

UNIVERSITY OF CALGARY

Why We Do What We Do: The Factors that Influence Energy Behaviour and How to Effect
Change in Alberta Energy Consumption Patterns

by

Eric Timmins

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Abstract

In order to address the growing issue of climate change, the Alberta Climate Leadership Plan was developed and implemented so the Province can work to minimize GHG emissions attributed to energy production. For this plan to be successful, reduction in energy demand and a change in energy culture in Alberta is required. This policy initiative demonstrates that integration of individual behaviour into energy analysis has become very relevant. Yet, it is not always clear what factors most affect energy behaviour. In this study, I examine the relationship between factors affecting energy behaviour and the implications for energy culture in Alberta. I conduct a qualitative case study on Alberta's climate policy analysing secondary data on energy use patterns and behaviour. Individual behaviour is influenced by internal factors, such as knowledge and attitudes, and external factors, including social norms and material constructs. Using these factors to effect change in Alberta will require intervention strategies that employ an integrated and interdisciplinary approach.

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Table of Contents

<i>Approval Page</i>	<i>i</i>
<i>Abstract.....</i>	<i>ii</i>
<i>Acknowledgements</i>	<i>iii</i>
<i>Table of Contents.....</i>	<i>iv</i>
<i>List of Tables.....</i>	<i>v</i>
<i>List of Figures</i>	<i>vi</i>
<i>Chapter 1. Introduction</i>	<i>1</i>
<i>Chapter 2. Literature Review.....</i>	<i>7</i>
2.1 Theory of Planned Behaviour	8
2.2 Value-Belief-Norm Theory	16
2.3 Model of Pro-environmental Behaviour	18
2.4 Behaviour Related to Energy Consumption	21
2.5 Energy and Society.....	24
2.6 Interventions	28
<i>Chapter 3. Methods.....</i>	<i>35</i>
<i>Chapter 4. Data Analysis</i>	<i>37</i>
<i>Chapter 5. Findings and Discussion</i>	<i>41</i>
<i>Chapter 6. Conclusions</i>	<i>54</i>
6.1 Recommendations.....	54
6.2 Limitations	58
6.3 Future Research.....	59
<i>References.....</i>	<i>60</i>
<i>Appendix A</i>	<i>66</i>

List of Tables

Table 1. Primary and secondary energy use by sector in Canada	37
Table 2. Electricity energy use by province in Canada.....	38
Table 3. Alberta electricity generation by fuel type.....	39
Table 4. Summary of recommendations.....	58

List of Figures

Figure 1: Theory of planned behaviour.....	8
Figure 2. The value-belief-norm theory.....	16
Figure 3. Model of pro-environmental behaviour.....	19
Figure 4. Energy cultures framework.....	27
Figure 5. Summary of behavioural aspects and intervention strategies.....	42

Chapter 1. Introduction

Global climate change affects both the human and the natural systems on earth, and currently poses a threat to the health, economy, and basic necessities of life, such as food and water for billions of people worldwide (The Intergovernmental Panel of Climate Change, 2015). Evidence of this ongoing warming has already been seen globally, in the form of extreme weather events, sea levels rising and the diminishment of ice and snow, which have caused reductions in global food supply (The Intergovernmental Panel of Climate Change, 2015). The steady increase of anthropogenic carbon dioxide emissions since the pre-industrial era is seen as the “extremely likely dominant cause” of these climate changes (The Intergovernmental Panel of Climate Change, 2015). This means that society shares the responsibility for the changing climate and in response to this challenge before us, society will have to either deliberately seek out, or be involuntarily subjected to, profound societal transformation regarding energy (Hackmann, 2014). Action on this front was taken in the form of the Paris Conference in 2015, where it was agreed upon that the participating countries would, among other things, “Pursue domestic mitigation measures” in order to curb growing carbon dioxide emissions and promote sustainable development (United Nations, 2015).

In Alberta, in preparation for the Paris Conference, a report was issued by the provincial government in November of 2015 that stated that “An ambitious and effective climate strategy will provide Alberta with credibility on the global stage at the upcoming 21st Conference of the Parties (COP) in Paris and in our upcoming national discussions on climate change and will ensure that our province is positioned as a policy leader on climate change mitigation” (Alberta,

2015, p. 2). This led to the development of the Climate Leadership Plan (CLP), in which, there are goals outlining how Alberta can make a move towards reducing their greenhouse gas (GHG) emissions and do their part in mitigating risks associated with climate change. The primary goal of the CLP is to achieve reductions in GHG emissions in Alberta, with secondary goals of economic diversification and an increased community health and well-being (Government of Alberta, 2015). Actions inherent in these overall goals include the phasing out of coal fired power plants and the integration of more renewable energy sources, up to 30% of the overall energy mix by the year 2030, as well as capping oil sands emissions and methane emissions from upstream oil and gas (Government of Alberta, 2015). For these targets to be reached by the desired deadlines, participation by all levels, government, industry and the public will be required. The CLP outlines the support and active engagement in green practices by Albertans as a major required contribution for the plan's success. In order to encourage the necessary changes, the Government of Alberta came up with the following six action areas: Climate policy and leadership, renewable energy, energy efficiency, supply and use of clean technology and transit, support and engagement of Albertans, and skills and employment in the green sector (Government of Alberta, 2015).

For the action area regarding the support and engagement of Albertans, Energy Efficiency Alberta (EEA) was formed. EEA was tasked with, among other things, developing programs and incentives to ensure Albertans will embrace energy efficiency and readily access new energy-saving technologies, whether at home, school or work (Government of Alberta, 2015). The goal is to develop a wide array of programs to most meaningfully and effectively cultivate interest, acceptance and enthusiasm for sustainability and energy efficiency among

Albertans (Government of Alberta, 2015). This plan involves the design and implementation of various intervention programs in order to ensure acceptance and participation in this sustainable energy transition, as well as to aid in demand side management of energy in Alberta. Under EEA, there has been the development of numerous economic incentive programs and education and energy literacy programs in order to better increase public awareness and acceptance of energy efficiency strategies and have been implemented to overcome identified economic and knowledge-based barriers. These programs include home improvement rebates and a no charge energy savings program, in which energy efficient technology will be installed for free (Government of Alberta, 2015). These programs were developed in response to public engagement sessions in which it was discerned that lack of public knowledge and economic factors were the main barriers to the widespread adoption of more sustainable energy practices (Government of Alberta, 2016). However, in order to continue growing the awareness and acceptance of sustainable practices and for the CLP to be ultimately effective, the Government has identified a need for a “Cultural change regarding energy” in Alberta (Government of Alberta, 2016). This means that the common social practices and overall culture around energy production and consumption in Alberta needs to be reconsidered if continued growth in CLP effectiveness is to be seen. With this, seeking to identify and overcome further barriers to sustainable behaviour implementation will be important.

Another aspect to be considered regarding the CLP is the risks regarding the decrease in energy availability, as the province moves away from traditionally reliable sources to integrating a more intermittent one in renewables. As one of the six action areas of the CLP,

investments in renewable energy infrastructure and subsequent production is increasing in Alberta. Renewable energy is sourced from inputs whose supply depends on out-of-control conditions, which is a challenge for operators and regulators of energy markets (Ambec & Crampus, 2012). The variability and unpredictability of intermittent energy sources can conflict with an energy market that demands a reliable supply. One of the ways to manage these issues of intermittency and energy availability associated with changing energy production is to alter energy consumption in such a way that it reduces the overall demand on the system. This can be applied to the residential sector in Alberta, as household energy conservation has been identified as an efficient and effective means of reducing energy demand and associated emissions (Karlin, Zinger, & Ford, 2015). The practices of energy conservation, efficiency, and changing energy sources all affect the demand for energy (National Energy Board, 2009). In order to effectively decrease overall energy consumption, people will be required to exhibit more sustainable behaviour when it comes to energy use. Energy conservation is generally seen as a reduction in level of output or service by deliberately using less energy, and therefore is directly connected to individual's behaviour (National Energy Board, 2009). Given that the causes of global climate change and overall environmental decline are frequently attributed to human behaviour related, a fundamental change to engaging in more sustainable energy behaviour by individuals can have a positive impact (Steg, Perlaviciute, & van der Werff, 2015). This type of sustainable behaviour involves low-carbon practices that may include ongoing behaviors, such as reduced demand for household heating, air- conditioning, vehicle miles traveled, and air travel, or taking up the use of lower-carbon travel modes (Axsen & Kurani, 2012). Other examples of sustainable behaviours involve individuals investing in energy

efficiency, such as refurbishment of houses and adoption of energy-efficient appliances (Steg et al., 2015). Overall, energy behaviour focuses on how individuals behave concerning their direct household level energy practices and subsequent energy consumption. Energy behaviour also includes behaviour on a more macro social level, which involves public opinions, attitudes and the overall culture regarding energy. The connection between household environmental attitudes and real energy consumption is relatively strong, and this connection between energy consumption and environmental perspectives matters because human behaviors contribute directly to environmental problems (Sapci & Considine, 2014)

Using behavioural aspects to better understand individual energy consumption will allow a more complete energy analysis to be conducted. In addition, behavioral interventions aimed at encouraging sustainable energy use will be more successful if they target important antecedents of behavior, and remove significant barriers to change (Steg et al., 2015). Overall, by gaining a better understanding of the behavioural factors regarding energy use more effective behavioural interventions can be developed and implemented, which has the potential to cause a decrease in energy demand. If this was to occur, it would be seen as a success for the CLP, as for this sustainable energy transition to be successful in the long run, there will need to be acceptance and participation by the majority of Albertans.

This leads to the main research question: What are the factors that most strongly influence energy behaviour and how can they be used to influence societal energy consumption practices in Alberta? The purpose of this research is to focus on the underlying reasons why or why not individuals exhibit sustainable behaviour when it comes to energy use. Seeking to understand what drives an individual's energy behaviour and what would be necessary for

them to alter it, could enable sustainability and energy saving strategies to be more appropriately tailored to energy consumers in Alberta. It would also allow for a better understanding of what interventions would be most effective in increasing societal acceptance of and participation in sustainable energy initiatives.

The research aims to address three different dimensions: energy, environment and social dimensions. The energy aspect involves changes to the existing energy culture and subsequent infrastructure in Alberta, understanding energy use of individuals and how to affect changes in overall energy consumption. It also seeks to better understand the existing societal views on energy and energy use in Alberta. In terms of the environment, integrating more sustainable energy consumption behaviours will allow for reduced energy demand and the successful integration of more renewable energy options. A better understanding of individual's energy behaviour will potentially allow for the development of more effective sustainability initiatives and policies. These will enable reductions in greenhouse gas emissions from energy sources and serve to decrease Alberta's carbon footprint overall. The social aspect involves the aspects of individual human and overall social behaviour as it relates to energy analysis. The focus will be on the exploration of the internal and external drivers of one's behaviour regarding energy and how to affect and influence change among them, as well as the role energy plays in our society.

