro account in this study.

I agree, as the account holder of the Milton Hydro account for this household, that I agree to all the above, that the Participant named above lives in my household and that the Participant named above has my permission to represent my Milton Hydro account in this study and to take part in this study. Yes No

Account Holder Name

Eligibility Survey

The original eligibility survey looked like this:

This survey is part of the recruitment efforts for the electricity study which you've been invited to participate in being conducted by Mary Beth Deline and Dr. Ian Rowlands from the Department of Environment and Resource Studies at the University of Waterloo in conjunction with Milton Hydro. Please fill out the survey questions to the best of your ability. All information you provide will be used for research purposes only. If you have any

questions about the survey in particular or the study in general, please feel free to contact Mary Beth Deline at 226.868.1414 or at medeline@uwaterloo.ca

1) Are you over the age of 18?

1) If Yes, continue

2) If no: discard, or, if technically possible, insert text: Thank you very much for your interest in the University of Waterloo study on residential electricity conservation being conducted by Mary Beth Deline and Dr. Ian Rowland in the Department of Environment at the University of Waterloo. Unfortunately you do not meet the study criteria at this time. If you have any questions about this study, please feel free to contact the researcher, Mary Beth Deline at medeline@uwaterloo.ca or (226) 868-1414. Thank you again.

2) Do you own and reside in your own home, and have you done so since August 2008?

1) If yes, continue

2) If no, discard, or, if technically possible, insert text: Thank you very much for your interest in the University of Waterloo study on residential electricity conservation being conducted by Mary Beth Deline and Dr. Ian Rowland in the Department of Environment at the University of Waterloo. Unfortunately you do not meet the study criteria at this time. If you have any questions about this study, please feel free to contact the researcher, Mary Beth Deline at medeline@uwaterloo.ca or (226) 868-1414. Thank you again.

3) Are you male or female?

1) Male

2) Female

4) Thanks. This next section asks about home renovations and household size to ensure there haven't been big changes to your electricity use attributable to these factors in the past year or will be during the study period. This information is considered confidential and will not be shared. Have you renovated your house since August 2008 in the following fashion?

1) Added an extension to your house?

2) Added a new furnace or hot water heater?

3) Did roofing work?

4) Added insulation?

5) Installed new windows?

1) If yes to any, discard.

2) If no to all, continue

5) Will you be renovating your house in any of the following ways this September, October or November?

1) Adding an extension to your house?

2) Adding a new furnace or hot water heater?

3) Planning on roofing work?

4) Planning on adding insulation?

5) Installing new windows?

1) If yes to any, discard.

2) If no to all, continue

6) Has the number of people living in your house changed since August 2008?

1) If yes, discard

2) If no, continue

7) Will your household size be changing during this September, October or November?

1) If yes, discard

2) If no, continue

8) The study asks you to do two things. Please respond if you'd be comfortable with each item by answering yes or no. Answering no to either question will not affect your eligibility to participate in this study.

1) Identify friends or acquaintances and invite them to participate in the study with you;

1. Yes; note.

1. If yes: A member of the research team will need to contact you in the next two weeks to identify a list of your friends and/or acquaintances. The process should not take more than 10 minutes. Do you agree to be contacted by telephone?

1. Yes: note. Please provide your telephone number and the best time of day to contact you.

1) Phone number:

2) Time of day:

1. No: continue and note

2) Take part in a questionnaire at the end of the study. The questionnaire will be e-mailed to you and will contain open-ended questions asking about your experience on the website and with the study.

1. Yes or no: mark down which.

(If participant has answered no to 4-7 and either yes or no to 8.1 and 8.2, continue).

9) Great, there are just a few more questions left that we need to ask to get information about your characteristics for study purposes. What you say here won't affect your eligibility for the study. What is your current house type?

1) single detached

2) semi-detached

3) other

4) not sure

10) And how many square feet do you estimate your house comprises?

1) >1000

2) 1000-1499

3) 1500-1599

4) 2000-2499

5) 2500-2999

6) 3000+

7) not sure

11) And how many people currently live in your house?

1) 1

2) 2

3) 3

4) 4

5) 5

6) 5+

12) What is the highest level of education you have achieved?

