Applying the Transtheoretical Model of Change to Environmentally Responsible Behaviour

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Abstract

There is near universal acceptance of the existence of climate change and the role of greenhouse gases, produced largely through the burning of coal for energy, in contributing to it. Conserving energy in the home is one area in which most people can contribute to reducing greenhouse gases and therefore climate change, yet currently Australia is lagging behind in conserving energy and producing renewable energy. Viewing behaviour change through the lens of the Transtheoretical Model of Behavior Change was explored and applied as providing a valuable way of understanding how and why people change their energy behaviour at home.

In this research, both quantitative and qualitative methods were used to adapt and validate a Stages of Change measure for household energy use in order to explore the factors reported by householders as being important in the decision-making process regarding changing their energy use. Responses were gathered through a web-based survey.

A draft Energy Behaviours Stages of Change Questionnaire was developed as part of this research. A total of 386 participants completed the draft Energy Behaviours Stages of Change Questionnaire, and 339 respondents provided a total of 926 responses to three open-ended questions. The participants in this study were demographically similar to the national average based on the 2011 census data.

A series of single-factor principal components analyses were applied to the draft EBSOCQ to optimize internal factorial consistency, with reduction retaining eight items within each of the five stages. Analysis based on Item Response Theory resulted in a shortened 20-item version. Factor analysis with Procrustes rotation confirmed good fit for both the long and short version of the theorized five-factor model.

Participants' responses to the three open-ended questions were coded and explored to identify themes in the decision to change process. Using the short version of the EBSOCQ, participants were identified as being in one of the five stages of change, and their responses were explored by stage. Cost factors were stated to be the primary reason across all stages to reduce

household energy use. Even when environmental concerns were expressed, these tended to be in addition, or secondary, to financial concerns. Subtle but distinct differences were noticeable between the themes expressed by respondents in the different stages of change.

This thesis demonstrated that the TTM framework can be successfully adapted and applied to pro-environmental behaviours, and that it is a useful framework for understanding how people change with respect to their energy use. Implications for the use of these insights within a social marketing campaign are discussed.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Student signature: Date:

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the student and co-authors' contributions to this work.

Main Supervisor signature: Date:

Ethics

This research received the approval of the Monash University Standing Committee for Ethical Research on Humans project number CF13/2426 - 2013001293

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

ERB …….. Environmentally Responsible Behaviour

GHG ……. Greenhouse Gas

NAM……..Norm Activation Model

IPCC …….Intergovernmental Panel on Climate Change

TPB ……. Theory of Planned Behaviour

TTM ……..Transtheoretical Model

VBN ……..Value-Belief-Norm (theory)

Chapter 1: Introduction

Remember upon the conduct of each depends the fate of all – Alexander the Great

The majority of scientists regard the scientific evidence supporting the existence of climate change, and the contribution made by anthropogenic greenhouse gas emissions, as unequivocal (e.g. Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2012; Garnaut, 2008, 2011b; IPCC, 2014a, 2014b; National Research Council, 2012; United Nations Framework Convention on Climate Change, 2014).

The impacts of climate change are wide-ranging and potentially catastrophic for all forms of life on earth. The projected impacts of climate change on a global scale include: increased risks of severe weather events (flood, drought, storm); reduced availability of clean water; reduced access to sufficient food; forced migration due to sea-level rises; reduced bio-diversity of flora and fauna; and increased health-related concerns and injury due to extreme weather events (Garnaut, 2011b; International Federation of Red Cross, 2004, 2010, 2011; IPCC, 2007c; Pachauri, 2007; Pittock, 2009). The Nobel Peace Prize Committee (Nobel Prize, 2007) identified an increased risk of global unrest and war due to the impact of climate changes that threaten living conditions and increase competition for resources.

Within Australia critical impacts of climate change include: the reliability of water supply; loss of biodiversity; increase in the severity, frequency and duration of severe heatwaves, droughts and bushfires; increased risk of inland flash floods and coastal flooding due to sea level rises (Braganza & Church, 2011; Garnaut, 2011b; Hennessy, 2011; Steffen, 2015a, 2015b; Steffen, Hughes, & Perkins, 2014).

The decade 2010-2020 has been termed the 'critical decade' for action on climate change to slow, and ideally stop, this warming trend (Steffen, 2015a). The IPCC (2007a) report that the largest growth in global greenhouse gas emissions during the period 1970 to 2004 came primarily from the burning of fossil fuels in the energy supply sector, with an increase of 147%.

Within Australia, electricity is the main source of energy used in the home (Commonwealth of Australia, 2008). Whilst most researchers refer to 'energy use' within the home or business, this usually refers specifically to electrical energy, unless otherwise stated. The same approach will be utilized in this thesis. Reducing (electrical) energy usage has been identified as the quickest, simplest and most cost-effective way to reduce greenhouse gas emissions (Department of Climate Change and Energy Efficiency, 2012). Residential electricity conservation can be achieved by both reducing the amount of actual electrical energy consumed, and also by increased energy efficiency of buildings and electrical appliances. Despite the evidence supporting climate change and the role of traditional forms of energy use in contributing to it, behaviour change and progress toward implementing electricity usage reductions has been slow, suggesting a vital role for psychology.

Psychological research has sought to explain, predict, and devise effective ways of influencing people's environmentally responsible behaviour (ERB) across a range of domains, such as recycling, purchasing of 'green' goods, transportation options and energy use. Many existing theories of behaviour change have been used to understand people's ERB, such as the Theory of Planed Behaviour (TPB; Ajzen, 1991, 2002); the Norm Activation Model (NAM; Schwartz, 1973; Schwartz, 1977); and the Schwartz Value Theory (Schwartz, 1992, 1994, 1999, 2010, 2011; Schwartz & Bilsky, 1987; Schwartz & Boehnke, 2004).

Recently, researchers have specifically developed models of ERB, such as the Value-Belief-Norm (VBN) Theory, which was developed to predict environmental activism (Stern, 2000b; Stern & Dietz, 1994; Stern, Dietz, Abel, Guagnano, & Kalof, 1999); and the Comprehensive Action Determination Model (CADM: Klöckner & Blöbaum, 2010), which was an attempt to create a comprehensive framework for understanding individuals' ERB. Additional research has looked at the role of factors such as worldview, political orientation, personality and socio-demographic variables. It has become increasingly accepted that ERB is multiply determined, with multiple antecedents and motives underlying people's behaviour at any given

time and place (De Young, 2000; Schultz, 2000; Stern & Dietz, 1994; Stern, Dietz, Kalof, & Guagnano, 1995).

With respect to energy-savings behaviour specifically, Steg (2008) identified three broad factors that influence household electrical energy conservation behaviour. These entail knowledge and information about climate change, energy usage in the house and how to change; motivation to change; and the ability for people to adopt alternative behaviours. Social influence approaches, in combination with incentives and strategic marketing, have been found to be effective mechanisms to produce electricity savings behaviour change, however, there are barriers such as cost, convenience and availability (Abrahamse & Matthies, 2013; Abrahamse & Steg, 2013; Lokhorst, Werner, Staats, van Dijk, & Gale, 2013).

Many researchers have identified the existence of a value-action gap, whereby people do not behave in a manner consistent with their beliefs or values (e.g. Barr, 2006; Barr, Gilg, & Ford, 2005; Blake, 1999; Kollmuss & Agyeman, 2002; Whitmarsh, Seyfang, & O'Neill, 2011). This has led to an investigation into the barriers to ERB, which has revealed that just as there are multiple determinants of people's ERB, there are also numerous barriers, which tend to be behaviour specific (Kempton, Darley, & Stern, 1992; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; Semenza et al., 2008). Consequently, numerous researchers have suggested that different strategies will be required for different households and target behaviours (Abrahamse & Matthies, 2013; Osbaldiston & Schott, 2012; Sweeney, Kresling, Webb, Soutar, & Mazzarol, 2013; Thøgersen & Grønhøj, 2010).

Statement of problem

There is arguably overwhelming scientific evidence that climate change is occurring and that anthropogenic greenhouse gas emissions are largely responsible. Within Australia, over-reliance on fossil fuels for energy is principally responsible for our high greenhouse gas emissions. It is therefore clear that Australians need encouragement to change their energy-use behaviour to assist with efforts to slow or stop the rate of climate change.

Despite the wealth of information provided by decades of research on ERB generally, and energy-use specifically, behaviour change of the magnitude required to make a difference to the rate of climate change has not occurred. That is, despite the relative scientific certainty regarding climate change, and knowledge of a broad range of determinants of pro-environmental behaviour, this has not translated into sufficient behaviour change at the household level.

A greater understanding is needed of the behaviour change process and the factors involved for Australian householders in their decision-making regarding changing their residential energy use.

Theoretical framework

Stage-based models of behaviour change assume that change occurs as a result of moving through a series of sequential and qualitatively different stages. Stage models are beneficial in understanding how change occurs and provide an opportunity to develop tailored interventions consistent with a social marketing approach (French & Blair-Stevens, 2010; French, Blair-Stevens, McVey, & Merritt, 2010; Peattie & Peattie, 2009).

Perhaps the best-known stage model is the Transtheoretical Model (TTM). Originally developed by DiClemente and Prochaska (DiClemente & Prochaska, 1982; Prochaska & DiClemente, 1982; Prochaska & DiClemente, 1983; Prochaska & DiClemente, 1986) as a model for intentional individual behaviour change in relation to smoking, alcohol and other drug use, it has since been used in a vast array of problem areas (e.g. Cole Monaghan et al., 2015; Fried et al., 2012; Levesque, Driskell, Prochaska, & Prochaska, 2008; Mao et al., 2012; McKetin et al., 2014).

The Stages of Change concept is an important element of the TTM, which delineates five stages (Precontemplation, Contemplation, Preparation, Action, and Maintenance) that are believed to reflect the sequential and motivational aspects of change (DiClemente et al., 1991; Prochaska & DiClemente, 1982; Prochaska & DiClemente, 1983; Prochaska & DiClemente, 1986; Prochaska, DiClemente, Velicer, Ginpil, & Norcross, 1985). Within the TTM it is believed

that people move sequentially through each stage, although people may relapse to a previous stage and some may cycle through several stages numerous times before achieving lasting behaviour change.

The TTM can be used to categorize individuals' stage of change and identify stage-specific strategies to overcome resistance in order to encourage and maintain behaviour change. One of the assumptions of the TTM is that the stages of change construct, and stage-matched interventions, can be applied across a broad range of behaviours (Prochaska & Velicer, 1997).

Although the TTM has received considerable criticism (e.g. Armitage, 2009; Herzog, 2008; Sutton, 2001; Weinstein, Rothman, & Sutton, 1998), it continues to be used as a framework for understanding how people change across a variety of disciplines. Arguably, a great deal of the TTM's popularity is attributable to the simplicity of its concepts and its user-friendliness as a tool for practitioners.

The TTM, and other stage-based models, have recently been applied in a growing number of studies on ERB (e.g. Bamberg, 2007; Bamberg, 2013a, 2013b; Freestone & McGoldrick, 2008; Gatersleben & Appleton, 2007; Klöckner, 2014; van Bekkum, Williams, & Morris, 2011; Weller et al., 2014), although, to date, no research on changing residential energy-use using the TTM framework has been conducted. The TTM is the theoretical model chosen for use in this research project, which represents an initial step in the application of the TTM framework to understanding householder's electrical energy use behaviour.

Aim of project

The aim of this study was to apply the framework of the TTM to understanding householder's electrical energy use behaviour. Specific aims of this research project were to:

- Provide an integrative review of the literature regarding pro-environmental behaviour generally, and household energy use specifically;
- Develop and validate a modified Stages of Change Questionnaire to assess individual's stage of change regarding their household electrical energy use; and

- Explore themes by stage of change that are important in the process of changing household energy use behaviour.

Methodology

In this research an embedded concurrent mixed method design was used. The first step in this research project involved adapting the existing Stages of Change Questionnaire to focus on household electrical energy consumption. These adaptations were informed by the theoretical underpinnings of the Transtheoretical Model. A self-administered questionnaire in the form of a web-based survey was developed and launched. The full questionnaire consisted of the elements described below.

Demographics

Standard demographic information regarding gender, year of birth, English-language skills, education, occupation, and living situation details were gathered. These data are used to ascertain the representativeness of the convenience sample to that of the Australian adult population, as well as to identify socio-demographic differences in the data collected.

EBSOCQ

The pilot Energy Behaviour Stages of Change Questionnaire (EBSOCQ) consisted of 75 statements about household energy use. Respondents were asked to rate their agreement with each statement on a 7-point Likert scale from strongly agree to strongly disagree.

BFI

The Big Five Inventory (BFI: John, Donahue, & Kentle, 1991) was initially included in the survey as a brief, highly reliable and well validated measure of personality factors.
Although gathered, the BFI results were not used in the final analyses as they were outside the scope of this research project.

Open-ended questions

Survey respondents were also asked to answer three open-ended questions centered on the factors involved in their decision-making regarding changing their household energy-use. These questions were:

1. What sorts of things helped you make, or would help you to make, that decision to change?
2. What was, or would be, the biggest or most influential factor in making this decision to change?
3. What sorts of things would you find helpful to make, or maintain, that change?

Participants

The target population for this research was the Australian adult population aged 18 years and over. The final pool of participants were a sample of convenience who either volunteered to complete the online questionnaire or were paid panel members sourced through Qualtrics.

Thesis Organization

This thesis begins with an overview of the research on climate change, including its impacts globally as well as for Australia, and adaptation and mitigation strategies. International political efforts to address climate change are discussed and Australia's adaptation and mitigation responses to climate change are reviewed. The need for research on changing household energy usage is presented.