Chapter 2. Literature Review

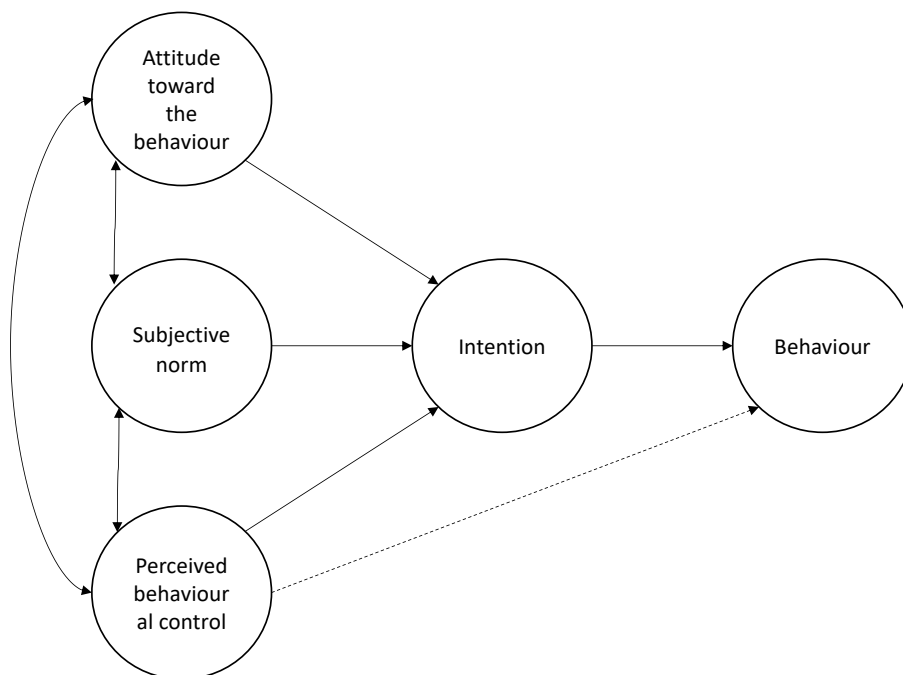
To understand best the role that behavioural factors play in energy behaviour, an integrated approach should be taken. This analysis includes various aspects of behavioural research and how they apply to environmental attitudes and actions, as well as to social norms and constructs regarding energy. The focus of my research is the connection between values, beliefs and knowledge and their relation to an individual's behaviour and the factors that most influence this relationship. I will then focus on how these individual behavioural aspects are affected by external social and cultural pressures, and what behavioural intervention strategies would be the most influential. This increased understanding of how to motivate and empower individuals and households to engage in a wide range of sustainable energy behaviors are needed to encourage a sustainable energy transition (Steg et al., 2015). Key aspects of my research will be utilized to develop recommendations for the ongoing implementation of the CLP in Alberta.

The research conducted for this report involved a literature review that focused on behavioural theories regarding energy, as well as theoretical approaches to energy culture, energy and society, and behavioural intervention strategies. This review required the use of peer-reviewed journal articles from a variety of psychology, science, marketing, sociology, and energy journals obtained from a variety of databases through the University of Calgary library system.

2.1 Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is a widely applied theoretical psychological framework used to explain behaviour and behaviour change. It is based on an individual's intention to perform a certain behaviour being the most proximal predictor of behaviour (Ajzen, 1991). Intentions in this context, are assumed to capture the motivational factors that influence a behaviour; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour (Ajzen, 1991). In this theory, intentions are broken down into three main components: Attitudes, subjective norms and perceived behavioural control (PBC) (Figure 1.) (Ajzen, 1991).

Figure 1. Theory of planned behaviour.



(Ajzen, 1991).

Attitudes refer to the individual's overall evaluation of performing the behaviour, be it positive or negative. Subjective norms are based on individuals' perception of whether other people they deem important in their life would want them to perform the behaviour, whereas PBC reflects the extent to which individuals perceive the behaviour to be under their volitional control (Fielding et al., 2008). This model has good explanatory power across any decision-making contexts and can be directly applied to pro-environmental and sustainable behaviour. A strength of the TPB model is that it allows for the inclusion of additional variables that are relevant to different particular behavioural contexts (Fielding et al., 2008).

The first component of planned behaviour is attitude, and in terms of sustainable behaviour, a pro-environmental attitude can be a major contributing factor. An attitude toward the environment refers to the overall level of concern one has for the environment. It is argued that specific attitudes to a given behaviour such as environmental activism will be a better predictor of intention to engage in that behaviour than will more general attitudes (Fielding et al., 2008). There have been studies done that have found direct empirical evidence connecting environmental attitudes with observable energy consumption behavior. One particular study found that households identify the link between environmental problems and personal energy use, and they reflect these concerns in their energy consumption behavior (Sapci & Considine, 2014). This shows that environmental attitudes have a direct and observable effect on energy consumption behaviour (Sapci & Considine, 2014). Since these attitudes have the potential to be major drivers of behaviour, it is important to know how these attitudes are developed.

A generally accepted theory is that attitudes that drive behavioural intentions are formed from an individual's belief and value systems. Basic value orientations of an individual, and particularly self-transcendent or biospheric-altruistic values, have explanatory power for individuals' beliefs about environmental conditions and their willingness to act in response to them (Stern et al., 1995). "These values have both direct effects on behavioral intentions and indirect effects flowing through beliefs, which may be affected by selective attention to information about valued objects or by direct assimilation to values" (Stern et al., 1995). This means that a person's attitudes towards environmental and sustainable behaviour are founded by how they value environmental aspects and consequences. These values can range from very little environmental value to a considerable amount, with variation amongst those considered pro-environmental.

These values can be more altruistically founded, meaning they have concern for the overall greater good or the environment in general, or they can be more egoistic, where the values are founded out of concern for themselves and how the consequences will impact them. Those who hold egoistic values regarding the environment are generally more concerned with economic costs regarding environmental protection and will likely oppose it if the costs are perceived as high (Stern and Dietz, 1994). However, if environmental damage or changes are perceived as to be directly and measurably affecting them, the egoistic nature of their values will likely drive them to take a more pro-environmental stance (Stern and Dietz, 1994). Environmental values that are altruistic in nature can be more socially founded or more biospherically founded. Social altruistic environmental values are concerned with the cost and benefits to larger human groups, like communities, nation's or humanity as a whole and tend to

have a strong emphasis on morality in their decision making (Stern and Dietz, 1994). Biospheric values are similar in nature to social altruistic ones but have an emphasis on the natural environment and involve morality focused on the non-human world (Stern and Dietz, 1994). Understanding the basis and focus of one's values is important, as a strong value orientation may lead someone to seek information selectively or to attend selectively to information about the consequences of an environmental condition for particular valued objects, and therefore to develop beliefs about those consequences that will guide action (Stern and Dietz, 1994). A belief in the nature and likelihood of an outcome and how that outcome will affect the valued "objects" is the main builder of the attitude construction process. The better this process is understood with regards to pro-environmental and sustainable behaviour will allow for the better anticipation of individual's reactions to emergent social and cultural changes regarding energy.

Another aspect of attitude formation based on values and beliefs is legitimacy. An individual's legitimacy judgement itself is an attitude that is influenced by domain specific beliefs and globally held values (Finch et al., 2015). In terms of attitudes towards the energy sector, these domain specific beliefs are built by the individual's perceived credibility of three different institutions: the industry itself, environmental non-government organizations (ENGO), and the mass media (Finch et al., 2015). How much credibility the individual assigns to the information of each of the institutions will greatly influence how the individual builds a value and belief system around this domain and ultimately how legitimate the individual feels that particular industry is. For example, if the individual assigns high credibility to the industry itself, low credibility to the ENGO's, and a moderate credibility to the mass media, this individual will

likely have a high legitimacy judgement for this industry and develop an attitude in favor of it. The other aspect of legitimacy is global values, which in the case of the energy sector, is the environment and the economy (Finch et al., 2015). These two values will also influence the building of domain specific beliefs and the subsequent legitimacy judgements. How one values the environment vs economic development will influence how much credibility they give the information from the different institutions therefore, how they ultimately feel about the particular industry in the energy sector. The final major influencer of legitimacy judgements was found to be physical proximity to the industry in general (Finch et al., 2015). In terms of the Canadian oil sands, research shows that those who reside closer to the oil sands themselves have different attitudes around them than those who reside further away (Finch et al., 2015). This research found that residents of Edmonton, AB had legitimacy judgments that gave higher credibility to the industry and had a higher overall legitimacy to the oil sands industry than that of residents of Toronto, ON (Finch et al., 2015). Therefore, an individual's legitimacy judgement is a result of both internal and external factors. While values and beliefs play a major role in attitude and subsequent behaviour formation, outside social influencers also factor in to this construction process.

The second component of behavioural intentions in the TPB is subjective norms, which involve an individual's perception of whether or not others they deem to be important want them to perform a certain behaviour (Fielding et al., 2008). This refers to the perceived social pressure to perform or refrain from acting in a certain way; meaning that individuals may behave in ways different to what their attitudes may indicate if external social influences are present. These social influences can include the attitudes and actions of other individuals, mass

media, and social movements (Stern and Dietz, 1994). When considering social norms as an influence on behaviour, it is important to note that there are two different meanings: descriptive and injunctive descriptions that refer to separate sources of human motivation (Cialdini et al., 1990). A descriptive social norm is one that describes what is typical or normal. It is what the majority of people do and provides evidence of what is the most effective and adaptive action and provides individuals with an information-processing shortcut when it comes to decision making and behaviour (Cialdini et al., 1990). Recognition and imitation of what others are doing is a more efficient means of behavioural decision making and is seen to influence the behaviour of most people (Cialdini et al., 1990). An injunctive social norm refers to rules or beliefs of morally approved and disapproved social conduct and specifies what ought to be done (Cialdini et al., 1990). It not only informs what to do, it also provides a socially accepted understanding of what is right and what is wrong. In most societies, these two types of social norms overlap quite frequently; however, they are conceptually and motivationally distinct.