1) Primary school

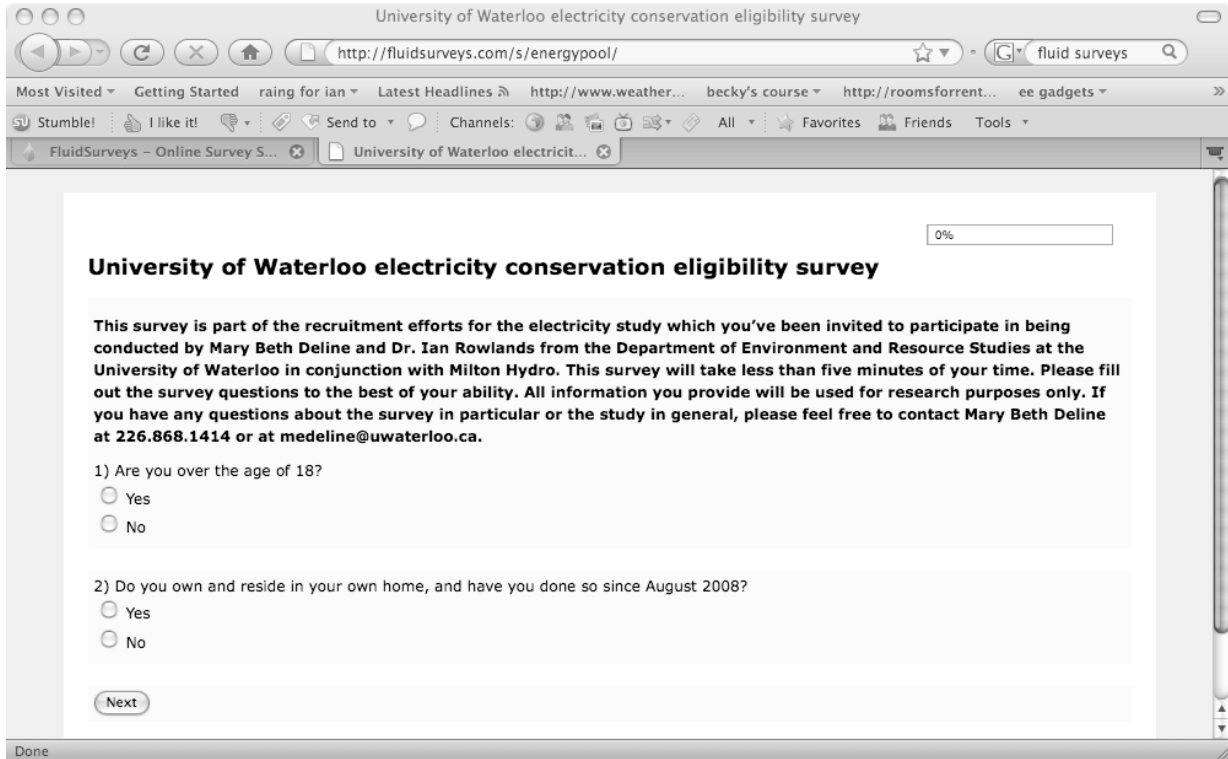
2) High school diploma

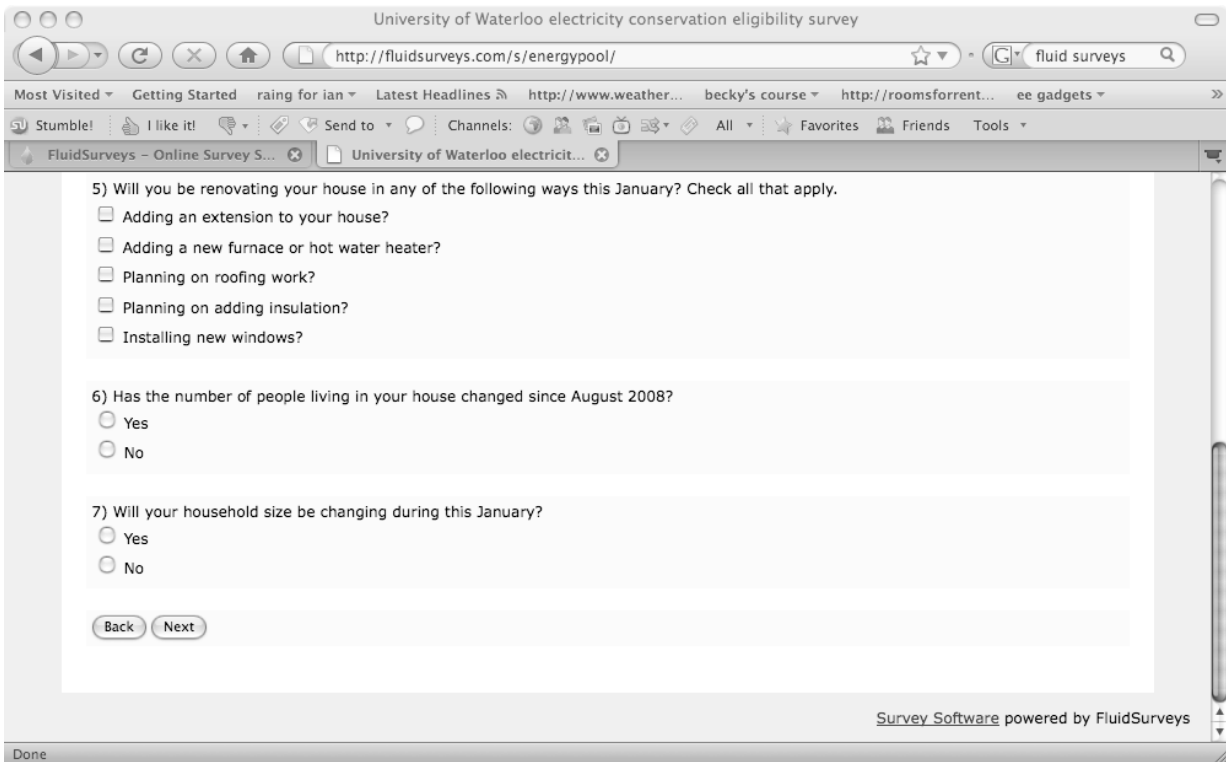
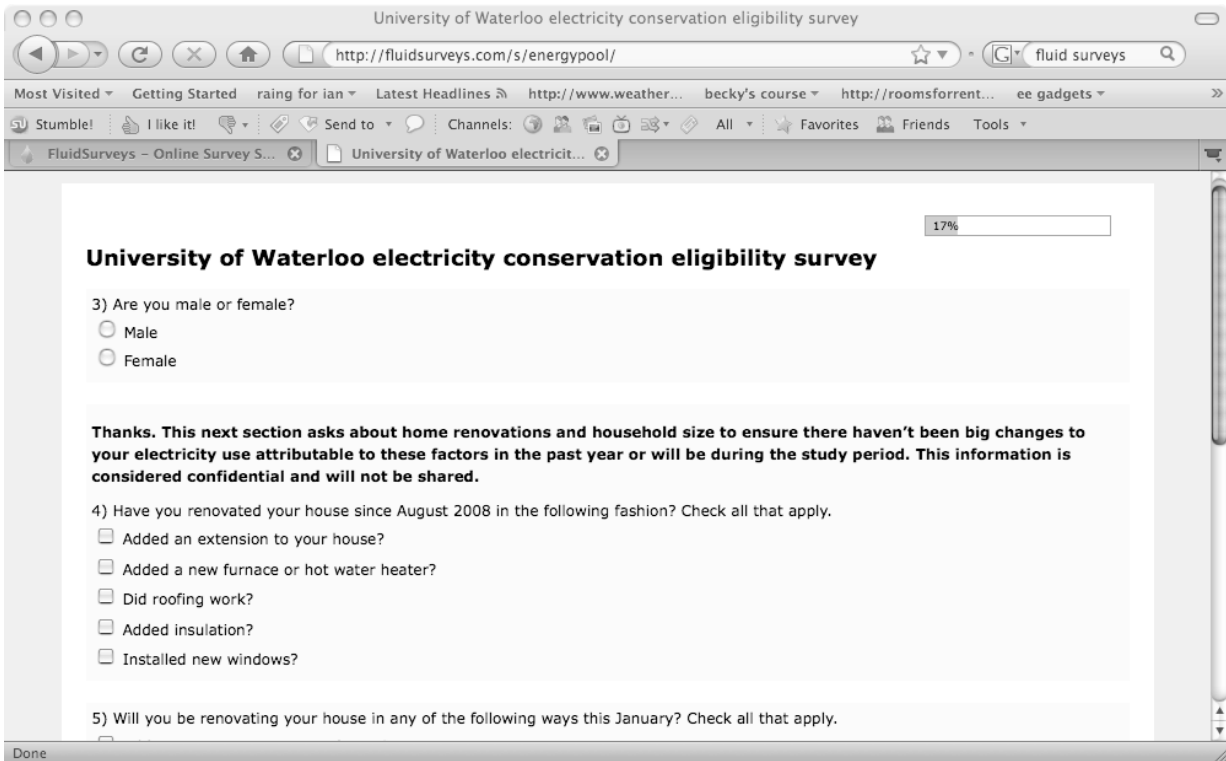
3) Post-secondary education (college, university)