In the third and fourth chapters, the researcher provides an integrative review of the literature regarding pro-environmental behaviour generally, and household energy use specifically. The third chapter reviews the existing research on many of the influential theories and models of environmentally responsible behaviour. This is presented within a meta-theoretical framework that addresses five broad approaches: learning and behavioural theories; motivation, moral and value theories; attitude, beliefs and intentions theories; emotion and affect theories; and other approaches including personality and individual differences, social influence and diffusion. Barrier to people's engagement with ERB are also discussed.

This is then followed by a review of the research specifically focused on reducing household energy use. Both direct and indirect energy savings are discussed in terms of two types of energy savings behaviour - efficiency behaviours and curtailment behaviours. Interventions and strategies that address the key factors of information, motivation, and alternatives are reviewed. It is concluded that no single intervention is effective across all behaviours and that interventions matched to the behaviour and the household are required.

The Transtheoretical Model, which was the theoretical framework chosen for use in this thesis, is described in the fifth chapter. The TTM, its constructs and the various forms of measurement of these constructs are reviewed. The literature review also includes research that has modified or adapted the TTM's constructs. The use of the TTM as a theoretical framework to guide social marketing interventions is discussed. This chapter concludes with a review of the research using the TTM and other stage-based models to explore environmentally responsible behaviour.

The research design and methodology used in this thesis are detailed in the sixth chapter. The operationalization of terms and measures used are described, and information on the participants for this research is provided. A comparison of the sample of participants in this study to the 2011 census data is provided.

Chapter 7 details the development and validation of a measure of stages of change in household energy use. The results of a series of statistical procedures conducted on the pilot EBSOCQ are detailed, which resulted in both a short (20-item) and long (40-item) version of the EBSOCQ being developed. The short version of the EBSOCQ was best able to discriminate between the five factors theorized in the TTM.

In Chapter 8, the research results on the themes expressed as important in changing household energy usage are discussed. The short form of the EBSOCQ was used to classify participants into one of the five stages of change, and stage matched themes are then explored. Economic reasons appeared to be the primary reason to reduce household energy use. While cost

was the primary reason given across all stages for wanting to change energy use, this was reflected differently across the five stages.

The final chapter of this thesis consists of a summary and discussion of the findings and the conclusions from this research. The implications and limitations of the study are discussed, with areas of further research identified. Suggestions for social marketing interventions based on the results of this thesis are made.

Chapter 2: Climate Change

The catastrophe now threatening us is unprecedented, and we often confuse the unprecedented with the improbable – Al Gore

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 through a resolution of the UN General Assembly, following scientific research that had lead many climate scientists to alert governments to the issue of climate change. The term 'climate change' has been defined as:

> A change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2014a, p 9).

The IPCC's main activities are the preparation of comprehensive assessment reports about the state of scientific, technical and socioeconomic knowledge on climate change, its causes, potential impacts and response strategies. There are currently three working groups, focusing on the science, impact and mitigation of climate change, and one task force charged with developing greenhouse gas inventories. The findings of the IPCC are presented as assessment reports, synthesizing the views of the working groups (e.g. IPCC, 2007a, 2007b, 2012, 2013; IPCC, 2014a, 2014b).

In 2007, the IPCC and Al Gore were jointly awarded the Nobel Peace Prize "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change" (Nobel Prize, 2007). In his Nobel Prize Lecture, the Chairman of the IPCC claimed that it was able to produce key scientific material that was relevant to policymakers and agreed to by all governments around the

world, due to the strength of the underlying scientific and technical material included in the IPCC reports (Pachauri, 2007).

The IPCC (2007a) have concluded that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (p. 2). The IPCC (2007b) state that evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, in particular, temperature increases. Additionally, the Panel states that observed changes in many physical and biological systems are consistent with global warming.

The CSIRO bluntly asserts that "climate change is real" (Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2012). This certainty in the reality of climate change has been articulated by numerous reviews (e.g. Garnaut, 2008; Garnaut, 2011b; Steffen, 2015a; Steffen et al., 2014; Stern 2006), governmental bodies (e.g. Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2012; Department of Climate Change and Energy Efficiency, 2012) and international committees (International Federation of Red Cross, 2012; IPCC, 2014a, 2014b; National Academy of Sciences and the Royal Society, 2014; National Research Council, 2012, 2013; The Royal Society, 2010; United Nations Framework Convention on Climate Change, 2014).

Over 90% of the global warming since the mid-20th century has been caused by greenhouse gas (GHG) emissions from human activities (Mapstone, 2011). The IPCC (2007a) states that "most of the global average warming over the past 50 years is very likely due to anthropogenic greenhouse gas increases and it is likely that there is a discernible human-induced warming averaged over each continent (except Antarctica)" (p. 5). Although global temperatures have varied naturally between ice ages and warm periods, there is no record within human history of temperatures ever having increased as rapidly as they have over the past 100 years (Mapstone, 2011). To the best of scientific knowledge, the climate change the world is currently

experiencing is unprecedented.

Globally, greenhouse gas emissions increased by 70% from 1970 to 2004 (IPCC, 2007a). In its latest report, the IPCC (2014b) states that "total anthropogenic GHG emissions were the highest in human history from 2000 to 2010" (p. 6). The increase in annual anthropogenic GHG emissions between 2000 and 2010 comes mainly from energy supply (47%) (IPCC, 2014b). Additionally, a previous IPCC (2007b) report had identified that the largest growth in global greenhouse gas emissions during the period 1970 to 2004 came from the energy supply sector, with an increase of 147%. The IPCC (2007b, 2014b) acknowledges that whilst a range of policies have been effective in reducing greenhouse gas emissions in many countries, the scale of these measures has not been sufficient to counteract the global growth in emissions.

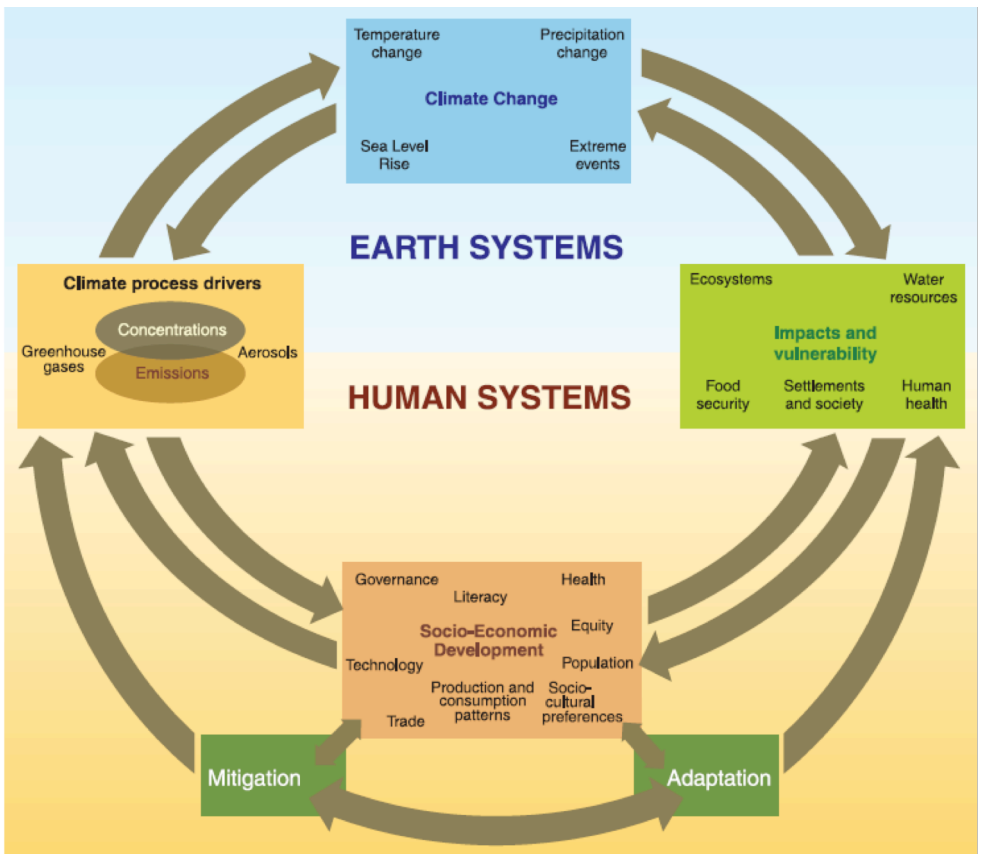
While carbon dioxide is the most important anthropogenic greenhouse gas, with emissions increasing by 80% between 1970 and 2004, other key greenhouse gases include methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (IPCC, 2007a). Anthropogenic increases in carbon dioxide come mainly from the burning of fossil fuels, such as coal, oil and natural gas; land use practices such as the destruction of forests and carbon-rich soil; and the manufacture of cement from limestone (Pittock, 2009).

Counteracting the input of carbon dioxide into the environment are natural 'sinks' in the land and oceans. Prior to the industrial revolution in the early 1800's, the amount of carbon released into the atmosphere as carbon dioxide was balanced by the uptake of carbon into land and ocean systems, referred to as carbon sinks. However, since that time, the release of carbon dioxide into the atmosphere has exceeded the capacity of the land and ocean sinks to absorb it. Land and ocean sinks removed respectively 30% and 25% of all anthropogenic carbon dioxide emissions over the period 2000 – 2008, which left 45% to accumulate in the atmosphere (Raupach & Fraser, 2011).

Alarmingly, the IPCC (2014b) warns that global greenhouse gas emissions will continue to grow over the next few decades, notwithstanding the current climate change mitigation policies

and sustainable development practices already in place. A schematic framework representing anthropogenic drivers, impacts of and responses to climate change, and their linkages, is shown in Figure 2.1.

Figure 2.1: Schematic framework of anthropogenic climate change drivers, impacts and responses (IPCC, 2007a)



Climate Change Skepticism

Despite the IPCC's unequivocal warning, there is a surprising lack of public acceptance that climate change is occurring, or that it is human-induced. In a review of the Australian public's opinions and beliefs regarding climate change, while nearly 83% of people agreed that climate change was happening, only approximately 50% agreed that human activity was causing it (Leviston & Walker, 2012). Approximately 40% of people surveyed thought climate change was the result of natural temperature variability.

The primary argument against the existence and/or the extent of human-induced climate change relies on criticism of the science underlying climate change predictions, often by individuals with no or limited scientific credentials. A major assertion by many of such climate change skeptics is that the impact of climate change will be minimal and moreover will be easily managed. Furthermore, there are those who are suspicious of the motives and integrity of climate scientists, such as the IPCC committees, accusing them of biased reporting of findings (Friends of Science, 2012; Lomborg, 2007). These criticisms have been widely refuted (Pittock, 2009; The Royal Society, 2005; Washington & Cook, 2011). Additionally, there have been claims that companies, such as ExxonMobil, have funded lobby groups to misrepresent the scientific evidence regarding climate change (The Royal Society, 2006).

Notwithstanding these criticisms, the overwhelming weight of scientific opinion and evidence established within the rigors of peer reviewed literature supports the existence of anthropogenic climate change and urges international action towards mitigation and adaptation (International Federation of Red Cross, 2012; IPCC, 2014a, 2014b; National Academy of Sciences and the Royal Society, 2014; National Research Council, 2012, 2013; The Royal Society, 2010; United Nations Framework Convention on Climate Change, 2014).

The Impact of Climate Change

Precise predictions regarding future global impacts of climate changes are virtually impossible. However, the IPCC and various other researchers have adopted scenarios that model various outcomes. The impacts of climate change extend beyond an increase in average temperature.

Various research reports (IPCC, 2007a, 2014a; National Research Council, 2012; Steffen, 2015b; Steffen et al., 2014) have linked climate change to an increase in extreme weather events, such as heat waves, droughts, floods, cyclones and wildfires. These climate changes will mean that the underlying conditions that affect almost every aspect of life on earth will become consistently different (Mapstone, 2011). More recent research has led some scientists to

postulate that the impacts from global climate change may be more severe than the initial 2007 IPCC models indicated (Braganza & Church, 2011; Garnaut, 2011a; Pittock, 2009).

In awarding the 2007 Nobel Peace Prize jointly to the IPCC and Al Gore, the Norwegian Nobel Committee highlighted the link they saw between the risk of accelerating climate change and the risk of violent conflict and wars. The Nobel Committee recognized that "extensive climate changes may alter and threaten the living conditions of much of mankind. They may induce large-scale migration and lead to greater competition for the earth's resources. Such changes will place particularly heavy burdens on the world's most vulnerable countries. There may be increased danger of violent conflicts and wars, within and between states" (Nobel Prize, 2007).

The projected impacts of climate change on a global scale include:

- reduced availability of, or access to, clean water;
- increased risks of flood, storm or drought. The number of weather related disasters internationally increased four and a half times since the 1960s to the 1990s;
- reduced access to sufficient food and the resources for agricultural production. Already across the world, almost 1 billion children, men and women go to bed hungry every night;
- forced migration due to sea-level rises, food and/or water shortages;
- reduction in bio-diversity of flora and fauna, with an expected 20-30% of plant and animal species at increased risk of extinction;
- increases in health-related concerns including malnutrition, diarrhoeal diseases, cardio-respiratory diseases and deaths, diseases and injury due to extreme weather events (Garnaut, 2011b; International Federation of Red Cross, 2004, 2010, 2011; IPCC, 2007c; Pachauri, 2007; Pittock, 2009).

The impacts of global climate change will affect both developed and developing countries alike. The nature and intensity of effects vary from region to region, as do various countries' respective capacity, in terms of affluence and infrastructure, to remediate the threat from climate

change (CountryWatch Incorporated, 2011; Pittock, 2009). In terms of deaths and injury from weather and climatic disasters, such as storms, floods and droughts, poorer societies are more greatly affected than wealthier societies. However, in developed countries, the impacts of these climatic changes tends to be economic (International Federation of Red Cross, 2010).