When individuals identify themselves as a part of a group, their behaviour will become group-based and will be guided by the norms of that group (Fielding et al., 2008). On a societal level, when individuals identify as members of society the existence of social norms serve influence behaviour by giving cues and indicators as to what actions are deemed acceptable and desirable in that society. In terms of sustainable behaviour, social norms have been found to effective influencers (Delmas et al., 2013). Studies have found that individuals that live in communities that openly encourage sustainable and pro-environmental behaviour had significantly higher individual participation in sustainable actions than other control

communities (Delmas et al., 2013). Studies have also shown that if their choices are publicly visible, individuals are more likely to purchase and utilize “green” products than if their choices were kept private (Delmas et al., 2013). It has been found that the existence of strong social norms in a society will contribute to a higher adoption of pro-environmental and sustainable behaviour (Gadenne et al., 2011). While norms can influence pro-environmental behaviour, it can also do the opposite. If individuals exist in a place where it is acceptable to act in an unsustainable way, then they are more likely to. Perceived inequity in action is often cited as a reason as to why individuals don’t act sustainably (Gifford, 2013). The concept of “if they don’t have to, why should I?” allows people to utilize social norms to justify their own behaviour, especially if well-known persons, organizations or even nations are used as a comparable (Gifford, 2013). This indicates that the culture regarding sustainability that exists in a society has the potential to affect behaviour regardless of the attitudes of the individuals in that society.

The third and arguably the most influential component of the TPB is perceived behavioural control, which involves the extent to which individuals perceive the behaviour to be under their volitional control (Fielding et al., 2008). This, in essence, is the ease or difficulty of performing the behaviour perceived by the individual, which serves to affect behaviour either directly or by affecting an individual’s intentions. A high level of perceived control should strengthen a person’s intention to perform a behaviour, and subsequently increase effort and perseverance (Ajzen, 2002). The control an individual feels they have over a certain behaviour involves many different factors. The first involves their self-efficacy, or belief in their capabilities to exercise control over their own lives, as well as how well they can successfully

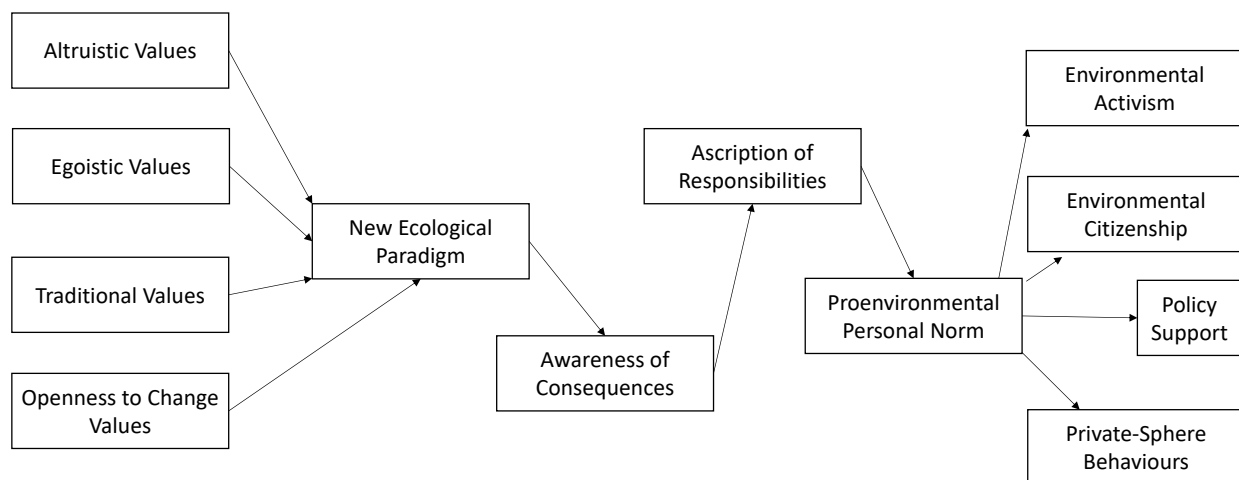
execute the courses of action required to produce the desired outcome (Ajzen, 2002). The more confident and in control an individual feels in regard to their own abilities, the more likely they are to take the necessary steps to perform a desired behaviour. Another factor of PBC is the controllability of the behaviour itself, which deals with the extent to which the performance is solely up to the actor (Ajzen, 2002). If an individual perceives a behaviour to only require an internal effort by them to perform it, then they will be significantly more likely to engage in it (Ajzen, 2002). In contrast, if performing the behaviour requires the overcoming of barriers, or requires the involvement of numerous other parties, the individual will likely feel a lack of control and will be significantly less likely to perform the behaviour (Cordano & Frieze, 2000).

Overall, the TPB is used to understand behaviour and behavioural change in individuals, with intent being the most proximal predictor. The first major aspect of the TPB is attitudes towards the certain behaviour, which are based on personally held values and beliefs. These internal factors affect how an individual feels towards a certain behaviour and must be present if they are to behave in a certain way. Another aspect of the TPB is the existence of social norms, which indicates that external pressures related to the social situation of the individual can direct behaviour regardless of existing attitudes. These pressures can be consequential, like rules, or directive, like guides or models, and either one serves to influence behavioural implementation. The third aspect of the TPB involves how much control an individual feels over their own behaviour, meaning that the more enlightened and empowered an individual feels towards a behaviour, the more likely they are to act on it. Understanding these aspects of behavioural intent are important to know why people behave a certain way and how, if one wishes, to intervene or change an individual's behaviour.

2.2 Value-Belief-Norm Theory

The Value-Belief-Norm (VBN) Theory is a psychologically based theory that was developed to specifically explain environmental behaviour. It seeks to integrate general values and environmental concern with norm activation models and works to mediate relationships between the behavioural variables. The theory proposes a causal chain of variables that go from general values and beliefs, to behaviour-specific beliefs and norms, to behaviour (Figure 2.) (Stern, P.C., Dietz, T., Abel, T.D., Guagnano, G.A., Kalof, L. (1999)

Figure 2. The value-belief-norm theory.



(Stern et al., 1999).

The theory holds that pro-environmental actions occur in response to personal moral norms about such actions and that these are activated in individuals who believe that environmental conditions pose threats to other people, other species, or the biosphere and that actions they initiate could avert those consequences (Steg et al., 1999). The beginning of the causal chain is personal values, which are viewed as being more general, stable beliefs that

are central to one's identity and tend to be guiding principles for them. In the VBN Theory, these values are divided into different value bases: egoistic vs altruistic and traditional vs openness to change (Steg et al., 1999). These value bases determine if an individual's concern regarding the environment is a result of concern for themselves or regarding things outside of themselves, such as other people or other non-human entities. An egoistic environmental value basis would be anchored in concern for how the impacts of that particular environmental degradation would affect them, whereas an altruistic value is based on how that degradation affects others. They also determine if an individual tends to be more concerned with the conservation of traditional values or if they are open to changing to new values when given new information. How an individual's value sets correspond with the given value bases determines how likely they are to accept a New Ecological Paradigm (NEP), which is a worldview that human activity has adverse effects of the fragile ecosystem (Steg et al., 1999). The use of NEP is a widely accepted social-psychological measure that focuses on broad beliefs and awareness about how human action is causing adverse consequences on the earth, and the more awareness and predisposition an individual has to this paradigm, the more likely they are to accept it (Steg et al., 1999). It also allows for the relation of one's existing values to how they see themselves in relation to the environment, which leads into the next step of recognizing the environmental impacts of their behaviour (Abrahamse & Steg, 2011). The more aware an individual becomes of the negative consequences of their actions, the stronger their feeling of responsibility towards these consequences will become. This leads to the activation of personal norms regarding pro-environmental behaviour as the individual feels a moral responsibility to act (Steg et al., 1999). These feelings of moral obligation are assumed to be positively related to

willingness to act pro-environmentally and actual pro-environmental behaviors (Abrahamse & Steg, 2011). This theory works through a causal progression from personally held values to the end result of acting in a pro-environmentally and sustainable way. Throughout the progression, there are many areas that can be shaped by external pressures, such as the introduction of new social norms, new information or gaining a different perspective on certain issues. The social context and structure external to this theory also plays a major role in the expression of the desired behaviours (Steg et al., 1999). The social aspects can act either as an opportunity or a constraint to the pro-environmental behaviour, which will ultimately determine the outcome of the causal progression in the VBN Theory.

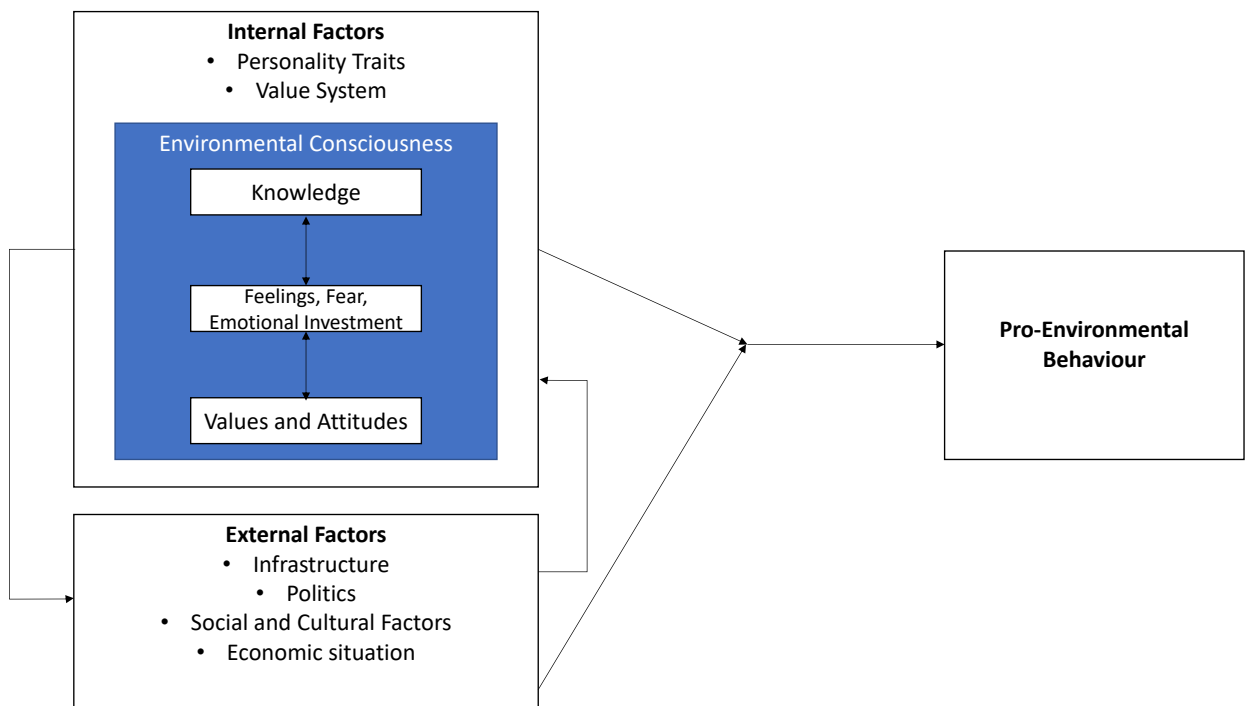
This theory indicates that differently-based values in an individual synthesize to form new beliefs and attitudes that will eventually lead to the enactment of pro-environmental behaviour. While its foundational aspects are similar to the TPB, it differs in that the foundational aspects are proposed to be causal results of one another. The behaviour cannot exist without the formation of personal norms, which in turn would not exist without individual values and awareness. The key aspect from this theory is that external pressures can act on the causal chain at any point and play a major influencing role in either supporting or hindering the behavioural implementation. Changing norms, information or rules can all be opportunities or constraints to certain types of behaviour.