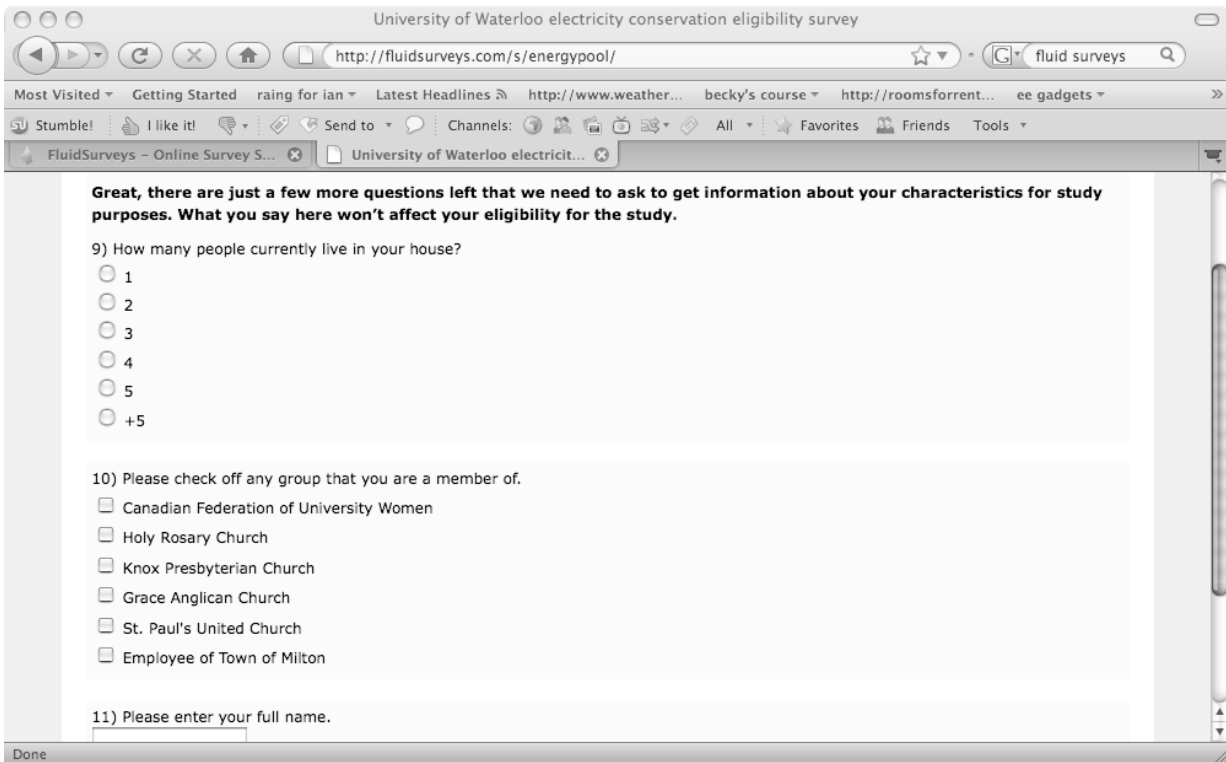
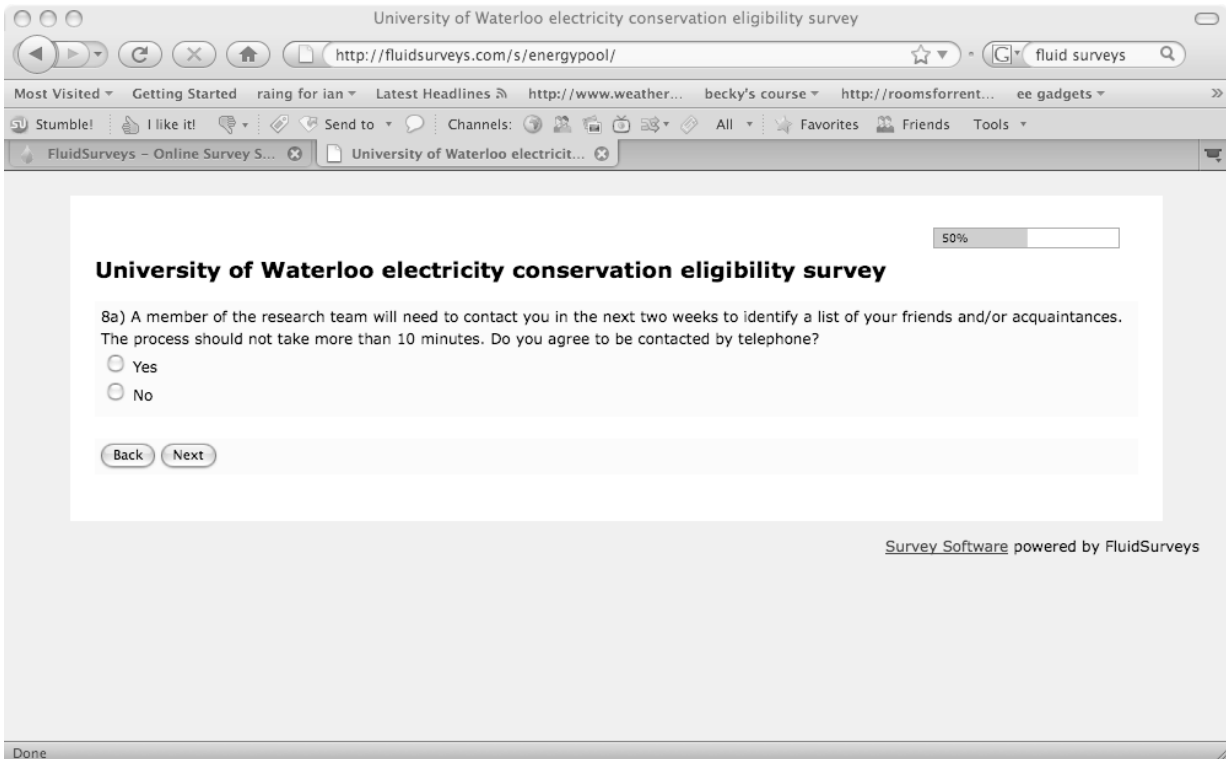
4) Not sure