In its recent World Disasters Report (2010) which focused on urban risk, the International Federation of Red Cross noted that the regions of the world that are more urbanized tend to have fewer deaths from natural disasters, but higher economic losses. All the world's wealthiest nations are predominantly urbanized, with most of the world's largest cities sited in the world's largest economies, while almost all the world's poorest nations are predominantly rural (International Federation of Red Cross, 2010). However, the report highlights that nearly 1 billion people living in urban areas live in over-crowded, poor-quality housing. The report notes that the links between urban poverty and disaster risk will be increased by climate change. The IPCC (2012) noted that "rapid urbanization and the growth of megacities, especially in developing countries, have led to the emergence of highly vulnerable urban communities, particularly through informal settlements and inadequate land management" (p. 6).

The 2015 Lancet Commission on Health and Climate Change (Watts et al.) state that "tackling climate change could be the greatest global health opportunity of the 21st century" (p. 1). This Commission refers to climate change as a medical emergency, with the threat it posed to human health being potentially so extreme that it could reverse the last 50 years of gains in development and global health.

The IPCC (2007c) identified Africa as one of the continents most vulnerable to the impacts of climate change. The African continent is the world's second-largest landmass and encompasses many of the world's least developed countries. It is the continent which is at the greatest risk of desertification, with environmental problems stemming from land and forest degradation (CountryWatch Incorporated, 2011).

Americans were shaken by an extreme weather condition, Hurricane Katrina, in August 2005. It was the costliest, and one of the five deadliest, hurricanes to ever strike the United States. Hurricane Katrina has been referred to as one of the most devastating natural disasters in the United States history (Knabb, Rhome, & Brown, 2006). More recently, Cyclone Pam, a category-5 storm struck Vanuatu in March 2015. The Climate Council has released a statement finding that the damage caused by Cyclone Pam through widespread flooding was exacerbated by climate change, and warning that the Pacific Islands are particularly vulnerable to climate change due to sea level rises, coastal inundation, ocean acidification and other impacts that may affect peoples health, as well as the critical industries of fishing and tourism (Steffen & Flannery, 2015).

Recent publications by the CSIRO and the Climate Council outline the climate change implications for Australia. These include that "drying is likely in southern areas of Australia, especially in winter, and in southern and eastern areas in spring…. Changes in summer tropical rainfall in northern Australia remain highly uncertain…. Intense rainfall events in most locations will become more extreme, driven by a warmer, wetter atmosphere. The combination of drying and increased evaporation means soil moisture is likely to decline over much of southern Australia. An increase in fire-weather risk is likely with warmer and drier conditions" (Whetton, 2011, p. 35). The year 2014 was Australia's third hottest year on record, while the annual number of record hot days across Australia has doubled since 1960 (Steffen, 2015a, 2015b).

Water security, or the reliability of water supply, problems are forecast within Australia as a result of reduced rainfall and higher rates of evaporation (Hennessy, 2011; IPCC, 2007c). The implications of this include less available water for irrigation, domestic and industrial use, and less water flow back into the environment, thereby reducing flows in major river systems. The combination of a decline in water supply and a projected increase in demand for water makes water potentially one of Australia's most critical national issues (Hennessy, 2011).

Significant loss of biodiversity is projected to occur by 2020 in ecologically rich sites such as the Great Barrier Reef and the Kakadu wetlands. CSIRO scientists have already noted that significant seasonal warmth caused episodes of coral bleaching on the Great Barrier Reef in both 1998 and 2002 (Braganza & Church, 2011).

Temperature changes have already been recorded across most of Australia, with a decrease in the frequency of extreme cold weather and an increase in the frequency of warm weather. Additionally, evidence indicates an increase in the severity, frequency and duration of severe heatwaves, warm extremes and bushfires (Braganza & Church, 2011; Steffen, 2015a, 2015b; Steffen et al., 2014).

The trend towards coastal development and population growth is projected to exacerbate risks from sea-level rises and increases in frequency and intensity of storms, inland flash floods and coastal flooding (IPCC, 2007c). With more than 85 per cent of Australia's population living in coastal regions, the impacts of sea level rises are expected to be significant (Garnaut, 2011b).

Australia experienced the worst and most consistent dry period in its recorded history over much of the past decade, an occurrence which has been termed the Millennium Drought (Gleick & Heberger, 2012). The Murray River failed to reach the sea for the first time ever in 2002. Bushfires swept through much of the country and dust storms blanketed major cities for days. Australia's sheep population dropped by 50 percent and rice and cotton production collapsed in some years. The drought ended in 2010 with torrential rains and flooding.

During late 2010 and early 2011, Queensland experienced significant flooding, with three quarters of the state declared a disaster zone. The flooding also extended into areas of New South Wales and Victoria. The then Federal Treasurer, Wayne Swan, confirmed that the floods were the biggest natural disaster in Australia's history, with an estimated damage bill in the range of $10-30 billion (ABC News, 2011).

The potentially devastating impacts of climate change on the physical environment, and associated impacts on human health, have been well documented. Efforts to mitigate and adapt

to climate change are now required.

Climate Change adaptation

Humans have responded and adapted to small variations in climate for thousands of years. However, the current climate changes are occurring much more rapidly than at any time in the past. Additionally, human lifestyle has evolved to depend more heavily on complex infrastructure and agriculture for survival (Mapstone, 2011).

Climate change has been described as a risk management issue, in that the longer it takes to act, and the weaker those actions are, the greater is the risk of dangerous and possibly irreversible outcomes (Raupach & Fraser, 2011).

Adaptation to climate change involves taking action to adjust or respond to the effects of changes in climate, such as reduced rainfall or rising sea level. Adaptation can also refer to actions designed to take advantage of new opportunities that may arise as a result of climate change.

Adaptation measures are essential, both to allow for the impacts of already occurring climate changes, as well as to accommodate future impacts from continued climate change which is inevitable due to past emissions (IPCC, 2007c, 2014a; Pittock, 2009; Stafford Smith & Ash, 2011). The IPCC (2007c, 2014a) acknowledges that whilst adaptation is occurring, more extensive adaption is required to reduce vulnerability to future climate change.

The United Nations Environment Programme (Burton, Smith, & Lenhart, 1998) has outlined eight categories of adaptation measures:

1. Bear losses. All other adaptation measures may be compared with the baseline response of "doing nothing" except bearing or accepting the losses. In theory, bearing loss occurs when those affected have no capacity to respond in any other ways (for example, in extremely poor communities) or where the costs of adaptation measures are considered to be high in relation to the risk or the expected damages.

2. Share losses. This type of adaptation response involves sharing the losses among a wider community. Such actions take place in traditional societies and in the most complex, high-tech societies. In traditional societies, many mechanisms exist to share losses among a wider community, such as extended families and village-level or similar small-scale communities. At the other end of the spectrum, large-scale societies share losses through public relief, rehabilitation, and reconstruction paid for from public funds. Sharing losses can also be achieved through private insurance.

3. Modify the threat. For some risks, it is possible to exercise a degree of control over the environmental threat itself. When this is a "natural" event such as a flood or a drought, possible measures include flood control works (dams, dikes, levees). For climate change, the major modification possibility is to slow the rate of climate change by reducing greenhouse gas emissions and eventually stabilising greenhouse concentrations in the atmosphere. In the language of the UNFCCC, such measures are referred to as mitigation of climate change and are considered to be in a different category of response from adaptation measures.

4. Prevent effects. A frequently used set of adaptation measures involves steps to prevent the effects of climate change and variability. An example for agriculture includes changes in crop management practices that use less water for irrigation water, and pest and disease control.

5. Change use. Where the threat of climate change makes the continuation of an economic activity impossible or extremely risky, consideration can be given to changing the use. For example, a farmer may choose to substitute a more drought tolerant crop or switch to varieties with lower moisture. Similarly, land currently used for crops may be returned to pasture or forest, or other uses may be found such as recreation, wildlife refuges, or national parks.

6. Change location. A more extreme response is to change the location of economic activities.

7. Research. The process of adaptation can also be advanced by research into new technologies and new methods of adaptation.

8. Educate, inform, and encourage behavioural change. Another type of adaptation is the dissemination of knowledge through education and public information campaigns, leading to behavioural change. Such activities have been little recognised and given little priority in the past, but are likely to assume increased importance as the need to involve more communities, sectors, and regions in adaptation becomes apparent (p.5.4 – 5.5).

Within Australia, the sectors which will require the most early adaptation are water, the natural environments, cities and infrastructure, the coastal zone, and agriculture (Stafford Smith & Ash, 2011). These scientists make the point that adaptation occurs at different scales, from the individual to the community, to the city, to the nation; as well as over varying time scales.

Climate Change mitigation

Climate change mitigation, on the other hand, refers to actions that aim to reduce the amount of climate change, typically by limiting the future increases in concentrations of greenhouse gases in the atmosphere. This can be achieved by either reducing the amount of greenhouse gas emissions or by increasing the amount of carbon dioxide that is taken up and stored in natural land and ocean sinks. Many impacts can be avoided, reduced or delayed by mitigation. A combination of both adaptation and mitigation measures can diminish the risks associated with climate change (IPCC, 2007c).

Article 2 of the United Nations Framework Convention on Climate Change (United Nations, 1992) incorporated the concept of 'avoiding dangerous anthropogenic interference with the climate system' as a focus of its framework policy. Limiting the average global surface temperature increase of 2°C (3.6°F) over the pre-industrial average has, since the 1990s, been commonly regarded as an adequate means of avoiding dangerous climate change, in science and policy making (e.g. Smith et al., 2009). While the concept of keeping increases in global average temperature below 2°C originated in the 1970s, it was not until the 2010 Cancun Agreements that the two degrees limit was enshrined in international climate policy (Hope & Pearce, 2014).

To have a 50:50 chance of keeping anthropogenic global warming below 2°C, it will be necessary to stop almost all carbon dioxide emissions before cumulative global emissions reach one trillion tonnes of carbon. The world has already emitted more than half of this quota since the industrial revolution and, at current growth rates for carbon dioxide emissions, the rest will be emitted by the middle of this century (Raupach & Fraser, 2011). Without mitigation, global emissions are projected to double between 2005 and 2030 (Garnaut, 2011c).

When considering mitigation measures, a crucial question arises as to how much reduction is sufficient. The answer to this question however is largely uncertain, although scientists know that large-scale reductions are required. The uncertainty as to how much reduction in emissions is needed is due to two factors. Firstly, there is uncertainty as to how sensitive the global climate is to various increases in greenhouse gases. Whilst the IPCC have modeled various scenarios, the impacts of climate change can lead to amplification effects, or positive feedback, effectively contributing to larger global warming increases. Secondly, uncertainty exists as to what concentration of greenhouse gases will lead to 'dangerous' climate change, as there are differing impacts of global warming, effecting different sectors of society and in different global regions (Pittock, 2009).

The 2007 IPCC report states that:

> Decision-making about the appropriate level of global mitigation over time involves an iterative risk management process that includes mitigation and adaptation, taking into account actual and avoided climate change damages, co-benefits, sustainability, equity, and attitudes to risk. Choices about the scale and timing of GHG mitigation involve balancing the economic costs of more rapid emission reductions now against the corresponding medium-term and long-term climate risks of delay (p.18).

The IPCC report goes on to outline key mitigation technologies and practices by sector. The IPCC also point out that changes in lifestyle and behaviour patterns can contribute to climate change mitigation across all sectors.

The Kyoto Protocol

The Kyoto Protocol was negotiated in December 1997 in the city of Kyoto, Japan and came into force February 16th, 2005. The Kyoto Protocol commits developed nations and countries in transition (former Soviet bloc countries) to achieve quantified reductions in greenhouse gas emissions. The Kyoto Protocol refers to the term 'carbon dioxide equivalent' (CO_2-e), as a standard measure that takes account of the different global warming potentials of the various greenhouse gases and expresses the cumulative effect in a common unit, using carbon dioxide as the reference gas.

Representatives of these countries, known as Annex 1 Parties, agreed to reduce their combined emissions of greenhouse gases by at least 5% compared to 1990 levels. The goal was to lower overall emissions from six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs and PFCs - calculated as an average over the five-year period 2008 and 2012 (inclusive), with specific targets varying from country to country. Known as the Doha Amendment, a second commitment period from January 2013 to December 2020, was proposed in 2012. During this second commitment period, parties to the agreement committed to reduce GHG emissions by at least 18 per cent below 1990 levels.

Recognizing that developed countries are principally responsible for the current high levels of greenhouse gas emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities" (United Nations Framework Convention on Climate Change, 2014).

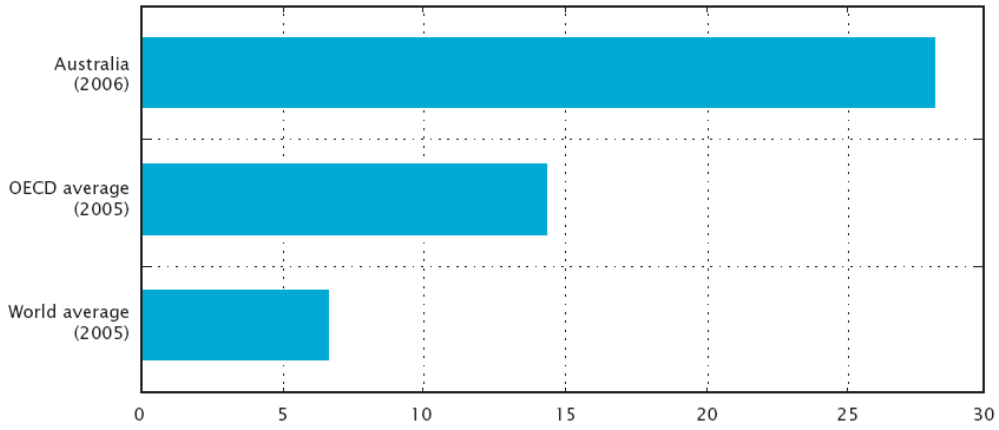
Following on from the Kyoto Protocol, the Bali Road Map was adopted at the 2007 Bali Climate Change Conference. The Bali Road Map consists of a number of decisions that represent the various tracks that are essential to reaching a secure climate future, including the Bali Action Plan, which charts the course for a new negotiating process designed to tackle climate change (United Nations Framework Convention on Climate Change, 2014).