2.3 Model of Pro-environmental Behaviour

This model was designed with influence from existing behavioural models in an attempt to better incorporate all the factors behind exhibiting pro-environmental behaviour. There are

many conflicting and competing factors that shape daily decision making and actions; this is also true for pro-environmental behaviour. In this model, both internal and external factors are seen as foundational aspects of pro-environmental behaviour (Figure 3.).

Figure 3. Model of pro-environmental behaviour.



(Kollmuss & Agyeman, 2002).

Regarding internal factors, there is no direct relationship attributed to environmental knowledge and pro-environmental behaviour (Kollmuss & Agyeman, 2002). Rather, internal factors in this model make up a complex called “pro-environmental consciousness”, which is made up of environmental knowledge, values, and attitudes together with emotional involvement (Kollmuss & Agyeman, 2002). The goal of this complex is to better define one’s existing internal environmental antecedents to behaviour, and when this complex is embedded

with broader personal values and personality traits, it gives a more complete picture of all the internal factors that influence pro-environmental behaviour.

The external factors in this model include existing infrastructure, political, social and cultural factors, as well as the economic conditions. In the model, both external and internal factors are seen as having influence on one another, and the biggest positive influence on pro-environmental behaviour is when the external and internal factors act synergistically (Kollmuss & Agyeman, 2002). This indicates that even if all the necessary internal factors are present, without influence from the external factors, there may not be enough overall influence to overcome barriers to behavioural implementation.

Also included in the model are various barriers to positive influence on pro-environmental behaviour. These barriers include economic and knowledge-based barriers, as well as lack of internal incentives. However, the most significant barrier identified in the model is that of old behaviour patterns. Old habits form a very strong barrier and are often overlooked regarding behaviour change and pro-environmental behaviour (Kollmuss & Agyeman, 2002). When there is a desire to establish a new behaviour, it has to be practiced in order for it to become habitual. Even those perfectly willing to accept a new behaviour or behaviour change may not succeed if they do not persist in practicing the desired behaviour to a point where it becomes habit (Kollmuss & Agyeman, 2002).

This model acknowledges that there are many internal and external aspects of pro-environmental behaviour and seeks to better understand how they interact and influence one another. A key aspect of the model is how internal and external factors are treated as equal foundational aspects of implementing pro-environmental behaviour. The previous theories saw

internal factors as the foundation of behaviour, with external pressures impacting them, while this model places them as equal. This changes the mindset around enacting pro-environmental and sustainable behaviour, as it demonstrates the importance of both the internal and external factors acting synergistically in order for the desired behaviour to be enacted. This required synergy emphasizes the need for interdisciplinary and integrated approaches to solving behaviourally based environmental issues.

2.4 Behaviour Related to Energy Consumption

In order to apply individual behavioural models to energy behaviour, it is necessary to have a conceptual understanding of behaviour and how it relates to energy consumption. Generally, energy consumption behaviour is grouped into three dominant perspectives: Rational economic, psychological and sociological (Davoudi, Dilley, & Crawford, 2014). The rational economic perspective suggest that people are utility maximizers and all their energy decisions will be based on logical and fiscally sound decisions (Davoudi et al, 2014). This implies that people's energy consumption behaviour will be a direct reflection of the costs and benefits and that the only interventions necessary to alter behaviour is that of education and financial incentives (Davoudi et al, 2014). Issues with this perspective are that it discounts social context and other non-rational aspects, such as habits and emotions. This has traditionally been the main perspective used to understand energy consumption behaviour.

The psychological perspective argues that rationality is bounded by limiting characteristics and therefore considers heuristics and patterns. It states that on top of rationality, decisions regarding energy consumption will contain various biases that run counter to fundamental

rationality assumptions (Davoudi et al, 2014). This perspective includes framing and accessibility to information regarding energy consumption, as well as considers habitual, ritual and conventional bases of human behaviour (Davoudi et al, 2014). It implies that humans are not always rational, may not always properly assess the costs and benefits prior to deciding, and that they may not always act in their own self-interest. Therefore, in understanding individual consumption behaviour, one cannot assume that rationality will always be the basis of the judgements made.

The two aforementioned perspectives focus on individual behavioural choices, while the sociological perspective also considers the social and cultural processes that play a crucial role in behavioural decision making (Davoudi et al, 2014). This perspective also considers rationality to be bounded by not only individual cognitive capacity, but by social context as well. People's decision making regarding energy use is being driven by their own desire for control, as well as in response to various social pressures. These pressures can exist in three particular forms that are influential to decision making: coercive, mimetic, and normative (Davoudi et al, 2014). Coercive social pressure involves the use of social sanctions, such as rules and regulations with punishments for non-conformity, in order to achieve desired behaviours. Mimetic pressure involves relying on imitating the actions of others to gain context and reduce complexity for desired behaviours. Normative pressure involves values and what is deemed acceptable behaviour. In order to affect behavioural change, these pressures can be employed. Those with the power to define the norms and standards of a society, as well as those who can lead by example and set cultural expectations, have the potential to bring about change throughout society and its institutions (DiMaggio & Powell, 1983).

In order to progress towards more sustainable forms of energy demand and supply as a society, there needs to be a shift in not only individual behaviour, but a reworking of institutional practices and systems of provision (Davoudi et al, 2014). A shift in energy behaviours requires a multi-level and cross-sectoral approach which addresses material, institutional, social and subjective determinants of behaviour simultaneously (Davoudi et al, 2014). Studies have shown that socio-demographic variables were the main determinant of household energy use, and that social constraints and opportunities strongly shape household energy consumption patterns (Abrahamse & Steg, 2009). However, in a different perspective, household energy savings and the adoption of sustainable practices were found to be mainly driven by psychological variables (Abrahamse & Steg, 2009). Contextual variables such as income shape households' opportunities for energy consumption, whereas reductions in energy use require conscious efforts to change behaviors/adopt energy-saving measures (Abrahamse & Steg, 2009). The finding that energy savings are related to psychological variables may be important from a policy perspective, as interventions or policy measures aimed at promoting energy savings may want to target specific (psychological) variables (such as enhancing levels of perceived behavioral control) (Abrahamse & Steg, 2009).

Overall, the aforementioned socio-psychological theories regarding behaviour show that exhibited behaviour results from many interacting factors. In terms of individual behaviour regarding sustainable practices with energy use, the building up of the internal factors of behaviour is important, as the establishment of a pro-environmental consciousness in an individual will pre-dispose them to acting in a more environmentally responsible way. This will then lead to a willingness to change practices for their consumption of energy, as their beliefs

and feelings towards the environment may cause them to consume energy less rationally or outside of the norm. Also, the more knowledgeable and more confident an individual feels in their own ability to act sustainably, the more likely they are to follow through and exhibit the behaviour. The theories also show that attention must be paid to the external factors around pro-environmental behaviour and energy consumption. Social constructs and infrastructure can either allow for individuals to act upon their existing attitudes or become a hinderance for them. Social and cultural values can also act as a guidance and reinforcement for the exhibition of sustainable energy behaviour, therefore understanding how energy and society interact is important.

2.5 Energy and Society

There are two different schools of thought regarding how energy and society interact. First, energy production and use are the consequence of changing political, economic, and technical systems, meaning that having energy is a result of the societal institutions that have been built up. The second is that energy supply and demand are realized through artefacts and infrastructure that constitute and are woven into complexes of social practice (Shove & Walker, 2014). This means that we don't use energy for the sake of using it, we use it to build our society and accomplish social practices; therefore, energy is a construct of our society, rather than just an outcome. The former is the way that energy is currently considered in our society; however, if change to the energy system of a society is to occur, a shift to the latter consideration may be required. In order for these deliberate efforts to reduce energy demand to be effective, the question of how energy and society interact should be answered (Shove &

Walker, 2014). Existing theories on drivers of change regarding energy proclaim that change in energy systems are technologically driven and therefore are shaped by social conditions and choices (Shove & Walker, 2014). This means that a change in energy must be through adoption of new technology, which will only happen through societal acceptance. Other existing theories proclaim change in energy systems are economically driven and therefore are a more political issue (Shove & Walker, 2014). This shows how there is discrepancy in how energy and social systems are thought to interact, as both theories credit different institutions as being the main driver behind the energy system shift. This then complicates the process of making changes to the energy system in order to achieve demand reductions. If a shift towards more sustainable energy practices is to be successful, then re-framing how we think society and energy interact is important.

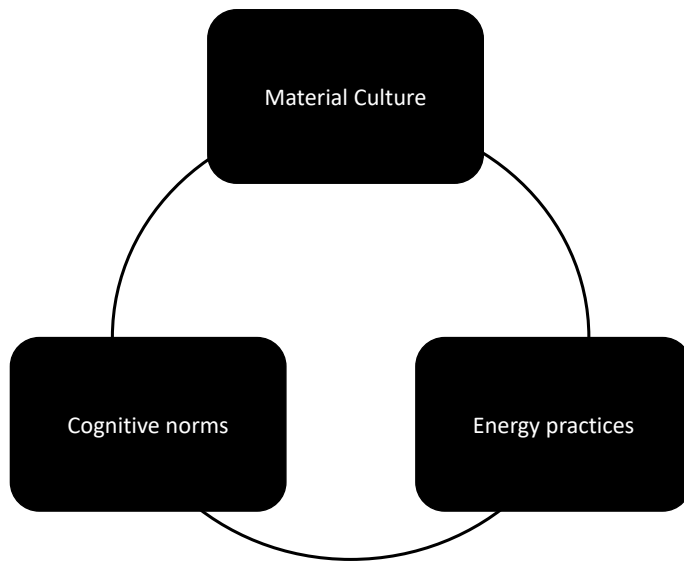
There is relevance and potential in conceptualizing energy not as a cause or a consequence of social systems but as an ingredient of the social practices and complexes of practice of which societies are composed (Shove & Walker, 2014). These practices are patterns of activities that are considered a normal part of our society, such as the use of energy at home, by watching television, or at the workplace, through holding meetings. These practices are a means of accomplishing something and, through participation, make an individual feel included in society. This is a fairly simple but fundamental change of orientation that has significant consequences for those interested in understanding, analysing and influencing energy demand. Because energy is used for the purpose of accomplishing social practices, accounting for change is not a matter of forces like technology or economics, but rather the details of the interactions, social order and practices in a society (Shove & Walker, 2014). A consideration that must be

made is that energy is used not for its own sake but as part of accomplishing other social practices. Energy demand is consequently dynamic, social, cultural, political and historical: it is bound up with the temporal rhythm of society and with what people do (Shove & Walker, 2014). Also, energy demand is profoundly shaped by material arrangements. In a very literal sense, demand and the means to consume constitute each other. These means encompass grids, power stations, road and rail networks through to the multitude of devices with which end-users engage (Shove & Walker, 2014). From this it follows that insofar as policy has an impact on energy use, it does so by means of modifying or transforming material arrangements, practices and social orders (Shove & Walker, 2014). Recognizing energy as an ingredient of social practice is important for climate change and sustainability considerations. This means that when considering the behavioural aspects of energy use, the societal use of energy and its associated infrastructure must also be considered simultaneously.