We have come to the end of the eligibility survey. Thank you for taking the time to complete it. Only those respondents who meet the criteria will be chosen to participate in the study. If chosen, you will receive an e-mail within two week's time notifying you of the next steps. Again, if you have any questions or concerns please do not hesitate to contact Mary Beth Deline at 226.868.1414 or at medeline@uwaterloo.ca

Eligibility Survey - Revised







Original Phone Script

1. Hi, my name's Mary Beth Deline (or name here) and I'm a graduate student at the University of Waterloo (helping a friend who's) working on a research project with Milton Hydro. We (They) are currently conducting research on electricity consumption. Can I speak to the person responsible for paying the electricity bill? I'm not trying to sell you anything and your participation is strictly voluntary.

1) If yes, continue to item 2.

2) If no: Thank you very much for your time tonight. Good-bye.

1) Great, thanks very much. I'm recruiting a limited number of participants for a study on electricity consumption. We're examining the effects of sharing electricity consumption with a group (like friends or neighbours) via on-line websites available to participants only. Participation will require less than half an hour between now and the end of January. To participate in the study, you will be asked to:

- Complete a consent form and fill out an on-line eligibility questionnaire;
- View a website for thirty seconds a day for one month. The website will either be a group website with up to nine other members or a single website which only you will be able to view; and,
- Answer a short questionnaire about your experience viewing the website. (If you don't want to answer the questionnaire you can still participate in the rest of the study).
- This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo.

Would you be interested in participating?

1) If yes, Great. Can I get your information and e-mail address to send you some more information and a consent form? (Record name, address, phone number and e-mail address). Thanks very much. The e-mail will contain a more detailed information letter and a link to the consent form. If you complete the consent form you'll be directed to the eligibility survey to determine if you meet the project parameters. Do you have any questions for me tonight about the study? (If so, answer them. If not:) Thank you for your time tonight. Goodbye and goodnight.

1) If no, say: Ok, I understand. Thank you very much for your time tonight. Goodbye.



**ARE YOU CONSUMING MORE OR LESS
ELECTRICITY THIS YEAR THAN LAST YEAR?**

Find out by signing up for a University of Waterloo study (undertaken in conjunction with Milton Hydro) on electricity consumption here:

<http://www.energypool.org/consentform.html>

The study will take **less than fifteen minutes** total. You'll be asked to:

- 1) **Fill out a consent form** and short questionnaire (less than five minutes); and
- 2) **View a website** once a day for two weeks (less than thirty seconds a day).

Questions? Comments? Contact Mary Beth Deline, graduate student at the University of Waterloo by e-mail (medeline@uwaterloo.ca) or telephone (226) 868-1414.

This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo.

E-mail to Churches

Proposed e-mail to parishoners of X Church

Dear Parishoners

We've been approached by the University of Waterloo to participate in an interesting study on electricity consumption which is being undertaken in conjunction with Milton Hydro. It'll take less than fifteen minutes of your time and you'll be able to see if you're consuming more electricity this year than last year. If enough of us sign up we'll also be put into an 'acquaintance' group so we can see how we're doing compared to each other.

To participate in the study, you'll be asked to:

- 1) **Fill out a consent form** and short questionnaire (less than five minutes);
- 2) **In January, view a website** once a day for two weeks (less than ten seconds a day).

If you're interested, please go to <http://www.energypool.org/consentform.html>

I've also enclosed an information letter from the research team if you'd like more information. The study's specifically examining the effects of sharing electricity consumption information with groups (like friends or neighbours) via on-line websites that only participants have access to. If you have any questions about the study, you can also contact one of the researchers directly. Her name is Mary Beth Deline and her e-mail is medeline@uwaterloo.ca, phone (226) 868-1414. This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo.

Cheers!

(Your sign off).

ENCL: Information letter (PDF)

E-mail to Colleagues, Friends and Project Partners

Subject header: research help needed for University of Waterloo electricity study undertaken in conjunction with Milton Hydro

Dear X

Hope you're well! I'm currently working on a research project for the University of Waterloo being undertaken in conjunction with Milton Hydro and we need some help recruiting people to the study. I was hoping you could help by:

- A) signing up for the study if you're interested and live in Milton. You can do so at <http://www.energypool.org/consentform.html>; or
- B) sending the attached e-mail package out to people you know in Milton, and asking them to sign up for the study and/or forward it on to people they think might be interested.

If you have any questions, comments or concerns, please let me know. This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo.

Thanks and cheers

(your name here).