The Copenhagen and the Cancun Agreements, reached in December 2009 and 2010 respectively, are a set of significant decisions by the international community to address the long-term challenge of climate change collectively and comprehensively over time and to take concrete action to accelerate the global response. The agreements are said to represent key steps forward in capturing plans to reduce greenhouse gas emissions and to help developing nations protect themselves from climate impacts and build their own sustainable futures (United Nations Framework Convention on Climate Change, 2014). A part of the Copenhagen and Cancun agreements is the commitment to hold temperature increase to below 2°C above pre-industrial levels. There was an acknowledgement as part of the 2011 Durban Outcomes (United Nations Framework Convention on Climate Change, 2014) of the gap between current national and international actions and intentions to reduce emissions, and the actual level required to keep average global temperatures rising no more than 2°C above pre-industrial levels. The United Nations Framework Convention on Climate Change (2014) have continued to hold climate change conferences with key outcomes agreed by governments in attendance, such as the Doha Climate Gateway in 2012, the 2013 Warsaw Outcomes, and the 2014 Bonn Climate Change Conference.

Australia's response to global mitigation efforts

Australia's per capita greenhouse gas emissions are the highest in the OECD and among the highest in the world (Garnaut, 2008). In 2006, Australia's per capita emissions were nearly twice the OECD average and more than four times the world average. The position of Australia relative to other countries is shown below in Figure 2.2. Despite this, the Kyoto Protocol allowed for an increase of 8% in emissions over 1990 levels.

Figure 2.2: Per capita greenhouse gas emissions (Garnaut, 2008).



Initially the Australian government was not a signatory to the Kyoto Protocol. However, after a change of government in 2007, Australia ratified the Kyoto Protocol at the Bali climate change negotiations and was instrumental in securing agreement on the Bali roadmap, which provides a pathway for the international community to agree on post 2012 action on climate change.

Despite the Australian government's initial refusal to sign the Protocol, Australia was on track to meet its emissions target through measures such as voluntary energy conservation, and restrictions on land clearing (Pittock, 2009).

Additionally, local governments became involved through the Cities for Climate Protection (CCP) program. CCP Australia was established in 1997 when 29 councils piloted the program and provided the local government sector access to program, technical and political support for local greenhouse action. Federal Government funding enabled the program to be rolled out across metropolitan, regional and rural Australia to become the largest local government greenhouse action program in the world (Department of the Environment Water Heritage and the Arts, 2009). In 2009, there were 238 councils, covering 84% of Australia's population, participating in the CCP Australia program. CCP Australia gained an international reputation for the solid, systematic and innovative work undertaken by councils in support of local action on climate change (Department of the Environment Water Heritage and the Arts, 2009).

The Garnaut Climate Change Review (Garnaut, 2008) was first commissioned by Australia's Commonwealth, State and Territory Governments in 2007, to conduct an independent study of the impacts of climate change on the Australian economy. This review recommended national action, including the design of an emissions trading scheme, but noted that a carbon tax would be preferable to an emissions trading scheme. The report also recommended that a new Australian climate change policy research institute be established to raise the quality of policy-related research.

In 2010, Professor Ross Garnaut was again commissioned by the Australian Government to provide an update to his 2008 Climate Change Review for the Australian community. The Garnaut Climate Change Review—Update 2011 (Garnaut, 2011a) consisted of a series of update papers and a final report in 2011, which addressed developments across a range of subjects including climate change science and impacts, emissions trends, carbon pricing, technology, land and the electricity sector.

In his 2011 review, Garnaut again made the point that Australia should play its proportionate role in global emissions reductions. Both the Australian Labor and Liberal governments have unconditionally committed to reduce emissions by 5% compared to 2000 levels by 2020 (Department of Climate Change and Energy Efficiency, 2011). In his report, Garnaut claimed that economy-wide pricing of carbon is central to emission reduction efforts and recommended that Australia adopt an emissions trading scheme with a fixed price on carbon (2011a). Garnaut's recommendations for the implementation of an emissions trading scheme are consistent with the IPCC's (2007a, 2014a, 2014b) findings regarding policies and measures that have been shown to be environmentally effective.

Australia's Clean Energy Future

In November 2011, the Australian government passed the Clean Energy Legislative Package. Part of this package included the introduction of a price on carbon pollution, which is a price on all greenhouse gas emissions. Whilst initially the carbon price was set, it was expected

to rise by 2.5 per cent a year in real terms during a three-year fixed price period until 1 July 2015. The carbon price mechanism would then transition to an emissions trading scheme where the price would be determined by the market. In her press release, the Prime Minister claimed that the carbon price was a central element of the Government's plan to move Australia to a clean energy future (Prime Minister of Australia, 2011).

The new carbon pricing mechanism, also referred to as a 'carbon tax', was expected to directly affect approximately 500 companies that are Australia's biggest polluters. Under the new legislation, these businesses would pay for each tonne of carbon (or carbon equivalent) pollution they emit. It is claimed that a price on carbon would create economic incentives for the biggest polluters to reduce their emissions of greenhouse gases and encourage businesses to:

- use or generate renewable energy;
- reduce energy consumption;
- implement technologies that will improve energy efficiency; and
- invest in renewable energy, such as solar and wind (Department of Climate Change and Energy Efficiency, 2012).

The government claimed that more than half of the revenue raised by the introduction of the carbon tax will be used to assist households with tax cuts, increased family payments and higher pensions, benefits and allowances. These benefits to households were in recognition of the increase in consumer prices expected as a result of the carbon tax. Carbon price revenue would also be used to support jobs and to invest in clean energy and climate change programs (Prime Minister of Australia, 2011).

The Clean Energy Legislation formed the basis of the Clean Energy Future initiative, which, in addition to the carbon price, included promoting innovation and investment in renewable energy, encouraging energy efficiency and creating opportunities in the land sector to cut pollution (Australian Government, 2011).

There was opposition to the introduction of a fixed price on carbon, with the Liberal Party of Australia vowing to "oppose it in opposition and rescind it in government". Key arguments against the carbon tax included that it will increase the price of everyday items, threaten jobs and be ineffective in addressing environmental concerns (Liberal Party of Australia, 2012). Additionally, it was argued that climate change mitigation strategies should be the result of incentives, rather than punitive laws (Hunt, 2011). When the Liberal Party were elected into government they abolished the Carbon Tax, effective 1 July 2014.

Energy Use

Australia's high greenhouse gas emissions are mainly the result of the high emissions intensity of energy use, primarily as the result of a reliance on coal for electricity (Garnaut, 2008). Electricity generation is the largest source of greenhouse gas emissions in Australia, accounting for 33% of emissions in the past year (Department of Climate Change and Energy Efficiency, 2015). Reducing the amount of energy used has been argued to be the quickest, simplest and most cost-effective way to reduce Australia's greenhouse gas emissions (Department of Climate Change and Energy Efficiency, 2012). Modeling by the CSIRO has shown that around one-third of the nation's energy greenhouse emissions savings could be expected to come from energy efficiency, one-third from the use of renewable energy and the remaining one-third from carbon capture and storage schemes (Smitham, Hayward, Graham, & Carras, 2011).

The need for mitigation efforts within the energy sector that offer long-term security of supply, are affordable, and have minimal impact on the environment, have been recognized (IPCC, 2007a; Sims et al., 2007). A number of mitigation options have been identified within this sector, including improved energy efficiency, the use of renewable sources and a reduced dependence on single sources of energy. Encouragingly, total energy consumption in Australia has been falling since 2011-12, due mainly to improvements in energy efficiency (Department of Industry and Science, 2015; Saddler, 2013).

The Clean Energy Future was an initiative designed to transform the energy sector, including replacing coal-fired power stations with new low-pollution and renewable energy technologies. Australia has more clean energy options than almost any other country, including solar power, wind power, biomass energy, hydro power, ocean energy, hot fractured rocks and nuclear energy (Smitham et al., 2011). However, a recent report by the Climate Council (Stock, Flannery, & Stock, 2015) found that while in 2014 investment in renewable energy has grown in many other countries, in Australia it fell by 35%. This report argues that Australia is missing out on investment in the global renewable energy boom due to policy uncertainty and Federal Government threats to reduce the Renewable Energy Target.

Residential Energy Use

Household energy conservation has been identified as potentially contributing savings of up to 20% in greenhouse gas emissions in the United States (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Gardner & Stern, 2008). Over the past decade, residential energy use has accounted for approximately 13% of the total energy consumed in Australia, with some forecasting growth of 1.7% per year (Akmal & Riwoe, 2005; Stark, Penney, & Feng, 2012). Findings such as these identify household energy conservation, which primarily is achieved through reductions in electricity use, as an efficient and effective means of reducing greenhouse gas emissions (Dietz et al., 2009; Gardner & Stern, 2008; Karlin et al., 2014).

Since 1990, the average energy consumption per Australian household has remained relatively constant, although the source of energy has changed. Within Australia, electricity is now the main source of energy within the home, with other sources, such as wood, reducing (Commonwealth of Australia, 2008). Whilst most researchers refer to 'energy use' within the home or business, this usually refers specifically to electrical energy, unless otherwise stated. The same approach will be utilized in this thesis.

A report by the Australian Department of the Environment, Water, Heritage and the Arts (Commonwealth of Australia, 2008) forecasts an increase in the number of residential households

by 61%, and an increase in the size of residential housing by 145%. Projecting forward to 2020 this report estimates a 6% decline in energy consumption per household compared to 1990 levels. However, there is an expected 20% increase in per person residential energy use over the period 1990-2020, which is partly explained by a decline in the number of people per household.

The most recent Australian energy update (Department of Industry and Science, 2015) recorded a fall of 1% in total energy consumption by the residential sector, with a 4% fall in electricity as the source of energy use in the residential sector.

It has been proposed that this decline in energy consumption per household is primarily being driven by the adoption of more energy efficient practices, appliances and housing, as well as in response to higher electricity prices (Commonwealth of Australia, 2008; Department of Industry and Science, 2015; Saddler, 2013).

The impact of price on residential energy use

A report investigating the reduction in electricity usage has found that since 2010, the amount of electricity used in Australia has reduced each year (Saddler, 2013). Saddler states in this report that one of the largest factors contributing to this decrease has been "the response of electricity consumers, especially residential consumers, to higher electricity prices" (p. 4). This finding is consistent with other research, which has found that low-income householders have been primarily driven by higher electricity prices to change their behaviour to reduce their household energy use (Chester, 2013).

Saddler (2013) attributes this change in consumer responsiveness to price, which began in 2010, to the political attention paid to the possible effect of a carbon tax on electricity prices. He argues that this political attention led to residential consumers paying more attention than they had previously to the amount they spend on electricity. This then resulted in consumers reducing their energy consumption, such that average annual household expenditure on electricity has barely increased, despite continued increases in electricity prices. The effect of this is that residential electricity customers have offset the effect of higher prices on their household

spending by reducing their electricity consumption.

Summary

The reality of anthropogenic climate change has been established by an overwhelming weight of scientific evidence (e.g. IPCC, 2013, 2014a, 2014b; National Academy of Sciences and the Royal Society, 2014; National Research Council, 2012, 2013). Australia's high greenhouse gas emissions mainly result from energy use, primarily as the result of a reliance on coal for electricity (Garnaut, 2008), and therefore reducing the amount of electrical energy used is an effective way to reduce Australia's greenhouse gas emissions. As such, an understanding is needed of the factors that underlie people's choices to engage in environmentally responsible consumer behaviour, as well as how it is possible to encourage and support people to change their environmentally responsible consumer behaviour.

In the following chapter, the dominant models and theories of pro-environmental behaviour are reviewed.

Chapter 3: Theories of Environmentally Responsible Behaviour

The future will either be green, or not at all – Bob Brown

In order to encourage more householders to adopt energy efficient behaviours as a means of reducing Australia's greenhouse gas emissions, and thereby assisting in global measures to slow the rate of climate change, an understanding is needed of why people engage in environmentally responsible behaviour.

Numerous theoretical frameworks and models have been developed to explain and predict individual's environmentally responsible behaviour. However, currently no conclusive answers have been found. Detailed below are a number of influential theories and models that have arisen from research and continue to inform thinking on ERB, while the research relating specifically to energy-use behaviours is reviewed in the following chapter.

Psychological research into environment-related issues began in the late 1960s (e.g. Buckhout, 1972; DeGroot, 1967; Griffiths & Langdon, 1968), with research into energy-related environmental problems emerging in the 1970s (e.g. Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Zube, Brush, & Fabos, 1975).

A body of research within environmental psychology has explored the area of environmentally responsible behaviour (ERB), which refers to "any individual or set of behaviours that consciously seeks to minimize the negative impact of the behaviour on the environment" (Kollmuss & Agyeman, 2002, p.240). Other definitions of pro-environmental behaviour are much broader, seeing ERB as "behaviour that harms the environment as little as possible, or even benefits the environment" (p. 309, Steg & Vlek, 2009a). Under this definition, no conscious effort need be made to benefit the environment, and an environmental benefit may,

in fact, be an unintended side-effect of behaviour (such as cycling to work because it is cheaper and healthier).