Another perspective on the relationship between energy and society is the energy culture framework. Energy cultures incorporate both the concepts of lifestyle and the material world as structures that influence energy behaviour (Stephenson, Barton, Carrington, Gnoth, Lawson, & Thorsnes, 2010). Entrenched cognitive, social, economic, institutional and technological processes lock us into trajectories and lock out sustainable alternatives (Stephenson et al., 2010). Adoption of new technologies is not straightforward: it involves adjustments to many aspects of a self-reinforcing system, such as cognitive routines, design criteria, regulations and standards, markets, sunk investments and competencies (Stephenson et al., 2010). The energy cultures framework is a model that seeks to understand the many factors that influence energy

behaviour in an integrated way by examining the interactions between cognitive norms, material culture, and energy practices (Figure 4).

Figure 4. Energy cultures framework



(Stephenson et al., 2010).

Cognitive norms include aspects like beliefs and understandings and have a strong influence on people's technology choices and their practices. Material culture includes the technologies themselves and building forms and infrastructure that influences technology choices and the potential for different energy practices. Energy practices involve activities and processes and determine how the technologies are used (Stephenson et al., 2010).

These three components bring together the technical aspects, the value and attitude systems and the individual, social and institutional interactions involved in energy behaviour (Stephenson et al., 2010). The social-psychological theories are integrated as internal and

external factors constituting individual behaviour work in concert in this framework. For sustainable energy behaviour to be implemented by individuals, the psychological component, social component and physical components all need to be interacting in a synergistic way. This framework should provide energy suppliers with a better picture of energy behaviours, based on the interactions of the three core concepts. This framework will also help with the identification of entrenched energy behaviours, as once stabilization has occurred, the dynamics between the components will be self-reinforcing. Inversely, when the components become misaligned, the potential for behaviour change arises. For example, if there is a change in belief of the importance of energy efficiency in society, this will affect the cognitive norms of the society, and, in order for the components to become re-aligned, subsequent changes will need to occur in the material culture and energy practices components (Stephenson et al., 2010). In particular, by identifying clusters of people or households with similar behavioural patterns, it can assist in the crafting of more effective interventions and incentives targeted to specific energy cultures (Stephenson et al., 2010).

2.6 Interventions

In order to effect change with energy related behaviour, intervention is required. The aim of interventions is to reduce electricity demand and negative environmental impacts by changing household consumption patterns, and in order to accomplish this, both macro and micro-level variables need to be considered (Abrahamse, Steg, Vlek, & Rothengatter, 2005). Generally, behavioural interventions are aimed at voluntary behaviour change, which involves targeting an individual's values, perceptions and preferences (Abrahamse et al., 2005). These interventions

may also aim to change the context in which decisions are made, through the use of financial incentives, laws, or the provision of energy efficient equipment (Abrahamse et al., 2005).

Behaviours related to reducing energy demand via household conservation can be divided into two categories: efficiency and curtailment. Efficiency are more one-off behaviours, like purchasing more energy efficient equipment or appliances, while curtailment is more repetitive and ongoing efforts to reduce overall energy use (Abrahamse et al., 2005).

There are two main types of behavioural intervention strategies: Antecedent interventions and consequence interventions. Both of these strategies involve the use of external forces in order to influence and ultimately affect behaviour, while utilizing different mechanisms to do so. Antecedent interventions aim to influence one or more determinants of behaviour prior to the performance of that behaviour. This involves a focus on providing information to increase knowledge which, in turn, are believed to influence behaviour (Abrahamse et al., 2005). These interventions include goal or target setting, providing information via mass media campaigns or workshops, or developing models to provide examples of recommended behaviours.

Consequence Interventions aim to influence behaviour through the use of positive or negative consequences. Using rewards and punishment on pro-environmental and environmentally unsound behaviours, respectively, will act as positive and negative reinforcement of those behaviours (Abrahamse et al., 2005). These interventions include feedback mechanisms as well as rewards and penalties.

Feedback interventions refer to the process of giving people information about their own behaviour that can be used to reinforce or modify future actions (Karlin et al., 2015). Feedback

in the energy domain is receiving increasing amounts of attention due to technological advances in sensing technology and energy infrastructure that enable energy information to be collected and fed back to customers quickly, cheaply and in real time (Karlin et al., 2015). Feedback can play a key role in engaging individuals in the residential sector about energy conservation by highlighting and increasing consumer awareness of otherwise abstract and seemingly invisible energy impacts of household behaviours (Karlin et al., 2015). While energy feedback has been found to be effective regarding energy saving behaviour, its effectiveness is dependent on several variables, which include feedback frequency, medium, measurement and duration (Karlin et al., 2015). The frequency of which the feedback is provided to consumers is an important variable. The more frequently and more immediately consumers receive their energy data, the more attention is drawn to it and the more strongly it associates the feedback with their actions and with consequences (Karlin et al., 2015). The medium in which the feedback is received also affects the effectiveness of feedback. Utilizing digitized media over traditional paper delivery for feedback will increase accessibility, frequency and engagement opportunities for feedback. The measurement communicated in feedback is also very important, as energy feedback given in kWh may be more abstract and more difficult for people to comprehend compared to data reported in financial terms or carbon emissions (Karlin et al., 2015). Comparisons serve to increase user engagement in the feedback as well. Having a benchmark or performance goal associated with the feedback data may serve to motivate greater reductions in energy use. Finally, feedback duration is a very important variable if the desired outcome is prolonged and lasting behavioural change. A longer, more complete set of

feedback data and a lengthened period of attention from the user are some of the benefits of a longer feedback duration (Karlin et al., 2015).

There is significant evidence that providing feedback is an effective strategy for promoting energy conservation behaviour. The effectiveness increases when combined with external incentives and goal-based and comparison-based interventions are utilized (Karlin et al., 2015). The success of feedback is also reliant on the user's level of engagement, which is generally influenced by the user's previous motivation to save energy (Oltra, Boso, Esplugas, & Prades 2013). If the user has a stronger pre-existing pro-sustainability attitude, then feedback mechanisms will have a greater impact on the exhibited behaviour. To be most effective, the feedback intervention must gain the individual's attention, maintain engagement over time, and incentivize the individual to reduce energy consumption (Oltra et al., 2013). Antecedent interventions can be successful but need to be appropriately tailored to their audience and are more successful when paired with other intervention strategies (Abrahamse et al., 2005). This indicates that a generalized antecedent intervention strategy will be less engaging and have a lesser effect than that of one developed with a specific audience in mind. Consequence interventions also are successful; however, if the consequence mechanism is not ongoing, then the intervention success decrease greatly (Abrahamse et al., 2005). The punishment and reward strategies require a lasting presence to have the desired effect on behaviour.

In terms of policy-based interventions for energy related behaviours, there are some issues with the current strategies. There currently is a disconnect in how policy treats the relationship between technological and social change. Existing policy throughout North America and Europe

tends to frame radical technical change as occurring in the context of social stasis, rather than them being interwoven and changing simultaneously (Spurling, McMeekin, Shove, Southerton, & Welch 2013). Energy and technology have become such a fundamental part of society that substantial change in one generally cannot occur without change in the other. This also implies that sustainability will not be achieved simply through supply side innovation; demand side consumption also plays a major role. Current policy focuses on individual consumer choices and behaviour without incorporating the social context in which the energy consumption decisions are being made (Spurling et al., 2013). Researchers have found that sustainability interventions are more effective when they focus on social practice as a whole, rather than just on individual behaviour (Spurling et al., 2013). If policy isn't framed properly, it may only serve to reinforce what "normal" is and can limit the potential for change and encourage existing unsustainable behaviour. Change is about what is considered "new" becoming "normal", so if policy doesn't properly frame the new, more sustainable practices, it could lead to society considering it to be still outside the norm and therefore not adopting the change. This can be overcome if policy focuses on re-framing what common social practice looks like and can develop a new "normal" for social practices (Spurling et al., 2013). An example is how recycling programs has made recycling become a new "normal" social practice. Prior to these programs, recycling was a practice outside of the social norms at the time. The development and implementation of the recycling programs enabled the act of recycling to become re-framed as a common social practice and itself has become the new societal norm.

Policy interventions seeking to promote sustainable consumption should consider all of behaviour, consumer choice and technology, rather than just forming interventions that focus

on the specific aspects individually. This may serve to develop more long-term interventions that guide trajectories of practice in more sustainable directions (Spurling et al., 2013). For interventions to be effective, the barriers to the desired sustainable behaviour adoption should be positively identified and interventions should be designed to overcome them (Wilson & Dowlatabadi, 2007). An aspect of policy interventions is implementing policy on a more community level to take advantage of social feedback, which can be harnessed and utilized to better promote change and social learnings regarding energy efficiency (Wilson & Dowlatabadi, 2007). For example, early adopters of sustainable behaviour and technology can provide feedback on experiences and outcomes that can offer support for positive attitude formation and complement normative beliefs (Wilson & Dowlatabadi, 2007). Utilizing interventions at a community level are very relevant and effective in areas where social norms at a household level act as barriers. Community based social interventions involve strategies such as social feedback, marketing, communication and reinforcement approaches (Wilson & Dowlatabadi, 2007). The social and cultural nature of energy demand may mean effective interventions are more time and place specific and not always universally applicable (Wilson & Dowlatabadi, 2007).