(Suggested e-mail to send out to people in Milton below)

Dear X,

Hope you're well! I was wondering if you wanted to participate in a University of Waterloo study on electricity consumption being undertaken in conjunction with Milton Hydro. It'll take less than half an hour of your time between now and the end of February and you'll be able to see if you're consuming more electricity this year than last year. The study's specifically examining the effects of sharing electricity consumption information with a group (like friends or neighbours) via on-line websites available to participants only. To participate in the study, you'll be asked to:

- 1) **Fill out a consent form** and short questionnaire (less than five minutes);
- 2) **View a website** once a day for two weeks (less than thirty seconds a day).

If you're interested, please go to <http://www.energypool.org/consentform.html>

I've also enclosed an information letter from the research team if you'd like more information. If you have any questions about the study, you can also contact one of the researchers directly. Her name is Mary Beth Deline and her e-mail is medeline@uwaterloo.ca, phone (226) 868-1414. This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics, University of Waterloo.

Cheers!

(Your sign off).

ENCL: Information letter (PDF)

Data Collection

Questionnaire Answers

Answers to Open-Ended Questions

2) How effective do you think your participation in the study was?

PARTICIPANT	COMMENT
F3	Five, our selection group was small so the influence of having others give feedback was minimal. However, the desire to do well was a significant overall factor and we did pay attention to our consumption during the survey.

3) Why do you think your participation in the study did or did not change your electricity consumption?

PARTICIPANT	COMMENT
N1	Happy faces don't have a meaning for me. I would rather see numbers and faces. If pricing would be used, then different naming system could be implemented to remain hidden.
O1	we are already making efforts to shift to off-peak times and reduce usage. Each day's daily life is different so the comparison to same day last year wasn't necessarily a good one without the details of the daily activities.

PARTICIPANT	COMMENT
F1	<i>Changed because higher energy appliances were operated in the low rate hours even though we has some sad days.</i>
C2	ANSWER I thought about my consumption more but I still had to wash the sheets if my son had an accident in the night etc. So I wasn't able to change my habits too much. I was also more aware of how the weather outside was playing into my consumption.
F2	<i>It made me aware of how I was doing (which was quite well) so I didn't feel the need to change much. I did however feel motivated to keep up the good work...like I was in a competition or something!</i>
N5	I don't think it changed my electricity consumption as I was getting a lot of smile faces at the start and after a few days was not that interested.

PARTICIPANT	COMMENT
C3	While I liked the website, especially looking forward each day to see if it was a happy or sad face, my family is not interested in reducing our electricity consumption ways. As long as premiere mcguinty is in power and hydro(milton hydro) continues practices their awful, somewhat illegal billing methods, I have no interest in helping either of those 2 entities by conserving energy. If I have to pay more on my hydro bill, then so be it. Note: milton hydro charged me \$30 admin fee for paying their bill late, which to me is an excessive penalty. The late fee should be the standard 2% monthly interest charge.
F3	The main influence of participation was to assist all members of our household to become focused on the issues. I would share our daily performance with everyone and it would influence their behaviours thus effecting our outcomes.

4) Did you receive messages from group members about your consumption rate changes during the study in the comment box? If so, what were the messages like? How did you react to the messages?

PARTICIPANT	COMMENT
F3	The messages were pretty limited though I wanted to stimulate some conversations (a factor might have been our small sample size). The problem with our group seemed to be the relatively positive outcomes which didn't give us much to discuss.
C3	No, did not receive any group msgs

PARTICIPANT	COMMENT
N5	Yes. Most comments related to participants questioning why they got a sad face. No reaction from myself.
F2	<i>They were just reacting to whether or not they got happy faces or frowning faces; commenting on "it was laundry day" or "company was over"...that type of thing.</i>
C2	No I did not find messages in the comment box.
F1	<i>Read them, they didn't influence our power use.</i>
O1	2 of the 3 of us entered comments as we had more sad faces than the third participant. It helped give reason for the sad faces and informed of similarities and differences in daily life.
N1	The messages were ok. I did not really react to them. Nobody really said, "hey, your doing bad...better do something to change your status"

5A) If yes, (you were influenced) why were you influenced?

PARTICIPANT	COMMENT
F3	Only, because we all have a somewhat competitive nature and don't want to be outdone by our neighbours when it comes to conservation.

PARTICIPANT	COMMENT
O1	to a point, but we continued to live daily.

5B) If you weren't influenced, why not?

PARTICIPANT	COMMENT
C3	No, for similar reasons as mentioned in response 3. Could care less who knows what my consumption rates are. My over usage results in added subsidies paid by the provincial government. I'm fine with that.
N5	No. The faces did not show enough detail.
F2	<i>Mainly because I was doing well, so I didn't feel the need to change anything...</i>
C2	no, I feel that I am fairly good at keeping my energy consumption fairly low, for the size of our home and the number of people that live here. Also I am home during the day so I do need to have the heat and some electronics on.
F1	<i>Because a study I wanted to demonstrate a normal life style/attitude</i>

PARTICIPANT	COMMENT
N1	No. No matter what, "we" as a family need electricity to live and electricity is going to be used. I could have been influenced by looking at the web site, but the other members of my family did not look at the website to be influenced. Possibly if the system was in the home for all to see, it might have a bigger effect.

6A) If the system was not fair, why not?

PARTICIPANT	COMMENT
F3	I think we could have narrowed the measures even more to swings that weren't as large to get more opportunity for discussion.

6B) If the system was fair, why was this so?

PARTICIPANT	COMMENT
C3	I loved the happy/sad faces and the criteria for each was good

PARTICIPANT	COMMENT
F2	<i>As far as I can tell, it was fair. Nothing much was going on at my place to use an excessive amount of electricity, so the happy faces seemed to reflect that.</i>
C2	I liked the faces it kept it simple but there were days that I wondered how far away from a smile or a neutral face I was.
O1	Would have been helpful to know what transpired on the day it was compared to.
N1	I think it was fair. I kind of knew my usage was steady for the weeks I was on. The day that the oven was used on a mid or peak period hurt my rank that day.

7) Were there other things besides the website that influenced your consumption rates during the study period? If so, please list them.