Much of the research on ERB has sought to explain why people engage in environmentally responsible behaviours and what the barriers are to engaging in these behaviours. A key feature of this body of research has been the recognition of a 'value-action gap', whereby people's environmental behaviour does not match their stated values or attitudes regarding the environment (Blake, 1999; Kollmuss & Agyeman, 2002).

Vining and Ebreo (2002) developed a meta-theoretical framework for considering the theories of conservation behaviour. While the term 'theory' is commonly used to as a general statement to describe a set of ideas and hypotheses that aim to summarise and explain observations; whereas a 'model' commonly refers to an operationalization of the theory that allows it to be tested. Vining and Ebreo explicitly state that they use the term 'theory' loosely to include models of behaviour. They found five broad approaches:

1. Learning/Behavioural theories;
2. Motivation, Moral, and Value theories;
3. Attitude, Beliefs, and Intentions theories;
4. Emotion and Affect theories; and
5. Other approaches.

This meta-theoretical framework will be adopted in this paper.

Learning/Behavioural Theories

The role of rewards in encouraging (or consequences in discouraging) environmentally responsible behaviour has been explored by behavioural scientists. In their critical review of behavioural interventions, Dwyer, Leeming, Cobern, Porter, and Jackson (1993) claim that behavioural research into ERB reached its peak in the mid 1970's, then has declined throughout the ensuing years.

Applied behavioural analysis is the application of behavioural techniques. Originally developed by Skinner (e.g. 1953, 1974), Behaviourism sees behaviour as referring to the entire range of what people do, focusing on observed behaviour. A behavioural approach to environmental psychology acknowledges that intra-personal factors (such as motivations, attitudes and beliefs) exist and exert an influence on observed behaviour. However, behavioural environmental analysts argue in favour of applying "intervention strategies directly to environmentally relevant behaviours, instead of attempting to modify environmental attitudes and values first and hoping for subsequent indirect influence on behaviours" (p. 20; Geller, 1989).

A basic tenet of applied behavioural analysis is the A-B-C model, which links an antecedent event (A) to a behaviour (B) which then produces a consequence (C) contingent on the behaviour. Behavioural intervention strategies can therefore focus on antecedent strategies or consequence strategies, both with the aim of changing a target behaviour (or set of behaviours). These two approaches will now be discussed in further detail.

Antecedent strategies

Contemporary research into what behaviouralists would refer to as antecedent strategies now refer to 'social influences' on behaviour. In their meta-analysis, Abrahamse and Steg (2013) identified the use of six social influence approaches: the use of social norms in information and feedback provision, block leaders and social networks, public commitment making, modelling, the use of social comparison in feedback provision, and feedback provision about group performance. The results of their meta-analysis supports the efficacy of social influence approaches, however, consistent with other research (Lokhorst et al., 2013), the interventions had different effects for different target groups. In a finding that surprised the authors, they found that the efficacy of the social influence approaches did not depend on the type of behaviour, a result that they claim "highlights the pervasive nature of social influence and its potential to encourage a range of pro-environmental behaviours" (p.11). In conclusion to their

meta-analysis, Abrahamse and Steg identify that one of the strengths of social influence approaches is their strong basis in theory and behaviour change principles.

Consequence strategies

Within behaviourism, consequences, contingent on behaviour, can be either positive (also termed a reward), which increases the likelihood of the behaviour occurring again; or negative (also sometimes termed a punishment), which decreases the likelihood of the behaviour re-occurring.

In their review, Dwyer et al. (1993) identified three general consequence intervention approaches: feedback, reward and penalty. These three general frameworks will be used to discuss previous behavioural research and its more current incarnations.

Feedback

The early research on the role of feedback has perhaps now been eclipsed by research on the role of normative messages. Indeed, the results of these early studies are in general accordance with more recent research on normative messages, which has found that providing feedback to electricity consumers regarding their use and/or energy savings resulted in a reduction of energy use – but only for high-consumption households (Bittle, Valesano, & Thaler, 1979; Brandon & Lewis, 1999). Similar to the findings of Schultz, Nolan, Cialdini, Goldstein, and Griskevicius (2007), the provision of this feedback (or normative message) for low-consumption households resulted in an *increase* in consumption.

Reward/Incentive

The reward-intervention studies reviewed by Dwyer et al. (1993) all used some form of financial incentive as the reward for the desired behaviour. Whilst financial reward is most often used as the outcome-contingent consequence (e.g. Hutton & McNeill, 1981), other studies have been more creative, such as the option of a tour of a mental-health facility contingent on driving fewer miles (Foxx & Hake, 1977). In these studies where maintenance of the behaviour after the

intervention was recorded, it was found that the target behaviour returned to, or near, pre-intervention levels once the incentive was removed.

Stern (1999) reviewed research which showed that combining financial incentives with non-financial incentives, such as convenience, increased the efficacy of the intervention. He also found that there was a role for information provision, or marketing, in initially gaining the attention of potential purchasers.

More recent research on the role of incentives as motivators for environmentally responsible behaviour has continued to look at non-financial incentives. Researchers such as Evans et al. (2013) have found that the environmental benefits of an activity can act as an incentive in itself for participants to engage in that activity.

Penalty

The application of penalties has again principally used financial loss as the penalty condition. Early research in this area (e.g. Levitt & Leventhal, 1986) found that the implementation of financial penalties were effective in changing behaviour, however, this did not generalise to similar behaviours where no penalties were in place.

Whilst it appears that behaviour modification approaches can be effective at promoting behavioural change, these changes do not appear to be lasting or to generalise to other conservation behaviours. Additionally, there is a significant ongoing cost associated with providing financial incentives. Furthermore, the value of the incentive may reduce over time, requiring the continued 'topping-up' of the financial incentive.

Motivation, Moral, and Value theories

Attribution Theory

Fritz Heider's (1958) seminal work is generally regarded as the commencement of psychological research into attribution and since that time, attribution theory has been a dominant theory in social psychology. Attributions refer to the processes people use to explain the causes

of behaviour and events. Attribution theory is now a general term used for various models that attempt to explain those processes (Kassin, Fein, & Markus, 2014).

Heider (1958) introduced the concept of 'naive psychology', whereby people make sense of and explain behaviours and events by attributing causal relationships. These types of explanations can be seen as either *intra*personal or *inter*personal. Intrapersonal attributions refer to those explanations of behaviour that are attributed to the self; whereas interpersonal attributions refer to explanations of behaviour which are attributed to factors in others or the external environment. Weiner (2001) proposed that there were only three underlying causal properties of the attributions made. These are:

1. Locus – this refers to the location of a cause, either within or external to the person. Explanations such as a lack of effort or ability would have a location within the person, while factors such as luck would have an external location;
2. Stability – refers to the enduring nature of the cause. Factors such as ability or aptitude would be seen as having a fairly enduring quality, whereas luck would be fleeting;
3. Controllability – refers to the level of control the person has over the factor. Effort for instance would be perceived as being highly within a person's control, whereas luck would not.

Attribution Bias

A number of attribution biases have also been identified, which refer to the systematic errors people make when they are attributing causes for their own and others' behaviour. One such error, which has become known as the fundamental attribution error (Jones & Harris, 1967; Pettigrew, 1979), refers to people's tendency to over-attribute causes of other people's behaviour to factors within that person, whilst under-estimating the impact of situational factors. This tendency has been found more within individualist societies than in collectivists societies (Krull et al., 1999). When considering their own behaviour, this error is essentially reversed. That is, people tend to under-attribute dispositional explanations for their own behaviour, whilst over-estimating situational explanations.

A false consensus bias also operates, where people tend to see their own behavioural choices and judgments as relatively common and appropriate to the situation and circumstances; while perceiving alternative responses as uncommon, deviant, or inappropriate (Marks & Miller, 1987; Mullen et al., 1985; Ross, Greene, & House, 1977).

Additionally, a self-serving or egocentric bias has been described, which refers to people's tendency to attribute their successes to internal factors but attribute their failures to external sources (Larson, 1977). In an extension of this, an ethnocentric bias has also been detected, whereby people ascribe internal or personal causes for the positive behaviour, and situational causes for negative behaviours, of members of their own in-group; while the reverse holds true for members of an out-group (Hewstone & Ward, 1985; Weber, 1994).

Attribution and people's behaviour regarding climate change

Recently, the role of attributions and biases has been used to understand people's behaviour in the face of climate change. In this arena, Weiner's (2001) notion of controllability suggests that an individual's attribution of control regarding climate change is predictive of their subsequent action to mitigate or adapt. That is, if a person attributes climate change to factors outside their control, such as to natural weather variations or the will of God, they are less likely to feel a sense of responsibility for the problem and to act in ways to address it. Research has borne out these predictions, with beliefs that climate change is human-induced related to greater engagement in mitigation behaviours (Ferguson & Branscombe, 2010; Malka, Krosnick, & Langer, 2009).

An ethnocentric bias has also been identified. When people are confronted about their own in-groups behaviour, they are more likely to attribute climate change to natural (i.e. uncontrollable) events, than when presented with the same information about an out-group's behaviour (Jang, 2013).

Additionally, given a false consensus bias, people may incorrectly assume that their opinion on the cause of climate change is more universal than reality would suggest. Indeed, evidence of

this misperception regarding opinions on climate change has already been indicated in the literature (Leviston, Walker, & Morwinski, 2013).

The Norm Activation model

The role of norms was initially explored with regard to altruistic behaviour (Schwartz, 1973, 1977) and have remained central to many explanations of ERB to this current day. The norm activation model (NAM) sought to explain the relationship between norms and overt behaviour, particularly with regard to why individuals often fail to act in accordance with their moral norms.

Norms are said to be shared beliefs about how people ought to act, which are enforced by the threat of sanctions or the promise of rewards. Schwartz (1977) defined a personal norm as self-expectation of specific action in a particular situation, experienced as a feeling of moral obligation. As such, personal norms can also be referred to as moral norms. Social norms, on the other hand, refer to norms which are based on group expectations and for which the reward and punishment backing the norm are externally defined and imposed.

According to Schwartz (1977), four conditions, or situational variables, are necessary for individual norms to be activated and be influential on behaviour and, as such, the relationship between norms and behaviour is dependent on how the individual defines the situation (Nilsson, 2010). These conditions are:

1. Problem awareness - an individual must be aware of the consequences that may result from their behaviour;
2. Ascription of responsibility – an individual must have some degree of responsibility for these consequences;
3. Outcome efficacy – an individual must be able to identify actions they can undertake in order to help; and,
4. Self-efficacy – an individual must recognise their own ability to be able to help.

While the norm activation model was initially proposed to account for altruism and helping behaviour, recent research has validated the role of norms in explaining and predicting environmental behaviour (e.g. Biel & Thøgersen, 2007; Black, Stern, & Elworth, 1985; de Groot & Steg, 2009; Ek & Söderholm, 2008; Nilsson, von Borgstede, & Biel, 2004; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008; Schultz, Khazian, & Zaleski, 2008; Steg & de Groot, 2010; Thøgersen, 1999a, 2008; Thøgersen & Ölander, 2003, 2006; Wall, Devine-Wright, & Mill, 2007).

However, comparing studies that have tested the NAM is difficult for a number of reasons. In many cases, studies have not included all four of the situational variables, the main constructs within the NAM have been conceptualized differently and studies have varied regarding how specific they are in their problem focus, varying from a general awareness of environmental problems to awareness of specific problems (as summarised in Steg & Nordlund, 2013).

ERB can be said to be a special case of pro-social behaviour, as it implies that people's behaviour benefits others while, in many cases, no direct individual benefits are gained (de Groot & Steg, 2009). ERB is commonly associated with both social and personal norms (e.g. Thøgersen, 1999a).

In a study investigating the impact of normative messages to promote household energy conservation, residents were provided with normative information regarding the average energy consumption of their neighbours (descriptive norm). In addition to the descriptive normative message, some households were also provided with a message conveying social approval or disapproval (injunctive norm). The provision of this normative information resulted in households changing their energy consumption to the neighbourhood average. An unfortunate side effect examined within this research was the 'boomerang effect', whereby households who were initially using less energy than the neighbourhood average increased their usage to the average. However, when the descriptive normative information was accompanied by an

injunctive normative message, households displayed an overall reduction of their energy consumption, thus eliminating the observed boomerang effect (Schultz et al., 2007).

In a study looking at conservation amongst hotel guests, normative messages were given to guests (Schultz et al., 2008). Both descriptive and injunctive normative messages were used. In this study, it was found that the use of normative messages caused a change in hotel guests' behaviour, and that a combination of both injunctive and descriptive norms was the most effective. Other research has also found that the provision of an injunctive norm moderates the influence of descriptive norms (Göckeritz et al., 2010). Research has also shown that descriptive and injunctive norms are likely to be positively correlated (Cialdini, 2003; Thøgersen, 2006).

However, research has also shown that individuals tend to under-estimate the influence of norms on their ERB and suggests that descriptive social norms might work outside an individual's awareness. Cialdini (2005) notes that ''People frequently ignore or severely underestimate the extent to which their actions in a situation are determined by the similar actions of others'' (p. 158).

In a study which explored consumers' willingness to conserve energy, the provision of normative information regarding the conservation behaviours of other households in the same neighbourhood was found to be more effective than information highlighting other reasons to conserve energy, despite the respondents rating the normative information as least motivating (Nolan et al., 2008). The authors of this study concluded that normative messages can be powerful methods of persuasion, although their influence is undetected.

In keeping with this finding, Nolan, Kenefick and Schultz (2011) explored energy experts' perceptions of normative messages compared to other motivational messages. They found that the energy experts did not recognize the full potential of the normative message and instead perceived the financial appeal to be the most motivating.

Recent research (McDonald, Fielding, & Louis, 2014a, 2014b) has begun to address situations in which there is norm conflict, or a lack of congruence between group norms, and the impact on intentions and behaviours.