Another socially focused intervention strategy is community-based social marketing (CBSM), which is a framework that focuses on using social marketing techniques to lower barriers to sustainable behaviour (Vigen & Mazur-Stommen, 2012). The basis of CBSM is that behaviour change is most effectively achieved through initiatives delivered at the community level and seeks to address that the psychological and social dimensions of human decision making are not done in isolation but rather in concert (Vigen & Mazur-Stommen, 2012). CBSM processes

and programs are designed to lower barriers that may go overlooked in conventional utility programs. These conventional programs, while offering generous financial incentives, struggle to achieve a high implementation rate as acting sustainably often involves more complex decision making and other, non-economic barriers (Vigen & Mazur-Stommen, 2012). The idea behind incorporating CBSM into these more complex programs is to move the program's focus from motivating individuals to engaging communities. Through harnessing the attributes of human sociability, programs can lower real and perceived barriers to action and motivate behavior change beyond what financial incentives can sustainably affect (Vigen & Mazur-Stommen, 2012). Community-based social marketing uses marketing principles and techniques to "create, communicate, and deliver value" to influence a targeted behavior (or set of behaviors) in a socially beneficial and long-term way (Vigen & Mazur-Stommen, 2012). This is accomplished by identifying the specific local barriers to the desired behaviour, via local engagement and research, and then developing a custom programs strategy designed to address them specifically.

Chapter 3. Methods

The research for this report involved a qualitative case study of Alberta Climate Leadership policy and actions, with a focus on the implications for behavioural shifts in societal consumption patterns. This case study uses data on the Climate Leadership Plan and Energy Efficiency Alberta from the Government of Alberta regarding their goals, objectives, and initiatives. Secondary and supporting data from reports and articles from public engagement sessions and follow up monitoring reports were also considered regarding policy and action. The data for this report was obtained from a variety of secondary sources, for which a deductive approach was taken. Data involving the energy use and behavioural patterns in the residential sector in both Alberta and Canada overall was targeted based on previous research into energy behaviour. One of the sources was Statistics Canada (StatCan), from which published reports entitled Households and the Environment: Energy Use were utilized. These reports are produced, published and made accessible to the public and the data collection occurs as a result of numerous nation-wide surveys conducted regarding residential energy use. These surveys include questions regarding energy use and technology habits, as well as social conditions such as education and income. These reports also integrate information from Environment Canada and Natural Resources Canada (NRCan) regarding energy and environmental trends throughout Canada. This paper will utilize data from the 2011 and 2013 Statistics Canada reports, as they are the most recently available and relevant published reports. Also utilized in this paper will be Natural Resources Canada's Energy Outlook 2016-2017 report regarding energy and electricity use statistics throughout Canada and Alberta, in order to see trends and gain context of overall residential energy use. The National Energy

Board (NEB) provincial energy profile report for Alberta was also utilized in order to better understand the energy infrastructure and energy impacts for Alberta.

Chapter 4. Data Analysis

Natural Resources Canada energy use and outlook reports show that in Canada, the residential sector accounts for 12% of total energy use and 32.9% of total electricity use per sector (See Table 1) (Natural Resources Canada, 2017).

Table 1. Energy use by sector in Canada.

Sector	% of Energy use
Industrial	28%
Residential	12%
Agriculture	2%
Commercial and Institutional	7%
Transportation	21%

(Natural Resources Canada, 2017).

In terms of energy use, this ranks the residential sector behind the transportation and industrial sectors, and for electricity, behind only the industrial sector. This shows that, while the residential sector in Canada is not the largest sector for energy consumption, it is still a fairly significant one and any efficiencies and reductions in energy demand from this sector can serve to have a substantial impact on overall energy and specifically electricity demand in Canada. In terms of electricity use in Alberta, it was found that they have the third highest electricity consumption per province in Canada, with 13% of all Canadian electricity being consumed there (Table 2) (Natural Resources Canada, 2017).

Table 2. Electricity energy use by province in Canada.

Province	% of Electricity use
B.C. and Territories	12%
Atlantic Canada	7%
Quebec	36%
Ontario	24%
Manitoba	4%
Saskatchewan	4%
Alberta	13%

(Natural Resources Canada, 2017)

This places Alberta behind only Ontario and Quebec and indicates that the province is a major electricity consumer in the country. Electricity demand for the residential sector in Alberta has been forecasted to increase from current annual consumption (~ 9900 GWh) to around 13500 GWh by the year 2029 (Appendix A, Table A4) (Alberta Electric System Operator, 2010). This forecasted increase in consumption is based on projected growth in Alberta's population and overall economic production. Electricity production in Alberta is dominated by fossil fuels, with over 87% of Alberta's electricity generation coming from either coal or natural gas in 2016 (Table 3) (National Energy Board, 2016).

Table 3. Alberta electricity generation by fuel type.

Fuel Type	% of Total Generation (82.3 TWh)
Coal & Coke	47%
Natural Gas	40%
Wind	7%
Hydro	3%
Biomass/Geothermal	3%

(National Energy Board, 2016).

Because of this reliance of fossil fuels, Alberta is also one of the largest producers of GHGs attributed to electricity production in Canada, as Alberta's power sector generated 46.1 MT CO₂e emissions, or 57% of total Canadian GHG emissions from power generation (National Energy Board, 2016). This data shows that as a major electricity consumer, Alberta stands to have an impact on the overall electricity use of the country and to play a major role in the reduction of GHG emissions attributed to electricity production.

The Households and the Environment reports gives data regarding tendencies to engage in energy saving practices across the country. Energy saving practices include retro-fitting homes to be more energy efficient, installing energy-star appliances, and engaging in energy reducing behaviour such as turning off lights and appliances when not in use (Statistics Canada, 2013). This report states that across all the listed energy saving practices, Alberta had lowest overall participation rate amongst all provinces in energy saving practices (Statistics Canada, 2013). This data implies that the citizens of Alberta are the least likely out of all the provinces to

adopt energy saving practices and engage in sustainable behaviour. These findings do correlate with the Government of Alberta's findings based on stakeholder engagement that there is a need to pursue a "shift in attitude and culture" and "build up a foundation for cultural change" regarding sustainable behaviour in Alberta (Government of Alberta, 2016). This means that changes and interventions will need to be made in Alberta if sustainable practices are to be more widely accepted and implemented.

The data from the Households and the Environment reports also gives insight into the energy consumption habits of various households across Canada in conjunction with other social factors, such as education level and income per household. When comparing energy use against these factors, some interesting trends were found, one of which being that home energy use increased with income and education level. Households across Canada with an annual income of \$150,000 and over consumed an average of 141 GJ of energy in 2011, compared to 68 GJ consumed by households with an annual income under \$20,000 (Appendix A Table A2.) (Statistics Canada, 2013). Total energy use was highest in households where at least one member had a university degree (109 GJ) as compared to those with the least level of education (87 GJ) (Appendix A Table A3.) (Statistics Canada, 2013). These Canadian trends were also mirrored in Alberta as well, with increased energy consumption levels being positively correlated to the higher income and more educated households (Statistics Canada, 2013).

Chapter 5. Findings and Discussion

The data demonstrates trends that indicate that the barriers considered to be most prevalent to sustainable behaviour, economic factors and lack of knowledge, are potentially not as dominant as once thought (Government of Alberta, 2016; Statistics Canada, 2013). This runs counter intuitive to the commonly held theory that low income and lack of knowledge inhibit sustainable behaviour. This is important as traditional programs for energy analysis are based on conventional wisdom that education and information, as well as economic incentives drive energy efficiency behaviour (Vigen & Mazur-Stommen, 2012). On an individual household level, current and existing economic studies typically assume that household equipment choices, as well as choices about equipment use, are driven almost exclusively by prices (of the equipment, of fuels, and of alternative ways of obtaining energy services), by household income constraints (Stern, 2014).

Recent studies indicate that the inclusion of behavioural factors in energy analysis may be increasingly more relevant (Stern, 2014). Traditional approaches towards energy analysis leaves significant gaps in explanation of “blind spots” that might be illuminated by analyses that are more integrative across social science concepts (Stern, 2014). Strictly quantitative factors, such as economics, technical knowledge and awareness, have been considered the only significant barriers to overcome, which discounts other factors that could be equally influential (Dowd, Ashworth, Carr-Cornish, & Stenner, 2012). Initially, research focused primarily on the technological challenges of sustainable energy use, but over time it has become clear that behaviour change is a critical component for any successful long-term acceptance strategy

(Dowd et al., 2012). The same goes for energy efficiency practices, although they tend to be technology focused, they also have a behavioural element. This is most evident in the wide range of levels of acceptance and uptake of new technology (National Energy Board, 2009). Behavioural aspects must be considered as they impact an individual's likelihood to adopt energy efficient technology and engage in energy efficient practices, and therefore can have an impact on their overall energy use and subsequent demand.

Figure 5. Summary of behavioural aspects and intervention strategies.

(Timmins, 2018).

The first major influencing factor is the individual behaviour aspect, where it is seen that a pro-environmental attitude directly correlates to an individual's likelihood to exhibit sustainable behaviour. As is seen in both the TPB and the VBN theory, it is one's own values and beliefs that form the foundation of their attitudes towards pro-environmental or sustainable behaviour. It is because of this that even if people share similar attitudes regarding the environment and sustainability, they may be founded upon completely different value systems. Some may be very altruistic and based on the values that pro-environmental behaviours must be exhibited for the good of the planet and all those who live on it, while others may be more ego based in that being pro-environmental is good for their own well-being. Understanding where individuals sit in regard to their value system allows for a better understanding of what truly drives their energy behaviour. The model of pro-environmental behaviour takes it a step further with the concept of the pro-environmental consciousness. This concept aims to incorporate all internal aspects, including knowledge and a broader value and belief system to try and give a more complete consideration of individual behavioural antecedents. These individual behaviour aspects directly relate to energy consumption behaviours as well. The rational economic and psychologically based consumption behavioural perspectives put individual actions and choices as the main determinants of their energy consumption. From this perspective, working to affect one's individually held values would be the most effective way to affect their energy consumption patterns.

In terms of Alberta, the data shows us that Albertans have one of the highest electricity consumption rates in Canada, as well as one of the lowest adoption rates of energy efficient technology and behaviours. This makes it apparent that on an individual behavioural level,

Albertans are not exhibiting sustainable behaviour at a rate comparable to the other provinces. This shows that individual behaviour plays a role in Alberta energy consumption patterns and also is indicative of the wider culturally held value systems of Albertans. However, this data only shows overall behaviour, not the antecedents to this individual behaviour that factor in to the implementation. If Alberta does seek cultural change by the means of individual behaviour change, they should first seek to understand the most influential behavioural antecedents of the energy behaviour in order to be most effective.

The research also shows that individual behaviours don't exist in a vacuum and that there are many external factors that affect one's energy behaviour. The main external factor that influence energy behaviour is the social structure in which the individual exists. The presence of social norms in a society puts pressures on individual's to potentially act in ways that may not always align with their value system and attitudes. If the social pressures are strong enough, they even can potentially change existing attitudes into conforming with the majority of society. From a pro-environmental standpoint, social pressure can provide great opportunities or constraints to individuals exhibiting sustainable behaviour, dependent on the social structure itself. Also, the social aspects that can shape behaviour include the activities and processes that are followed by society. Utilizing the perspective of the energy cultures framework, it becomes apparent that in our society, energy and the practices associated with them are a function of that society itself. This indicates that even if individuals are to possess all the antecedents to exhibiting pro-environmental behaviours, if the established social constructs and energy practices of that society do not easily allow for changes to one's energy behaviour, then that individual becomes limited in their sustainable behaviour exhibition. In Alberta, this is seen

through the data, as the implementation of energy efficient behaviour is seen as outside of the norm, with it not being practice by the majority of Albertans, and therefore is not common practice. If adopting and exhibiting more sustainable behaviours became a part of the social norm or common social practice, then more individuals would be more apt to act on or develop any pro-environmental values.