PARTICIPANT	COMMENT
C3	No.
N5	<ul style="list-style-type: none"> -Wife was home every day during the study period. -Colder weather. -Adjusted the inside temp up a degree at night.
F2	No
C2	No

PARTICIPANT	COMMENT
F1	<i>No</i>
O1	Not especially as we continued to live rather than just eg eating out or avoiding using the treadmill in order to get a happy face.
N1	Yes, I installed a plasma and surround sound system that uses more power than what I am used too. I changed the dishwasher from normal setting to economy setting. Aside from the website, nobody or anything else encouraged me to better my electricity usage.

8) Did you discuss this study with members of your website group outside the website (ie on the phone or in person?) If so, please list them

PARTICIPANT	COMMENT
F3	F1
C3	No, only discussed with my wife. She liked the study and the website too. She would interrupt my day at work to ask if we got a happy or sad face (we got more sad faces than happy faces)
N5	<i>No.</i>
F2	<i>No</i>
C2	I wasn't really aware that there were members in my website group.

PARTICIPANT	COMMENT
F1	No
O1	only briefly in a meeting that included O2, O3 and N5 who thought the comparison was to last week.
N1	No. I may know them from the website, but I do not know all the people regularly in person.

9) Please write down anything about your experience during the study that you particularly liked

PARTICIPANT	COMMENT
F3	It was interesting to be focused on something concrete in trying to determine the reasons for better performance in 2010 than 2009. These thoughts spawned more opportunity for household improvements.
C3	No comment
N5	I went to the site almost every day. Was interested in what others had commented on.
F2	<i>Kind of enjoyed the sense of "competition"...</i>
C2	It was simple. It would be a good method to teach children about energy conservation.

PARTICIPANT	COMMENT
F1	<i>eally no particular reaction, just interested to participate and then see what the overall outcome was.</i>
O1	finally getting a happy face.
N1	I liked that I could see "neighbours" usages (in this case in the form of a face) to compair with how well or not well my household is doing.

10) Please write down anything that you didn't like about your experience during this study or anything you found confusing.

PARTICIPANT	COMMENT
C3	No comment
N5	I don't think the base line method was clear to all participants.
F2	<i>Had a hard time log-ing into the site. I believe there was a blank space added to the end of my login name, which took me forever to figure out why I couldn't login....</i>
C2	It would be interesting to know how I compared to other people who had the same size home with the same # of people living in it. Also what our consumption is compared to a home where everyone is working during the day.

PARTICIPANT	COMMENT
O1	didn't have details of the daily activities from the past to figure out why we were rated happy, sad, neutral.
N1	I hit the back button from my browser and double posted. There should be sometype of post retraction/edit.

11) Is there any information that you would like to pass on to Milton Hydro anonymously?

PARTICIPANT	COMMENT
C3	<p>As stated above in reference to their billing practices, I feel their \$30 late fee is illegal. If I don't pay the bill, or am late, then charge me interest on my next bill, not a \$30 collection penalty. -- another tip, change your billing of electricity into just 2 lines.</p> <ul style="list-style-type: none"> -monthly fee -usage fee <p>Debt retirement to me is not a fee I should be paying. They are adding an extra tax due to their mismanagement. If anything, call it a mismanagement or incompetence fee.</p> <p>Transportation fee should be incorporated into the monthly or usage fee. Do phone companies charge you an extra charge for transporting the calls or the data. Its not like we have control over how the hydro is transported. Its just a way of masking the true cost of ones hydro unit rate.</p>
F2	No
F1	No

PARTICIPANT	COMMENT
O1	not especially
N1	Please decrease your hydro rates. To have incentives to go green ie: installation of roof top solar panels.

12) Are you aware of the energy savings features provided by Milton Hydro? If yes, which ones? If yes, were you aware of these before you began the study?

PARTICIPANT	COMMENT
C3	yes I am aware. I get their flyers and energy savings tips in my monthly bills. I just throw them away in the recycle bin.
F2	No
C2	No I am not aware of programs that Milton Hydro offer but we have many energy saving features recommended by Milton Hydro, programmable thermostat, energy saving light bulbs, insulation on our water heater and some pipes. We keep our home at 19.5 -20.5 during the day 21 in the evening and down to 18 for sleeping.
F1	Yes, <i>Only the rate pattern, Yes</i>
O1	am somewhat aware of those offered.
N1	Fridge round up Peaksaver Aware of these before study began.

Comments

Typology:

- A) Social status (pride or shame)
- B) Information seeking
- C) Planning
- D) Action
- E) Excuse for indicator
- F) Commenting on group
- G) Seeking a type of indicator
- H) Speculation about what is causing indicator status
- I) *=response to other's comment

Participant	Date	Comment	Type
C1		none	
C2	31-Jan-10	"there was a extream cold weather warning - 22 "	E
C3		none	
O1	28-Jan-10	"X (name removed for privacy) has been on a bread/rolls baking "mission" during the day"	E
	28-Jan-10	" Planning to get on the treadmill myself when I get home tonight-we 3 have that in common "	*, F
	1-Feb-10	"Cooked turkey etc for family dinner"	E

Participant	Date	Comment	Type
	3-Feb-10	“ looked up my calendar for last year and we didn't cook supper 2 nights during last week of Jan - still waiting for a Smile!”	E, G
	4-Feb-10	“finally a Smile! We ate leftovers last night and have caught up with the dishwashing from Sunday. “	A, D, E, G
	9-Feb-10	“My excuse is baking valentine cookies. Baking is a rare occasion.”	E
O2		none	
O3	28-Jan-10	“Guess my new treadmill isn't doing much for energy conservation - is that a good reason not to use it anymore?!?!”	A, B, E
	29-Jan-10	“Might have to stop exercing!! Treadmill = Sad Face :(NO Treadmill = Happy Face :) “	C, E, G, H

Participant	Date	Comment	Type
F1	29-Jan-10	"Because we do not fully rely on propane furnace for heat, our power use has not been as greatly affected by cold snap."	E, H, *
	2-Feb-10	"Don't know why our power consumption was 'up'. X (name removed for privacy) did some ironing."	E, H
	3-Feb-10	"hmm - may have been our electric stove - X (name removed for privacy) did a bunch of pasta cooking!"	E, H,
	9-Feb-10	"so be it!"	A,
	10-Feb-10	"Wow don't know the reason - likely Wed. the 10th will also be sad, because of laudnery today!"	E, H
F2	2-Feb-10	"I'm doing well...maybe because my house is only a few years old...."	A, E, H