While some researchers have looked at the role of individuals' subjective beliefs about the norms of society or groups they belong to, referred to as perceived or subjective social norms, other researchers have looked at internalized norms, also referred to as moral or personal norms (Thøgersen, 2006, 2009). Thøgersen (2009) reflects, it is usually believed that individuals comply with social norms due to external social pressure, and to personal norms for internal reasons, that is, because they feel it is the (morally) right thing to do. However, research has shown that the effect of personal norms is much stronger than the direct effect of social norms (Bamberg, Hunecke, & Blöbaum, 2007; Oom Do Valle, Rebelo, Reis, & Menezes, 2005). Recent research has supported a mediator model, in which the four situational factors of the NAM predict the strength of an individual's personal norms (De Groot & Steg, 2009; Steg & De Groot, 2010), which in turn appears to mediate the influence of social norms (Nigbur, Lyons, & Uzzell, 2010; Thøgersen, 2009; Thøgersen & Ölander, 2006).

The identification of both personal and social norms, and the potentially stronger effect of personal norms on behaviour, has potential impacts on people's ERB. Ideally, it is presumed that if the social and personal norm are aligned in favour of a particular ERB this behaviour has the greatest likelihood of occurring. However, if the social and personal norms are incongruent, then it appears that the personal norm will more greatly influence the behaviour. It is therefore incumbent on those seeking to produce greater ERB to promote the development of personal norms that are consistent with this behaviour.

Values Theory

Schwartz has claimed that norms are the expression of internalized values (Schwartz, 1999). His work in the area of norms led him to the task of identifying a comprehensive, universal set of basic values that explain individual differences in attitudes and behaviour. This

theory has become known as the Schwartz Value Theory (Schwartz, 1992, 1994, 1999, 2010, 2011; Schwartz & Bilsky, 1987; Schwartz & Boehnke, 2004).

Basic values have been defined as "trans-situational goals, varying in importance, that serve as guiding principles in the life of a person" (Schwartz, 2011, p. 464.) Schwartz has identified 10 types of basic values, which he argues are present across societies, with people differing only in the relative importance they place on each of the values (Schwartz, 1992, 1994; Schwartz & Boehnke, 2004). These 10 values can further be grouped into clusters or dimensions. The 10 values are distinguished from one another by the goal or motivation that they express. These 10 basic values are:

1. Power – social status and prestige, control or dominance over people and resources;
2. Achievement -Personal success through demonstrating competence according to social standards;
3. Hedonism – Pleasure and sensuous gratification for oneself;
4. Stimulation – Excitement, novelty and challenge in life;
5. Self-direction – Independent thought and action;
6. Universalism – Understanding, appreciation, tolerance and protection for the welfare of all people and for nature;
7. Benevolence – Preservation and enhancement of the welfare of people with whom one is in frequent personal contact;
8. Tradition – Respect, commitment and acceptance of the customs and ideas that traditional culture or religion provide the self;
9. Conformity – Restraint of actions, inclinations and impulses likely to upset or harm others and violate social expectations or norms;
10. Security – Safety, harmony and stability of society, of relationships and of self (Schwartz, 1992, 2011).

It has been recognized within the theory that the pursuit of any of the 10 values may have consequences that can either conflict or be compatible with the pursuit of any of the other values. As such, while people may pursue different values, it is proposed that they do this in different actions at different times. The theory also proposes that these 10 values form a continuum of related motivations, which gives rise to a circular structure (Schwartz, 2010; Schwartz & Boehnke, 2004). Within this circular structure, the closer any two values are around the circle, the more similar are their underlying motivations. Similarly, the more distant values are around the circle, the more antagonistic are their motivations. As such, behaviour can be seen as the result of a compromise between competing values.

It has been claimed that by providing insight into the competing forces which motivate behaviour, the Values Theory can integrate different motivational theories and may underlie a unifying theory of human motivation (Schwartz, 2010). Furthermore, as values are said to be general and underlie a wide range of specific attitudes, norms and behaviours, it has been argued that they are an efficient means of explaining ERB (de Groot & Thøgersen, 2013).

With regard to pro-social behaviours, such as ERB, it has been claimed that whilst each of the 10 values might be relevant under some conditions, the values that affect pro-social behaviour most frequently across contexts are along the self-transcendence dimension. Schwartz and others have found that values along the self-transcendence dimension, specifically values of universalism, benevolence, conformity, security and power, are related to ERB and that these results are valid cross-culturally (Bardi & Schwartz, 2003; Nilsson & Biel, 2008; Nilsson et al., 2004; Pepper, Jackson, & Uzzell, 2009; Poortinga, Steg, & Vlek, 2004; Schultz & Zelezny, 1999; Schwartz, 2010; Thøgersen & Ölander, 2003). It is believed that these values underlie ERB, as environmental behaviour often involves a conflict between immediate individual gains and long-term collective interests (Nordlund & Garvill, 2002, 2003; Thøgersen & Ölander, 2003).

Attempts have been made to modify Schwartz's original Value Theory to identify a specific environmental value cluster. In one such attempt, Thompson and Barton (1994) proposed that

there are two opposing motives underlying environmental attitudes – ecocentrism and anthropocentrism. Both value orientations are said to support environmental issues, however, they are believed to have different underlying motives for this. Ecocentric individuals are thought to value nature for its own sake, and, therefore, judge that it deserves protection because of its intrinsic value. In contrast, anthropocentric individuals are said to value nature because of the material or physical benefits it provides in enhancing the quality of life for humans. Apathetic orientations reflect those individuals who have no or limited concern for the environment.

Thompson and Barton (1994) hypothesized that ecocentrism would be associated with a higher rate of conserving behaviour, while anthropocentrism would be associated with lower rates of conserving behaviours. This hypothesis has been supported through studies that have found ecocentric values positively associated with ecological behaviours, while anthropocentric and apathetic values were negatively associated with ecological behaviours (Casey & Scott, 2006; Karpiak & Baril, 2008; Schultz & Zelezny, 1999).

Self-determination theory

Self-determination theory proposes that there are both intrinsic and extrinsic forms of motivation, and that both *what* a person strives to achieve is as important as *why* they strive to achieve it (Ryan & Deci, 2000; Sheldon, Ryan, Deci, & Kasser, 2004). Intrinsic motivation refers to internally driven, autonomous motivation where a person performs an activity for the sense of satisfaction gained from the behaviour. In contrast, extrinsic motivation refers to behaviours that are driven by the pursuit of an external reward. Deci and Ryan (2000) identified four types of behavioural regulation ranging from the least to the most autonomous, namely external (controlled), introjected (to avoid guilt or shame), identified (personally endorsed) and integrated regulation (congruent with own values, goals and needs). As such, externally motivated behaviours can be autonomous, in that the person freely chooses to undertake them in order to gain the desired outcome, ranging to behaviours that are conducted due to high levels of

control by external authorities, such as laws or rules. It follows then that the same behaviour can be performed by different people as a result of different motivations.

Research has shown that self-determined motivation is a good predictor of behaviour and, when combined with constructs from the Theory of Planned Behaviour, has a direct effect on behaviour as well as an indirect effect on behaviour through intentions (Hagger & Chatzisarantis, 2009; Hagger, Chatzisarantis, & Biddle, 2002; Moller, Ryan, & Deci, 2006; Sheldon et al., 2004). It has also been found that behaviours that are autonomously motivated are more likely to be sustained in the long-term (Moller et al., 2006).

In a study looking at consumer energy saving behaviour, Webb, Soutar, Mazzarol, and Saldaris (2013) found that an increase in autonomous motivation was associated with an increase in energy savings. The authors suggested that organisations that want to reduce household energy consumption should explore ways in which more autonomously motivated behaviours can be enhanced. They also point out that their findings are consistent with earlier research, such as that by Thøgersen and Grønhøj (2010), which indicated the importance of internalized norms or self-expectations and self-efficacy on energy saving by households.

Recent research that addressed SDT in the context of harmful behaviours may also have some relevance to the field of ERB. Amiot, Sansfaçon, and Louis (2013) found that people whose in-group encouraged them to engage in harmful behaviours reported higher levels of motivation to engage in these behaviours, theoretically through a process of internalizing the in-group norms. Whilst it is acknowledged that what constitutes harmful behaviours is socially determined, when applied to the area of ERB, this research suggests that a potential explanation for people engaging in environmentally harmful behaviours may be due to an identification with an in-group, and an internalization of the norms of this group, which are contrary to behaviours that are beneficial environmentally.

Stage Models

In contrast to the theories of ERB previously reviewed, stage-based models of behaviour change assume that change occurs as a result of moving through a series of sequential and qualitatively different stages.

The Transtheoretical Model

Perhaps the best-known stage model of change is the Transtheoretical Model (TTM), originally developed by DiClemente and Prochaska (DiClemente & Prochaska, 1982; Prochaska & DiClemente, 1982; Prochaska & DiClemente, 1983; Prochaska & DiClemente, 1986) as a model for intentional individual behaviour change in relation to smoking, alcohol and other drug use. The TTM is a stage-based model of intentional behaviour change that can be utilized to categorize individuals' stage of change and identify stage-specific strategies to overcome resistance in order to encourage and maintain behaviour change. One of the assumptions of the TTM is that there are a common set of five stages and ten processes people can apply across a broad range of behaviours (Prochaska & Velicer, 1997).

Although originally developed and used within a public health field, the TTM has since been applied to behaviour change in a vast array of other problem areas, including pro-environmental behaviours, such as environmentally conscious eating or 'green eating' (Weller et al., 2014).

This model forms the basis of many of the hypotheses of this current research thesis and as such, will be discussed in greater detail in a following chapter.

Stage model of self-regulated behavioural change

While accepting many of the criticisms of the TTM, yet still believing in the theoretical utility of stage-based models to develop tailored interventions, Bamberg (2013b) used constructs from the Theory of Planned Behaviour, the Norm Activation Model and the model of action phases to develop his stage model of self-regulated behavioural change (SSBC). Central to this model is the belief that behaviour change occurs as a person moves through a series of four

stages. Similar to models such as the TTM, within each of the SSBC's four stages the person is required to solve a specific task to successfully change their behaviour.

The four stages of the SSBC, and the tasks at each stage are:

1. Predecisional – At this stage, social and personal norms, negative and positive emotion associated with the behavioural goal, perceptions of responsibility and awareness of negative consequences of current behaviour all impact on the individual to form a goal intention. Commitment to a specific behavioural goal then marks the person's transition to the next stage;
2. Preactional – the task at this stage is to identify the most suitable behavioural strategy to achieve the goal, taking into account the person's attitude and perceived behavioural control over these strategies;
3. Actional – At this stage, the person implements the chosen behavioural strategy and this implementation intention marks the transition to the final stage;
4. Postactional – Within this final stage, the person reflects on their achievement and evaluates whether further action is required. Additionally within this stage, the person may face temptation to revert to their previous behaviour.

Bamberg (2013a) applied this model to develop tailored interventions in a social marketing campaign to reduce car use. The results of this study found that the stage-based interventions significantly reduced car use, while the standardized (non stage-based) intervention had no significant effect. Klöckner (2014) sought to improve research on stage models, using the SSBC model in particular to explore how people move through stages in the decision to purchase an electric car. His results supported a stage model, with different constructs being important at difference stages. Klöckner identified the prospect of identifying specific points in time during each stage where an intervention is most likely to trigger stage progression.

Attitude, Beliefs, and Intention theories

Linear Models

Initially, models of ERB were based on a linear progression, whereby knowledge led to awareness and concern, which then led to environmental behaviour. These models, also referred to as information-deficit models, assumed that by increasing people's knowledge of environmental issues, this would in turn lead to an increase in their level of awareness and concern, which would then produce the desired environmentally conscious behaviours (Blake, 1999; Burgess, Harrison, & Filius, 1998). While these models have largely been shown to be too simplistic and ineffective, it has been argued that information-deficit models still underlie many political approaches to environmental issues and public awareness campaigns (Blake, 1999; Owens, 2000).

A key assumption of information-deficit models is that greater knowledge will lead to a change in behaviour. The failure of interventions based on these models to produce desired behaviour change suggests that the barriers to changing behaviour are not due to a lack of knowledge or understanding, and that there are other factors involved in people's decisions regarding their ERB.

Heimlich and Ardoin (2008) argue that in order to understand behaviour, it is necessary to explore the interplay between the cognitive and affective components. Amongst the cognitive factors are included attitudes, values and norms. Numerous theories have been put forward to explain the influence of these factors on people's ERB. Three of the most influential and well-researched theories, which are detailed further below, initially were developed outside the environmental domain. However, more recent work has seen models of ERB developed specifically.

The Theory of Reasoned Action and the Theory of Planned Behaviour

The Theory of Planned Behaviour (Ajzen, 1991, 2002) is an extension of the Theory of Reasoned Action (Ajzen & Fishbein, 1977; Fishbein & Ajzen, 1975), to include the factor of

perceived behavioural control. Ajzen (2001) has claimed that the theory is now one of the most influential and popular conceptual frameworks for the study of human behaviour. The Theory of Planned Behaviour (TPB) is based on the belief that whether a person undertakes a behaviour or not depends on both motivation and ability, where behavioural intention is seen as the primary antecedent of actual behaviour.

According to the Theory of Planned Behaviour human behavioural intention is formed by three kinds of beliefs:

1. Behavioural beliefs - beliefs about the likely consequences of the behaviour and on evaluations of the desirability of those consequences;
2. Normative beliefs – beliefs about the normative expectations of other people; and
3. Control beliefs – beliefs about the presence of factors that may further or hinder performance of the behaviour.