Another external social influence in Alberta is the proximity to less sustainable energy resources and the value placed on economic development. As was earlier discussed, the close physical proximity Albertans have to the oil and gas industry is a large influence on the development of pro-environmental attitudes in Alberta (Finch, Deephouse, & Varella, 2015). This close proximity leads to an increased credibility being placed on the oil and gas industry, and a decreased credibility for the ENGOS. This, coupled with the economic development aspect, has led to the oil and gas industry having increased legitimacy and becoming a substantial aspect of social practice in Alberta. The outcome of this is that shifting away from oil and gas to an industry with less perceived legitimacy, such as renewables, will receive more resistance than staying with the status quo.

The material aspect also is a large factor in energy behaviour, as the physical infrastructure and technology that is available to consumers play a significant role in what kind of energy behaviour they can exhibit. An individual with pro-environmental values and attitudes, that align with that of their social constructs may still be hindered in their ability to act sustainably if the physical environment in which they live does not allow for it. This is the case in Alberta, where 87% of the current electricity production and existing infrastructure is fossil fuel based. So, Albertans are not able to implement sustainable energy behaviour and use more

sustainable forms of energy, regardless of their pre-existing attitudes and values. Also, changes in energy production will require a significant shift away from the existing infrastructure and will require investment and development in new infrastructure, therefore a cultural shift in energy comes at a cost and could expand existing financial barriers to more sustainable behaviour exhibition.

All of these different aspects of energy behaviour are constantly interacting and impacting one another, therefore gaining a more complete understanding of energy behaviour requires an integrated approach. In order to successfully change culture regarding energy use and consumption, multiple interventions can be applied to different factors and aspects of energy behaviour in order to remove the necessary barriers and promote the necessary influences (See Figure 5).

The first behavioural factor that can be effectively intervened upon is to influence the values and beliefs systems of individuals to build up pro-environmental attitudes. This aspect is valuable as those that possess a pro-environmental attitude generally are more apt to consider the environmental consequences of their actions and behave more sustainably when it comes to energy, as well as can act as champions for this type of behaviour and potentially influence others. Effective intervention can be accomplished through a variety of different mechanisms. First, the use of antecedent interventions, such as knowledge-based interventions, like mass media campaigns or workshops focused on education and advocacy. This has been attempted in Alberta with programs and tools developed by Energy Efficiency Alberta, including the Energy Efficiency Tool and the Smart home Tool, both of which were developed in order to provide individuals with more information regarding residential energy efficiency and its impacts

(Government of Alberta, 2015). Other antecedent interventions that would be effective are goal or target setting, as well as providing models of the desired behaviours. These types of interventions would be effective in influencing personal values as they help individuals overcome information barriers and also allows them to better understand the negative outcomes non-environmental behaviours can have. The goal setting and behavioural models would enable people to put their own behaviour into a bigger picture context and provide them visibility to different options on how to improve their behaviour. This knowledge and context could effectively shift their value system to be more pro-environmental as well as provide them with a higher measure of perceived control over their own behaviour. This would also impact one's pro-environmental consciousness, which would cause one to feel a stronger sense of moral responsibility towards environmental issues. Together, this would serve to change an individual's overall behavioural intent and subsequently, their likelihood of implementing more sustainable behaviour.

Another means of influencing values and beliefs systems is with consequence-based interventions, which focus on encouraging or discouraging certain types of behaviours with rewards or punishments, respectively. This is a feedback mechanism, where people get immediate and tangible feedback to their behaviour. If done effectively, this type of reinforcement can lead to people shifting their existing values or accepting new values altogether in response. Also, there can be feedback that is less formal, such as social feedback where individuals or communities who have adopted more sustainable energy behaviour can be utilized spread the word about the positive aspects of it, as well as highlight negative effects of undesired energy behaviour. This can be effective as this could serve to reduce some

informational and communication barriers regarding sustainability and energy efficient technology, as well as provide a visible example for others to follow. It also creates a form of social pressure, where individuals may adopt these types of behaviours in order to fit in or feel as if they are a part of their community.

Another useful form of feedback-based interventions regarding individual behavioural is feedback related to energy audits and energy use data. Giving people direct and tangible data regarding their household energy use habits helps them to contextualize the impacts of their energy use and potentially see the direct effects of their behaviour changes. This coupled with ideal goal and target setting for energy use, which allows for direct comparisons, is another form of behaviour reinforcement that can lead to value and attitudinal changes with energy use.

This type of feedback intervention could address one of the sustainability barriers in Alberta: the lack of direct access to and proper context their energy use data for Alberta residents (Pembina Institute, 2014). If more real-time residence-specific energy use data was more widely available, residents could have a more complete and accurate assessment of their direct and indirect energy use habits. Also, current energy feedback systems in Alberta lack proper context, as they are usually shared in units such as kWh, which can alienate residents from fully understanding their energy impact (Pembina Institute, 2014). These are communication barriers that contribute to an overall lack of awareness of the impact that one's actions and habits have on residential energy use. A related barrier is the of lack of residential sustainability goals, targets or performance standards in Alberta (Pembina Institute, 2014). If

the goal is to achieve energy demand reductions and change the culture of energy use, then residents need a benchmark for which they can compare themselves to. If they are obtaining feedback on their energy use, this would provide context for the residents to know at what point and how much they need to cut back energy use to see a meaningful reduction.

The next underlying behavioural factor that can be meaningfully affected by interventions is social structure and inherent norms. The social structure is so closely tied with energy that in order to change the energy practices and behaviours in a society, changes to the social structure and institutions also must occur. The existence of social norms regarding energy behaviour do serve to guide individuals behaviour and drive social practices and therefore can result in larger scale communities all behaving in a similar manner. This also allows for certain social practices, such as those related to energy, to become more institutionalized and eventually these practices become “normal” and operating outside them is seen as unconventional and going against the norm. A way to effectively intervene and affect change in this area is to utilize policy to establish a “new normal” for energy practices in a society. By modifying the ranges of social practices that are accepted and reproduced in a society, the energy demand that follows it will also be modified. This would serve to re-frame what is considered to be common social practice regarding energy. For example, the current social practice for getting electricity in an urban setting is through an established grid connection transmitted from a utility level power source. If policies were to come into place that encouraged the development and operation of microgrid renewable energy, this could eventually establish a new normal for energy practices in that society. This type of intervention could also be applied to existing common practices on the demand side as well, such as what

“normal” energy consumption levels should be or what “normal” work and social practices are. Both of these could serve to change the way common energy practices are considered in our society and work towards lowering the overall energy demand.

The research has shown that social interventions become more effective when they are applied at a community level. An example of this is the development of community based social marketing campaigns that are focused on particular communities and their specific barriers regarding sustainable behaviour. This type of intervention program allows for potential communication barriers to be overcome, as there is a better understanding of the target audience, as well as of the specific issues of an area. A program like this would be more effective than a “one-size fits all” intervention program that could overlook important local aspects or not be relevant to the local community. Also, by focusing on issues on a community level rather than on a global level, the emphasis can be placed on issues with everyday life meaning and more effectively relate to how people think. This would allow for individuals to have greater PBC over the sustainability issues, as they would likely better understand the issues, have a more relevant context around them, and potentially have more ideas on how to solve them.

In order to increase success rates of community focused interventions, the communities can be “primed” prior to implementation. This would involve the identification of residential areas, based on building types and demographics, as well as their overall energy consumption habits and working with them to develop specific social marketing programs. This would then be marketed and implemented in that community prior to other incentives and interventions being developed. By preparing these areas ahead of time, allows for an increased acceptability

and participation in these incentive programs. The overall goal of targeting interventions at the social structures and norms of an area is to eventually have energy efficiency and sustainability principles to become institutionalized in energy groups, such as residential groups. If these principles become a part of the social fabric and ingrained in the common practices of an area, then the likelihood of individuals exhibiting more sustainable energy behaviour increases.

The material aspects of energy behaviour are also very important, as they are the major factor that shapes energy demand. Demand for energy and having the means to consume energy are directly related. The existing energy infrastructure built up in a society was built to suit a certain set of social practices and it has become necessary to have in order to exist within that society. If a change in energy behaviour in a society is desired, then the necessary changes in material aspects must be made accordingly. First, the technology for more sustainable energy use and practices must be available. This includes both the supply side with energy production, such as renewable energy technologies, as well as on the demand side, with energy efficient options. In this sense, the term “available” refers not only to its existence, but to the affordability and level of risk associated with the acquisition of the technology. The development of policy around financial incentives to aid in the availability on both the supply and demand side would serve to increase technology production and consumption, as it would stimulate the development and adoption of the new technologies and lower the risks for both suppliers and consumers. A key factor of these policies would be to involve more longer-term commitments to further reduce the risks for both suppliers and consumers

Policy development can also be an effective intervention for changing the structure of energy demand in a society. Utilizing policy around urban planning and development will serve

to change the way that energy infrastructure is built and how energy is consumed. If changes are made around zoning and density of residential areas, this will change the energy infrastructure and demands of an area. The more consideration energy and sustainability is given during the zoning and planning phases of development, the more capable the residents of that area will be in exhibiting sustainable behaviour.

Another important factor in the material aspects is the amount of built energy efficiency and sustainable capacity a society has. This means that the more established sustainable infrastructure there is in an area, the fewer material barriers there are to sustainable behaviour implementation. Possible interventions in this involve changes and updates to the building code to be more efficiency based and have a higher standard for efficiency in newly built homes. This would increase the amount of energy efficient options on the market and would reduce the need to retrofit homes in order to be considered energy efficient. Other options include seeking to increase the amount and density of renewable and/or sustainable energy infrastructure in an area. These interventions could address another identified barrier to a cultural change towards sustainability in Alberta: the lack of proper infrastructure that effects one's ability to implement sustainable behaviour (Pembina Institute, 2014). In Alberta, residences built to high energy efficiency standards are not common practice in housing development, therefore if a resident wishes to implement more sustainable practices or energy efficient equipment, they will have to do it themselves or have it custom done. Also, residents do not have direct control over energy production and distribution, and therefore may not be able to behave as sustainably as they desire if the grid supplied electrical sources are fossil fuel based (Borth, 2015). This allows people to have more options and therefore more choice when it comes to the type of energy

the utilize in their households. This would also allow for true consumer demand for sustainable energy if people actually have the options to choose from.