Participant	Date	Comment	Type
F3	28-Jan-10	"I think the weather pattern has really influenced the positive performance until now."	A, E, H
	29-Jan-10	"I think this confirms my hypothesis, the temperature has dropped my energy performance has dropped also"	E, H
	1-Feb-10	"Family arrangements today meant there were fewer people in the house reducing consumption"	E, H
	2-Feb-10	"After watching this trend for a while I have a few theories. 1. no more desk top computers at home. 2. a new front door. 3. a new bedroom window. We are also trying to consciously keep lights turned off and appliances utilized only in the "cheap" time"	C, D, E, G, H

Participant	Date	Comment	Type
	5-Feb-10	We have been watching our times of use on the "smart" meter but I believe this is overall consumption and not just cost in the survey?	B, H
	8-Feb-10	This one is a mystery as we are often out of the house much of Sunday?	E, H
S1 (Fur)		none	
S2 (Emma)		none	
S3 (Bern)		none	
N1	27-Jan-10	"Hello All!	F
N1	28-Jan-10	How many of us has insulation behind our thermostats?	B
	28-Jan-10	From Reduction Tips above..."Ensure that the hole in the wall behind the thermostat is insulated."	B, *

Participant	Date	Comment	Type
	29-Jan-10	Finally a smile. I had to turn my main breaker off to get it LOL.	A, D, G
	2-Feb-10	I just picked up a energy monitor that you hook up to the meter. Price wasn't bad.	D
N2	29-Jan-10	I'm "smiling" but I may have gamed the system. A week ago I was really sick for about 5 days and had the heat turned way up. So of course now that it's back to normal it's going to help with some of my electricity usage.	E, H
	11-Feb-10	How do you tell if you are "winning" ;-)	A, G,
N3	28-Jan-10	boo :-(A
N3	29-Jan-10	apparently I suck at this ... I can't imagine that we're using more - the same maybe, but not more.	A

Participant	Date	Comment	Type
	11-Feb-10	I would say N2, that as long as you're not me, you have a shot at winning :-) I'm still at a loss as to how we managed to consistently use more.	A, H
N4	27-Jan-10	Nice! Happy face!	A
	28-Jan-10	W00t! Another happy face for today. Insulation behind thermostats? My sits on the wall.	A, H, *
	29-Jan-10	I checked my usage, 27th was 19KWh, 28th was 21.01KWh.. got me a Neutral face	B, G, H
N5	28-Jan-10	Yeah a happy face.	A,
	28 - /01/2010	I had to put tape over the hole as it was causing my ecobee tstat to behave oddly.	H, I
	29-Jan-10	3 days in a row.	A
	29-Jan-10	Really?	I

2009	C1	C2	C3	O1	O2	O3	F1	F2	F3	S1	S2	S3	N1	N2	N3	N4	N5
4	25.88	39.92	34.99	20.86	48.11	32.99	23.95	33.33	24.04	42.64	22.31	21.15	16.77	27.87	29.02	21.25	18.41
5	30.57	40.39	25.89	26.86	46.91	21.65	19.72	23.86	21.25	44.22	14.9	19.51	13.8	38.28	23.28	24.38	16.96
6	24.61	40.76	29.29	19.72	45.05	29.85	12.94	17.63	21.75	47.27	25.71	27.16	22.43	32.13	20.1	17.85	18.92
7	30.88	23.98	20.89	13.09	53.85	19.62	20.44	44.22	46.8	45.91	10.86	37.59	30.71	31.8	22.89	20.02	35.87
8	45.33	17.22	23.75	11.09	59.92	26.65	14.9	40.18	19.06	48.4	25.98	26.85	24.38	33.31	17.39	17.3	13.91
9	32.56	18.78	26.23	11.74	43.31	27.92	14.58	35.95	34.32	41.37	22.28	20.15	13.25	34.32	17.48	17.34	15.08
Week day Average	29.87	33.78	28.7	19.97	45.76	25.32	19.36	30.54	29.37	43.98	19.96	33.02	15.92	31.41	22.14	20.85	17.16
Week end Average	36.89	30.83	23.08	19.96	57.47	24.3	17.89	39.82	29.22	47.24	20.58	22.62	30.05	34.27	19.66	20.66	24.1

Results

2009 Temperature for Burlington Piers Station, Environment Canada

Station Name	BURLINGTON PIERS (AUT)																
Province	ONTARIO																
Latitude	43.3																
Longitude	-79.8																
Elevation	77.4																
Climate Identifier	6151061																
WMO Identifier	71437																
TC Identifier	WWB																
Legend																	
[Empty]	No Data Available																
M	Missing																
E	Estimated																
A	Accumulated																

C	Precipitation Occurred; Amount Uncertain								
L	Precipitation May or May Not Have Occurred								
F	Accumulated and Estimated								
N	Temperature Missing but Known to be > 0								
Y	Temperature Missing but Known to be < 0								
S	More Than One Occurrence								
T	Trace								
*	Data for this day has undergone only preliminary quality checking.								
Date/Time	Year	Month	Day	Data Quality	Max Temp (°C)	Max Temp Flag	Min Temp (°C)	Min Temp Flag	Mean Temp (°C)
2009-1-1	2009	1	1	*	-2.6		-12.4		-7.5
2009-1-2	2009	1	2	*	1		-3.1		-1.1
2009-1-3	2009	1	3	*	-0.1		-7.1		-3.6
2009-1-4	2009	1	4	*	1.4		-8		-3.3
2009-1-5	2009	1	5	*	2		-5.6		-1.8
2009-1-6	2009	1	6	*	-0.1		-6.6		-3.4