Within the TPB, behavioural beliefs produce either a favourable or unfavourable attitude toward the behaviour. Normative beliefs result in perceived social pressure, also referred to as the subjective norm. Control beliefs refer to the perceived difficulty in performing the behaviour and give rise to perceived behavioural control. Together, the factors of attitude toward the behaviour, subjective norm and perceived behavioural control lead to the formation of a behavioural intention.

Behavioural intentions are assumed to reflect the motivational factors that influence behaviour. Ajzen (1991, 2002) has stressed however that a behavioural intention can only translate into a behavioural action when that behaviour is under sufficient control of the person. In this way, perceived behavioural control also directly influences behaviour. Ajzen (1991) has stated that "The relative importance of attitude, subjective norm, and perceived behavioural control in the prediction of intention is expected to vary across behaviours and situations" (p. 188).

The concept of perceived behavioural control is central to the TPB. In his more recent work, Ajzen (2002) has suggested that the term should be regarded as "perceived control over performance of a behaviour" (p. 668), in order to avoid confusion with control over the outcome of the behaviour. The inclusion of the perceived behavioural control factor is aimed at allowing prediction of behaviours that are not under complete volitional control and to help explain why intentions do not always predict behaviours. Although some studies have found little predictive power for this construct (e.g. Nigbur et al., 2010), the predictive validity of perceived behavioural control on performance of a behaviour has been found to be greatest when direct control over the behaviour is low (Madden, Ellen, & Ajzen, 1992) .

Hines, Hungerford and Tomera (1986/87) conducted a meta-analysis of 128 studies in order to identify the variables that were important in motivating individuals to engage in ERB. The variables they identified were: knowledge of issues and of action strategies, locus of control, attitudes, verbal commitment and personal sense of responsibility. They found that there were higher correlations between the variables with actual or observed behaviour rather than self-reported behaviour.

In a follow-up study to the original Hines, Hungerford and Tomera meta-analysis, Armitage and Conner (2001) conducted a meta-analysis of 185 published, empirical studies of the TPB. They found that the TPB accounted for 27% of the variance in predicting behaviour, and 39% of the variance in predicting intentions. They also found that the subjective norm factor had the weakest correlation with behavioural intention, when compared with attitude and perceived behavioural control. The perceived behavioural control factor was found to add 6% to the prediction of intention, over and above the contribution of attitude and subjective norm. Bamberg and Möser (2007) found that on average, intention accounted for 27% of the variance in self-reported environmental behaviours.

Kaiser and Scheuthle (2003) investigated whether the TPB's predictive ability could be improved by the addition of a measure of moral norms. Their results indicated that the original

three determinants of the TPB (attitudes, subjective norms and perceived behavioural control) accounted for 81% of people's intentions and explained 51% of the variance in people's ecological behaviour. They found that moral norms did not improve the prediction of intention.

Whilst not developed as a theory specifically addressing environmental behaviour, the TPB has recently been applied within that field. In a study regarding renewable energy use which used the Theory of Reasoned Action as the theoretical framework, general support was found for the positive association between the theorized constructs of beliefs and attitude, and willingness to pay more for renewable energy (Bang, Ellinger, Hadjimarcou, & Traichal, 2000). However, the study found that the potential impact of consumers' environmental concern on their attitude toward paying more for renewable energy might be limited and unstable. The authors concluded that concerned consumers were not seeking greater knowledge leading to the development of cognition-based beliefs about the value of using renewable energy, as would be expected within information-deficit models. Their results found that while consumers' concern did not lead to increased knowledge, it was related to the development of a favourable attitude toward paying a premium for renewable energy (the 'attitude toward behaviour' construct within the theory).

In a similar study that looked at the determinants of green electricity adoption in Germany, Gerpott and Mahmudova (2010) found that consumers' intention to adopt green electricity was most strongly influenced by their general attitudes towards environmental protection issues and the social endorsement of green power use by close social contacts (the subjective norm construct within the theory).

One of the major limitations of the TPB, and of studies that use it as their theoretical base, is the assumption that a stated intention to undertake a behaviour does translate into actual behaviour. However, there is strong evidence that this is not the case (e.g. Rowlands, Scott, & Parker, 2003; Scott, 1999). In a report addressing willingness-to-pay and actual adoption of green energy tariffs, Diaz-Rainey & Tzavara (2009) state that "The existing empirical evidence

on green energy markets points to a large and persistent divergence between actual adoption rates and the number of consumers claiming a willingness to pay" (p. 2).

Follows and Jobber (2000) developed a consumer model of ERB in relation to a specific product purchase, based on the TPB. They found a direct relationship from values, to the theorized constructs of product specific attitudes, purchase intention and consequent purchase behaviour.

The TPB has also been used to develop a behavioural intervention aimed at increasing the purchase of green electricity (Litvine & Wüstenhagen, 2011). In this study, researchers found that by providing targeted information aimed at changing individual's attitudes, social norms and perceived behaviour control regarding purchasing green electricity, significant increases in purchasing of green electricity resulted. The researchers also found that the perception of benefit was highly correlated with intention to purchase. Furthermore, the researchers were able to significantly increase action when they were able to increase perceived benefit by providing targeted information. In this study, the perception of benefit moderated the impact of willingness-to-pay, such that the importance of price decreased when benefits were clearly understood and social norms were activated.

The main criticisms of the TPB relate to its sufficiency and limitations in explaining human behaviour. Measurement issues have been recognized as being a concern within the TPB (Ajzen, 1991, 2002; Ajzen & Fishbein, 1977; Ajzen & Madden, 1986; Ajzen, Timko, & White, 1982; Doll & Ajzen, 1992; Fishbein & Ajzen, 1975), with reviews and meta-analyses indicating that even with well-designed measures of the theory's main constructs, correlations between the constructs are only around 0.60 (Ajzen, 2011; Armitage & Conner, 2001; McEachan, Conner, Taylor, & Lawton, 2011).

Value-Belief-Norm Theory

Unlike many other theories of environmental behaviour, the Value-Belief-Norm (VBN) Theory was specifically developed to predict environmental activism (Stern, 2000b; Stern &

Dietz, 1994; Stern et al., 1999). This theory links Schwartz's Norm-Activation model and Values theory with the New Ecological Paradigm by means of a causal chain, whereby each variable is believed to affect the next variable, and possibly other variables further down in the chain. The VBN Theory proposes that values lead to beliefs, which then lead to norms and subsequently to behaviour.

Within the VBN theory, the definition of values is consistent with Schwartz's reference to general goals that serve as guiding principles in life. Under this model, it is believed that there are three value orientations underlying environmental concern. These are:

1. An egoistic value orientation, in which people will especially consider costs and benefits for them personally;
2. An altruistic value orientation, in which people will focus on perceived costs and benefits for the other people; and,
3. A biospheric value orientation, in which people will consider costs and benefits for the ecosystem and biosphere (Stern, 2000b).

Numerous studies have supported this three-way model of value orientations (Amérigo, Aragonés, De Frutos, Sevillano, & Cortés, 2007; De Groot & Steg, 2007b; de Groot & Steg, 2008; Hansla, Gamble, Juliusson, & Gärling, 2008b; Schultz, 2000, 2001; Snelgar, 2006). These value orientations have also been validated cross-culturally (De Groot & Steg, 2007b; Schultz et al., 2005).

It has been found that altruistic and biospheric value orientations are positively associated with people engaging in ERB, while an egoistic value orientation is negatively associated with ERB (de Groot & Steg, 2008; Nordlund & Garvill, 2002; Schultz et al., 2005; Stern & Dietz, 1994; Stern, Dietz, & Guagnano, 1998). Researchers have further found that biospheric values were more strongly related to pro-environmental intention and behaviour than altruistic values (de Groot & Steg, 2008; de Groot & Steg, 2010; Steg, De Groot, Dreijerink, Abrahamse, & Siero, 2011).

The Schwartz Values Theory argues that the influence of social norms on behaviour is not direct; rather, it is mediated by personal norms of altruistic behaviour. Values, particularly biospheric values, have been found to be more powerful in explaining personal norms than an individual's worldview and environmental concern (Steg et al., 2011).

The VBN theory proposes that these three value orientations underlie an individual's ecological worldview, which is consistent with Dunlap and Van Liere's NEP terminology (Dunlap, 2008; Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig, & Jones, 2000). Further, the VBN theory holds that an individual's ecological worldview leads to an awareness of the consequences of their behaviour on the environment and thereby an assumption of responsibility to reduce the negative environmental impact of their behaviour.

Following on from beliefs are a person's environmental norms, which give rise to their sense of obligation to take pro-environmental action. This role of norms is consistent with the norm-activation model, which sees norms as mediators of behaviour. Personal norms are then believed to influence a range of environmental actions or inactions.

The VBN theory has been successful in explaining a range of environmentally significant behaviours (Abrahamse & Steg, 2011; Nordlund & Garvill, 2003; Steg, Dreijerink, & Abrahamse, 2005; Stern et al., 1999) and has also been used to inform models for understanding specific environmental consumer behaviours (e.g. Ford, Williams, Bishop, & Webb, 2009). Some researchers however contend that the TPB explains the variance in people's behaviour better than the VBN model (Kaiser, Hübner, & Bogner, 2005).

In a meta-analysis of 57 independent studies conducted between 1995 - 2006, Bamberg and Moser (2007) identified that pro-environmental behavioural intention mediated the impact of all other psycho-social impacts and significantly predicted pro-environmental behaviour. They further found that the factors of attitude, behavioural control and personal moral norms were all significant predictors of pro-environmental behaviour. Although initially conducted as a meta-

analysis of studies supporting the TPB, these results provide support for Stern's integrative VBN theory.

Comprehensive Action Determination Model

More recently, Klöckner and Blöbaum (2010) have argued for a comprehensive model that could be applied to all situations. Whilst they acknowledge the contributions of theories such as the TPB, NAM and VBN to explaining environmentally responsible behaviour, they argue that all these models show limitations in some domains. The Comprehensive Action Determination Model (CADM: Klöckner & Blöbaum, 2010) represents their attempt to combine models such as the TPB, the NAM and the concept of habits, to create a comprehensive framework for understanding individuals' environmentally responsible behaviour.

Within this model, there are three determinants of an individual's behaviour:

1. Habitual processes – incorporating schemas and habits;
2. Intentional processes – incorporating the concepts of intentions and attitudes;
3. Situational influences – incorporating concepts of perceived behavioural control and objective constraints.

Furthermore, normative processes (incorporating the concepts of both subjective and personal norms) are believed to mediate the influence of habitual and intentional processes on behaviour. This model is comprehensive in that it includes a wide variety of possible predictors and explicitly assumes that their relative importance will vary within different situations.

In a study on travel mode choice, (Klöckner & Blöbaum, 2010) compared the TPB, NAM, and a combination of the two, to the CADM. Their results showed that while the other models demonstrated good model fit, the CADM explained more of the variance. Furthermore, Klöckner (2013) conducted a meta-analysis of 56 data sets across a range of environmentally responsible behaviours. His analysis showed that as a model, the CADM was able to fit the data.

Criticisms of psycho-social factors

It has been argued by some that there is an over-reliance in the current research agenda on individual psycho-social factors (e.g. Moloney, Horne, & Fien, 2010). One of the criticisms of a psychosocial focus is that it can lead to an over-focus on the role of information in changing people's behaviour. Whilst it is acknowledged that the provision of timely and accurate information can be an important first step in alerting people to the need to change and methods of changing, information alone rarely results in permanent or sustained behavioural change (Stern, 2000a). The provision of information regarding the impact of climate change can also result in unwanted reactions, such as denial or becoming desensitized, resigned, cynical and/or helpless (The Australian Psychological Society Limited (APS), 2012).

Various studies and factor analyses have found that individuals are inconsistent in their ERB, such as behaviour not matching stated values or intentions, as well as behaving differently across different environmental behaviours (e.g. Blake, 1999; Gatersleben, Steg, & Vlek, 2002; Kollmuss & Agyeman, 2002). As such, it has become apparent to many researchers that psychosocial factors alone are insufficient to explain individual's ERB.

Criticism has also been directed at models that focus exclusively on the characteristics of individuals, with it being argued that the relevance of context and interpersonal connection are being ignored (Wakefield, Elliott, Eyles, & Cole, 2006). The role of social identity and the importance of inter-group processes are an emerging area of research in environmental activism (Dono, Webb, & Richardson, 2010).

Emotion and Affect Theories

There is a body of research that supports the beneficial impact of spending time in natural environments (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Greenleaf, Bryant, & Pollock, 2014; Hartig, Kaiser, & Strumse, 2007; Kjellgren & Buhrkall, 2010; Snell & Simmonds, 2012; White, Pahl, Ashbullby, Herbert, & Depledge, 2013), however, the affective motivations for ERB are a less-well researched area of psychology.

Pooley and O'Connor (2000) suggest that environmental educators need to address the role of emotions and beliefs in changing people's ERB. De Young (2000) proposes that intrinsic satisfaction can underlie people's motivation to engage in ERB. He reports that "certain patterns of behaviour are worth engaging in because of the personal, internal contentment that engaging in these behaviours provides" (p.515). Pelletier and colleagues (Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998) also found "people indicated that they engage in environmentally conscious behaviours for the pleasure and satisfaction they derive from doing so" (p. 460). Additionally, Steg (2005) found that commuter car use was most strongly related to symbolic and affective motives, rather than instrumental motives such as cost.

Emotional affinity, or connectedness, with nature has also been related to greater ERB (Schultz, 2001; Schultz, Shriver, Tabanico, & Khazian, 2004). The results of Gosling and Williams' (2010) study on connectedness to nature, place attachment and conservation behaviour also supported the importance of using affective strategies to promote conservation behaviours.