Chapter 6. Conclusions

Overall, it was found that there are multiple factors that affect one's energy behaviour. These factors are both internally and externally focused and both can have significant effects on individual behavioural implementation regarding energy and can vary in effect and importance depending on the context in which they are present. To understand what behavioural factors are the most influential, there must be an understanding of the individual, social, and material aspects and barriers of that specific area and population. Once this is understood, it can be utilized to potentially affect the energy culture of the area. This could involve the use of intervention strategies that can be developed for these factors and implemented in such a way as to increase acceptance of and participation in sustainability initiatives.

6.1 Recommendations

For Alberta, the first recommendation is for the existing interventions programs (See Table 4). These are mainly focused on overcoming economic and educational or knowledge barriers. It is important to continue implementing these programs, as these barriers do play a role in constraining sustainable behaviour. There are opportunities for improvements within these existing programs, as the mass media campaigns and available workshops currently employed to combat the educational barriers could be supplemented with more specific, community-based interventions. Working with identified communities to develop sustainability marketing campaigns that better incorporate specific messaging and barrier solutions could work to increase participation in energy efficiency programs. The use of social feedback from sustainability and energy efficiency advocates in these community settings would also serve to

strengthen the existing programs. Also, the CLP currently has identified renewable energy and energy efficiency outlined as action areas for the plan. So far this has resulted in the securing of renewable energy contracts and the shutting down of coal fired powerplants. This has also lead to investments in energy efficiency technology install programs for residential areas. This would be an area that they should continue to expand and strengthen. By investing and developing more sustainable infrastructure for Albertans, they are providing a means to overcome material-based barriers to Albertans exhibiting sustainable energy behaviour.

Additional intervention measures that should be considered for Alberta include the use of policy designed to integrate energy efficiency into Alberta residential infrastructure. This program would be twofold: increasing energy efficiency standards into the building code for new developments and performing energy audits on existing homes. In Alberta, they have adopted the National Energy Code for Buildings (NECB), which states minimum guidelines for housing efficiencies in building envelope, lighting, HVAC, and hot water (National Research Council Canada, 2011). In this act it states that while these are minimum requirements, there is nothing stopping homeowners from achieving even greater energy efficiencies than that listed in the code. If this code was to be improved upon in Alberta and the minimum standards of energy efficiency in the residential sector were raised, then this would serve to provide more availability of energy efficient homes to the consumer, as well as serve to make energy efficient homes become the “new normal” in Alberta. Instead of Albertans thinking of energy efficient technologies and practices in their household as an extra expense or extra effort, which they both are currently, they would now be commonplace and considered the new standard. Areas that have regulated higher energy efficiency standards see as high as 30% reductions in overall

energy demand in the residential and commercial sectors (Alberta Energy Efficiency Alliance, 2014). The second aspect is to develop some sort of residential energy labelling system for existing homes in Alberta (Borth, 2015). The idea is that when an existing home comes on the market to be sold, it must undergo an energy audit and the result must be shared on the listing, prior to the home selling. This would again create a “new normal” where energy efficiency becomes a feature of a home, and if the homes are lacking in this area it could potentially be seen as a deficiency and lower the sales price. If this were to become a standard in the industry, energy efficiency would become an important factor as now there is now a form of consequence for poor energy efficient homes that would influence the behaviour of homeowners. Mandatory energy labelling has been employed throughout Denmark, and it has been attributed to an increase in residential energy efficiency actions (Alberta Energy Efficiency Alliance, 2014).

Another intervention strategy that could be employed in Alberta is more informative billing procedures for energy use (See Table 4). Involved in this would be a more complete and more informative breakdown of household’s energy use on their monthly energy bills. This would ideally show more of a breakdown of their energy use amounts and patterns, which would allow them to better understand their own habits. This could be coupled with more real time energy use feedback, so that the residents could get the information quicker and more regularly. In order to accomplish this, technologies or devices that collect, track and share overall energy usage and energy consumption patterns would be required (Karlin, Ford, & Squiers, 2012). These technologies should be more established products with sufficient information available, which would include smart grids or smart meters, as well as in home

energy displays (Karlin et al., 2012). These technologies would provide users with a visibility to their own energy behaviour and impacts. A key to the effectiveness of this would be to communicate the energy use data in such a way that it is in a context that the residents can discern meaning from, such as in financial or GHG equivalence. By implementing this feedback style intervention strategy, households would have more direct information on their energy use and have a better understanding of the impacts of their actions. Regular and relatively immediate feedback would also give feedback on the effectiveness of the implementation of any energy efficiency or sustainability practices or technology. Another aspect of this intervention would be to develop “ideal” energy use goals or energy use benchmarks for residents to try and meet at a household level. By having their own data and a means of comparison, people may be more motivated to try and meet these expectations, as they now are more aware of their own use and have a goal to meet.

All of these intervention strategies are aimed at affecting some underlying internal or external aspects of individual behaviour regarding residential energy use in Alberta. By seeking to impact these factors, the goal is to affect change in the energy culture of Alberta in such a way as to increase acceptance and participation by Alberta residents in a transition towards more sustainable energy and a more sustainable lifestyle.

Table 4. Summary of recommendations.

Recommendations	Purpose	Examples
Continue existing education and outreach programs	Overcome identified knowledge and education barriers around sustainability and energy efficiency	Mass media campaigns, workshops
Continue existing financial incentive programs	Overcome financial/economic barriers related to energy efficiency technology and practices	Rebates, discounts
Continue renewable infrastructure development	Work to remove material-based barriers	Renewable energy sources and infrastructure
Update building code in Alberta	Increase energy efficiency standards to increase capacity and establish a new normal	Raise minimum guidelines for building envelope, lighting, HVAC, hot water, etc
Residential energy labelling system	Existing homes undergo an energy audit prior to being sold; make energy efficiency a feature of homes	Energy efficiency rating on house listings
Informative billing	Provide a complete and informative breakdown of household energy use; provide real time feedback data; provide usage targets	Smart grids, smart meters, real time usage data base

(Timmins, 2018).

6.2 Limitations

Throughout this research project, there were some limitations that were experienced. First, time constraints necessitated the use of generalized, secondary data from which the behavioural and energy consumption pattern trends were observed. This data did not allow for the observation of trends as they relate to specific areas and specific groups of people. The ideal data set would have consisted of more primary data would be collected regarding certain factors and antecedents and how they relate to energy behaviour in Alberta.

Another limitation was the strictly theoretical approach that was taken regarding behaviour and intervention strategies. This meant that more generalized theories and models were employed to better understand energy behaviour in Alberta. This can lead to incorrect assumptions or applications regarding these theories and models, if the area of focus in the research reacted differently to them. Integrating actual behaviour from the research area into the project would reduce these assumptions and potential incorrectness and would provide a more accurate depiction of individual behaviour and energy culture in the area.

6.3 Future Research

There are some intriguing and exciting opportunities for future work in this research area. First, having research that directly focuses on specific areas of Alberta, which would involve collecting primary data on the energy use and behavioural patterns in these areas, as well as looking into the material and technological infrastructure of the area. This would allow for a better understanding of the influences and barriers to sustainable energy behaviour in those areas. From there, this could lead to the actual planning and development of intervention plans for these areas of Alberta. Future research could consider such aspects as: what it would take to implement these strategies? What would be involved in each intervention plan? What would success of these strategies look like and how would it be measured? This would work to further the research of this project into the actual implementation of interventions strategies and work towards the overall goal of changing energy culture in Alberta.

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Appendix A

Table A1. Electricity energy use per sector in Canada.

Sector	Energy use (PJ)	% of the total
Residential	566.4	32.9%
Commercial	359.4	20.9%
Industrial	755.1	43.9%
Transportation	4.4	0.3%
Agriculture	35.9	2.1%
Total	1720.9	100%

(Natural Resources Canada, 2017)

Table A2. Average household energy use, by household and dwelling characteristics- Household income.

	Less than \$20,000	\$20,000 to less than \$40,000	\$40,000 to less than \$60,000	\$60,000 to less than \$80,000	\$80,000 to less than \$100,000	\$100,000 to less than \$150,000	\$150,000 and over	Not stated	All households
gigajoules per household									
Canada	68	81	94	108	109	129	141	104	105
Newfoundland and Labrador	148	92	111 ^E	119	106	102	121	103	111
Prince Edward Island	F	122	F	168 ^E	F	F	F	120	142
Nova Scotia	81	81	108	112	108	103	F	114	101
New Brunswick	73	76	84	96	118	108	119	102 ^E	92
Quebec	61	78	94	111	112	121	129	77	95
Ontario	61	76	100	108	114	128	141	104	107
Manitoba	52 ^E	90	74	97	118	142	146	92	98
Saskatchewan	98	88	105	131	104	128	139	100	110
Alberta	99 ^E	113	97	118	136	159	155	119	130
British Columbia	57 ^E	78	79	93	89	125	141	120	99
	Less than \$20,000	\$20,000 to less than \$40,000	\$40,000 to less than \$60,000	\$60,000 to less than \$80,000	\$80,000 to less than \$100,000	\$100,000 to less than \$150,000	\$150,000 and over	Not stated	All households

(Statistics Canada, 2013)

Table A3. Average household energy use, by household and dwelling characteristics- Education level.

	0 to 8 years or some secondary	Grade 11 to 13, graduate	Some post secondary, or post secondary certificate	University	Not stated	All households
gigajoules per household						
Canada	87	98	106	109	105	105
Newfoundland and Labrador	136	113	114	93	F	111
Prince Edward Island	F	F	145	143	F	142
Nova Scotia	84	106	98	108	F	101
New Brunswick	75	91	91	97	F	92
Quebec	98	81	101	94	86 ^E	95
Ontario	70 ^E	101	100	116	84 ^E	107
Manitoba	71	77	113	105	F	98
Saskatchewan	102	109	123	106	F	110
Alberta	91	130	136	130	F	130
British Columbia	89	96	106	96	F	99
	0 to 8 years or some secondary	Grade 11 to 13, graduate	Some post secondary, or post secondary certificate	University	Not stated	All households

(Statistics Canada, 2013)

Table A4. Projected annual energy consumption in the Alberta residential sector.

Year	Projected Annual Energy Consumption (GWh)
2009	8,981
2010	9,151
2011	9,369
2012	9,594
2013	9,808
2014	10,003
2015	10,204
2016	10,408
2017	10,606
2018	10,812
2019	11,016
2020	11,229
2021	11,447
2022	11,669
2023	11,896
2024	12,126
2025	12,359
2026	12,590
2027	12,826
2028	13,064
2029	13,310

(Alberta Electrical System Operator, 2010).