2009-1-7	2009	1	7	*	1.2		-1.3		-0.1
2009-1-8	2009	1	8	*	-1		-7.2		-4.1
2009-1-9	2009	1	9	*	-4.7		-8.3		-6.5
2009-1-10	2009	1	10	*	-2.5		-9.3		-5.9
2009-1-11	2009	1	11	*	-4.8		-9.8		-7.3
2009-1-12	2009	1	12	*	-1.7		-9.6		-5.7
2009-1-13	2009	1	13	*	1.5		-13.3		-5.9
2009-1-14	2009	1	14	*	-11.3		-17.9		-14.6
2009-1-15	2009	1	15	*	-9.9		-15.4		-12.7
2009-1-16	2009	1	16	*	-11.9		-16.9		-14.4
2009-1-17	2009	1	17	*	-5.9		-17.1		-11.5
2009-1-18	2009	1	18	*	-1.7		-7.4		-4.6
2009-1-19	2009	1	19	*	-5.6		-11.2		-8.4
2009-1-20	2009	1	20	*	-6.4	E	-13.1	E	-9.8
2009-1-21	2009	1	21	*	-3.9		-15.9		-9.9
2009-1-22	2009	1	22	*	-1.2		-3.9		-2.6
2009-1-23	2009	1	23	*	4.3		-4.4		-0.1
2009-1-24	2009	1	24	*	-4.4		-12.9		-8.7
2009-1-25	2009	1	25	*	-8.3		-13.9		-11.1
2009-1-26	2009	1	26	*	-7.4		-14.3		-10.9
2009-1-27	2009	1	27	*	-3.5		-10.8		-7.2
2009-1-28	2009	1	28	*	-2.6		-8.9		-5.8
2009-1-29	2009	1	29	*	-2.1		-9.3		-5.7
2009-1-30	2009	1	30	*	-2.3		-10.3		-6.3
2009-1-31	2009	1	31	*	-3.6		-13.1		-8.4
2009-2-1	2009	2	1	*	4.4		-3.6		0.4
2009-2-2	2009	2	2	*	3.6		-6.5		-1.5
2009-2-3	2009	2	3	*	-1.9		-6.5		-4.2
2009-2-4	2009	2	4	*	-6.2		-15.7		-11
2009-2-5	2009	2	5	*	-7.4		-18.6		-13
2009-2-6	2009	2	6	*	-1.2		-9.9		-5.6
2009-2-7	2009	2	7	*	9.3		-8.4		0.5
2009-2-8	2009	2	8	*	4.8		-1.6		1.6
2009-2-9	2009	2	9	*	2.1		-3.1		-0.5

2010 Temperature for Burlington Piers Station, Environment Canada

Station Name	BURLINGTON PIERS (AUT)								
Province	ONTARIO								
Latitude	43.3								
Longitude	-79.8								
Elevation	77.4								
Climate Identifier	6151061								
WMO Identifier	71437								
TC Identifier	WWB								
Legend									
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N	Temperature Missing but Known to be > 0								

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S	More Than One Occurrence								
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*	Data for this day has undergone only preliminary quality checking.								
Date/Time	Year	Month	Day	Data Quality	Max Temp (°C)	Max Temp Flag	Min Temp (°C)	Min Temp Flag	Mean Temp (°C)
2010-1-1	2010	1	1	*	1.9		-8.2		-3.2
2010-1-2	2010	1	2	*	-8		-12.3		-10.2
2010-1-3	2010	1	3	*	-6.6		-12.1		-9.4
2010-1-4	2010	1	4	*	-5.6		-9.5		-7.6
2010-1-5	2010	1	5	*	-3.4		-8.8		-6.1
2010-1-6	2010	1	6	*	-2.1		-6.1		-4.1
2010-1-7	2010	1	7	*	-0.9		-5.9		-3.4
2010-1-8	2010	1	8	*	-3.4	E	-9.2	E	-6.3
2010-1-9	2010	1	9	*	-5.5		-12.2		-8.9
2010-1-10	2010	1	10	*	-3.4		-12.9		-8.2
2010-1-11	2010	1	11	*	-3.2		-5.8		-4.5
2010-1-12	2010	1	12	*	-3.1		-6.8		-5
2010-1-13	2010	1	13	*	0.1		-5.2		-2.6
2010-1-14	2010	1	14	*	5.3		-3.4		1
2010-1-15	2010	1	15	*	3.9		1.8		2.9
2010-1-16	2010	1	16	*	1.9		-0.3		0.8
2010-1-17	2010	1	17	*	2.8		0.3		1.6
2010-1-18	2010	1	18	*	1.6		-1.7		-0.1
2010-1-19	2010	1	19	*	1.9		-1.6		0.2
2010-1-20	2010	1	20	*	-0.7		-5.1		-2.9
2010-1-21	2010	1	21	*	1.4		-5.6		-2.1

2010-1-22	2010	1	22	*	2.5		0.2		1.4
2010-1-23	2010	1	23	*	2.3		-0.5		0.9
2010-1-24	2010	1	24	*	4.4		0.9		2.7
2010-1-25	2010	1	25	*	6.6		1		3.8
2010-1-26	2010	1	26	*	1.4		-1.1		0.2
2010-1-27	2010	1	27	*	-0.7		-4.6		-2.7
2010-1-28	2010	1	28	*	-2.2		-11.7		-7
2010-1-29	2010	1	29	*	-9.1		-14.7		-11.9
2010-1-30	2010	1	30	*	-9		-17		-13
2010-1-31	2010	1	31	*	-3.9		-11		-7.5
2010-2-1	2010	2	1	*	-3.5		-7		-5.3
2010-2-2	2010	2	2	*	-1.7		-6.6		-4.2
2010-2-3	2010	2	3	*	0.8		-5.2		-2.2
2010-2-4	2010	2	4	*	0.5		-6.7		-3.1
2010-2-5	2010	2	5	*	0.3		-4.5		-2.1
2010-2-6	2010	2	6	*	-2.5		-10.5		-6.5
2010-2-7	2010	2	7	*	-1.6		-9.9		-5.8
2010-2-8	2010	2	8	*	-0.5		-8.3		-4.4
2010-2-9	2010	2	9	*	-0.4		-5.7		-3.1