Other approaches

Worldview

Whilst much of psychology is interested in the individual-level factors that influence behaviour, some researchers have attempted to identify factors that operate at a societal or cultural level to define groups of people and influence their behaviour. A related set of cultural level, psychological pro-environmental determinants has been identified: environmental concern, ecological worldview, and myths of nature. These will now be discussed in relation to pro-environmental behaviour.

Environmental concern

The term 'environmental concern' has been used in the literature to refer to a person's general attitude toward the environment (Fransson & Gärling, 1999). The term however tends to be something of a catchall phrase. Debate regarding its conceptualization and measurement have been ongoing (Franzen & Vogl, 2013; Hedlund-de Witt, de Boer, & Boersema, 2014; Van Liere

& Dunlap, 1981), with many societal and individual-level factors being proposed to influence environmental concern, including beliefs, values, traditions and cultural norms.

Despite the numerous studies that continue to use it (e.g. Fujii, 2006; Hartmann & Apaolaza-Ibáñez, 2011; Wu, Huang, & Teng, 2013), reviews have concluded that environmental concern does not correlate highly with specific pro-environmental behaviours (Bamberg, 2003; Hines et al., 1986/87). This is possibly due to the number of factors it has been associated with and the numerous barriers to behaviour change (Gifford, 2011). It has now been suggested that environmental concern is best viewed as an ideology, an important but indirect determinant of specific behaviour (Bamberg, 2003).

Ecological worldview

Similar to environmental concern, it has been suggested that an individual's environmental behaviour reflects their ecological worldview about nature and humans' relationship to it. Dunlap and Van Liere (Dunlap, 2002, 2008; Dunlap & Van Liere, 1978; Dunlap et al., 2000) termed this new worldview the New Environmental Paradigm (NEP), which consisted of three major themes: existence of ecological limits to growth, importance of maintaining the balance of nature, and rejection of the anthropocentric notion that nature exists primarily for human use. The NEP is construed as a worldview regarding the planet as an interconnected system and as such, actions that harm the environment have detrimental consequences for the individual and significant others (Dunlap et al., 2000).

The NEP Scale was devised as a measure of a person's worldview about the relationships of human beings to the environment. The NEP was revised to the New Ecological Paradigm, measured by the revised NEP scale, which tapped a wider range of elements of an ecological worldview, rather than a socio-political domain (Dunlap et al., 2000). Both the original and the revised NEP scale have been used by researchers as a measure of environmental concern, environmental values and environmental attitudes, although Dunlap himself has stated that treating it as a measure of environmental beliefs is the most accurate usage. It has been argued

that the universal nature of the beliefs measured by the NEP scale is the reason why it has become the most widely used measure of environmental attitudes since its publication (Dunlap, 2002; Stern et al., 1995).

In a meta-analysis of studies that used the NEP scale in some form, Hawcroft and Milfont (2010) found that across the 68 studies they focused on, which encompassed 36 nations, there was great variation in the way the NEP scale was used, particularly with regard to the number of items used and the number of points on the Likert scale employed. Their review found that variations in sample type and scale lengths affected NEP scores, and recommended that future researchers should use a 5-point Likert scale and use all 15 items of the revised NEP scale.

Myths of Nature

General beliefs and attitudes towards the environmental have also been associated with the definitions and images of nature people hold. Cultural theory (Thompson, 2003; Wildavsky, 1987) seeks to explain societal conflict over risk, which is viewed in terms of a fourfold typology of forms of social solidarity. Each form of social solidarity has an associated premise, also known as Myths of Nature. The Myths of Nature are said to reflect different archetypal views on the vulnerability of nature. Four myths are distinguished: nature capricious, nature tolerant, nature benign and nature ephemeral. These four Myths of Nature are said to reflect individual perceptions of risk as well as preferred strategies for risk reduction (Grendstad & Selle, 2000; Steg & Vlek, 2009b). Those who believe the nature-ephemeral myth are most environmentally concerned; those who believe the nature-benign myth are least concerned (Poortinga, Steg, & Vlek, 2003). The Myths of Nature have provided a useful framework for exploring environmental issues at a cultural and political level, such as public perceptions associated with environmental changes and the risks associated with climate change (e.g. Akerlof, Maibach, Fitzgerald, Cedeno, & Neuman, 2013; Fath & Beck, 2005; Goebbert, Jenkins-Smith, Klockow, Nowlin, & Silva, 2012; Kahan, Jenkins-Smith, & Braman, 2010; Price, Walker, & Boschetti, 2014).

Social Identity

Identity theory posits that people have a number of different identities, which reflect parts of the self, dependent upon the situation they are in. These identities are organized in prominence and salience hierarchies, such that more prominent and salient identities provide a stronger guide to behaviour than less prominent and salient identities (Brenner, Serpe, & Stryker, 2014; Stryker, 1980; Stryker & Burke, 2000). Research has found that one's environmental identity influences ERB (e.g. Dresner, Handelman, Braun, & Rollwagen-Bollens, 2014; Matsuba et al., 2012; Stets & Biga, 2003). Furthermore, the influence of a person's environmental identity on their pro-environmental behaviour has been found to be greater than variables such as environmental attitudes and environmental beliefs (Kashima, Paladino, & Margetts, 2014; Sparks & Shepherd, 1992; Stets & Biga, 2003; Whitmarsh & O'Neill, 2010).

Political Orientation

Research has shown that political orientation, or a person's political social identity, effects their beliefs about climate change. Left-wing political supporters are more likely than right-wing political supporters to believe in anthropogenic climate change (Fielding, Head, Laffan, Western, & Hoegh-Guldberg, 2012; McCright & Dunlap, 2011; Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011). Beliefs about climate change affect a person's ERB, with climate change skepticism having been linked to reduced support for government policy on climate change, and engagement and support of pro-environmental actions (Ding, Maibach, Zhao, Roser-Renouf, & Leiserowitz, 2011; Engels, Huther, Schafer, & Held, 2013; Whitmarsh, 2011). Unsworth and Fielding (2014) found that making political identity salient increased climate change skepticism and reduced support for government climate change policies, especially when those people already held right-wing political views. It has been suggested that there is a need to de-politicize climate change in order to promote greater pro-environmental action and policy support (Östman, 2013; Unsworth & Fielding, 2014).

Goal-directed behaviour

Another body of research has viewed conservation behaviour as goal-directed behaviour. Goal-framing theory (Lindenberg & Steg, 2007) proposes that goals 'frame' what people attend to, how they process information and their subsequent behaviour. It is believed that at any time, one goal is dominant, or focal, and becomes the goal frame, while the other goals operate to support or oppose the focal goal. This theory builds on Lindenberg's (2001) earlier work which identified three types of general goals which have been described as:

1. Hedonic goals – to feel better right now;
2. Gain goals – to guard and improve one's resources; and
3. Normative goals – to act appropriately (Lindenberg, 2001, 2013; Lindenberg & Steg, 2007).

Under this theory, hedonic goals are assumed to be the strongest, while normative goals need additional external support to become focal (Lindenberg & Steg, 2007). It has been argued that the three goal frames identified in this theory coincide with current theories of ERB and offer an integrative framework for understanding ERB (Lindenberg & Steg, 2007; Steg & Nordlund, 2013). Normative goals can be seen to underlie the NAM and VBN theories, while hedonic goals underlie affective motivations. Gain goals are said to underlie the self-interested motivations within the TPB.

Kaiser and Wilson (2004) claim that "psychologists underestimate the significance of concepts such as attitudes and values, because it is not a behavior's apparent face value that matters, but rather the reason (i.e., the intention) behind an act" (p. 1532).

Socio-demographic factors

It has been argued that psychological factors alone are insufficient to explain and predict individuals ERB (e.g. Poortinga et al., 2004), and as such, research on ERB has also looked at the role of socio-demographic factors.

Income and household size have been found to be important determinants of household energy use, where households with higher incomes and more members use more energy (Abrahamse & Steg, 2009, 2011; Gatersleben et al., 2002; Moll et al., 2005; Poortinga et al., 2004). This relationship has also been found regarding water use (Fielding, Russell, Spinks, & Mankad, 2012). Age has also been found to be a factor, with older people engaging in less ERB than younger people (Abrahamse & Steg, 2011; Granzin & Olsen, 1991; Hines et al., 1986/87; Straughan & Roberts, 1999).

Gender differences have also been explored, with findings supporting the view that females are more likely than males to hold attitudes consistent with greater ERB (Arabatzis & Malesios, 2013; Granzin & Olsen, 1991; Sakellari & Skanavis, 2013; Straughan & Roberts, 1999; Zelezny, Chua, & Aldrich, 2000). Zelezny, Chua, and Aldrich (2000) found that the effect of gender on pro-environmental behaviour was consistently stronger than on environmental attitudes.

Interestingly, Abrahamse and Steg (2009) found that while energy use was determined by socio-demographic variables (rather than by psychological variables), household energy saving (reductions in energy use) was most associated with psychological factors and socio-demographic variables were not significant.

Abrahamse and Steg (2011) however also state that in their study, the psychological variables from the TPB and VBN theories were related to household energy use, when socio-demographic variables were controlled for. They thereby argue in support of the importance of these variables in explanations of household energy use. Additionally, Granzin and Olsen (1991) found that while demographic variables contributed to an understanding of environmental protection activities, participation could be better understood in terms of personal values. Straughan and Roberts (1999) also state that demographic data are not as useful as psychographic criteria.

Personality

Another area of interest within the environmental psychology field is the role of personality traits in understanding individuals ERB, particularly with respect to the Big Five taxonomy of personality traits (Goldberg, 1993). Research investigating the role of 'personality variables' and environmental behaviour is not new, with the conclusion that personality has an influence on environmental behaviour being reached nearly forty years ago (Arbuthnot, 1977). However, some of this research has tended to use a broad definition of personality, rather than personality as seen within the Five Factor Model. For example, Balderjahn (1988) found that personality influenced ecological behaviour, but did delineate this influence in terms of the Big Five dimensions. Similarly, Pettus and Giles (1987) identified that self-controlled, well organized, and goal oriented people were more likely to display pro-environmental behaviours. More recently, several studies have shown a link between the 'personality traits' of altruism with littering (Ojedokun & Balogun, 2010; Ojedokun, 2011), while research into the 'personal characteristics' of farmers' use of water and conservation practices (Quinn & Burbach, 2008; Quinn & Burbach, 2010) actually assessed their ecological worldview, rather than personality factors specifically.

The Big Five and ERB

The traits of Agreeableness, Openness, Conscientiousness, and to a lesser extent, Extraversion have all been identified as associated with pro-environmental behaviours, whilst Neuroticism has shown an inverse relationship. In one study, the dimensions of Agreeableness, Extroversion and Conscientiousness were found to be characteristic of ecological consumers (Fraj & Martinez, 2006). Similarly, other research has found that Agreeableness negatively predicted consumerism, while Agreeableness and Openness each uniquely predicted environmentalism (Hirsh, 2010; Hirsh & Dolderman, 2007). In a further study, Swami, Chamorro-Premuzic, Snelgar, and Furnham (2011) found that the Big Five factors of Agreeableness and Conscientiousness directly and positively predicted waste management behaviour. Nisbet, Zelenski, and Murphy (2009) also found that people who scored highly on

their measure of nature relatedness were also higher on scores of Agreeableness, Openness and Extraversion, with a weaker correlation between nature relatedness and Conscientiousness. Looking at a specific type of responsible behaviour, Musa, Seng, Thirumoorthi, and Abessi (2011) and Ong and Musa (2012) found that Agreeableness, Openness and Extraversion were related to more responsible underwater behaviour, while Neuroticism was negatively related to this behaviour. Additionally, Kim, Schmöcker, Bergstad, Fujii, and Gärling (2013) found that greater acceptability of transport pricing was related to the Big Five factors of Extraversion, Agreeableness and Conscientiousness.

Summarizing the results of a number of studies, Milfont and Sibley (2012) found that Agreeableness, Conscientiousness and Openness were most strongly linked to environmental engagement. These authors hypothesized that higher scores on measures of Agreeableness relate to higher levels of empathy, which is thought to motivate pro-environmental behaviours. Higher scores on a measure of Openness are associated with increased cognitive ability and flexibility of thought, which are then presumed to allow a greater appreciation of the scientific literature on climate change, the role of humanity in the larger ecology, and a greater aesthetic appreciation of natural beauty. High scores on measures of Conscientiousness are believed to convey greater responsibility, long-term planning and a sense of duty, which then express as environmental concern and action.

Spillover Effect

Given the magnitude of the environmental problems that need to be addressed through individual behaviour change, there are clear efficiencies if it were possible that an intervention aimed at a particular type of behaviour change could produce positive behaviour in another, related behaviour. Such an effect is known as a 'positive spillover' effect, and has been the subject of research in promoting environmentally responsible behaviour (e.g. Klöckner, Nayum, & Mehmetoglu, 2013; Thøgersen, 1999b; Thøgersen & Crompton, 2009; Thøgersen & Ölander, 2003). More optimistically, it has also been suggested that people may start with a small or

seemingly insignificant environmentally responsible behaviour, which would then spillover into new behaviours with a greater impact (as summarised in Thøgersen & Crompton, 2009).

Regrettably, negative spillover can also occur, in which adopting a certain ERB actually decreases the chances of that person adopting another pro-environmental behaviour, as a result of people using the one behaviour to justify not doing the other (Catlin & Wang, 2013; Diekmann & Preisendörfer, 1998; Thøgersen, 1999b).

Unfortunately, some research has provided little support for a positive spillover effect (Poortinga, Whitmarsh, & Suffolk, 2013), while other research has found that it only occurs in particular situations, many of which are difficult to control (Thøgersen & Crompton, 2009). Furthermore, both negative and positive spillover can co-occur, which has been given as one of the reasons why it is difficult to generalise pro-environmental behaviours (Thøgersen & Crompton, 2009; Thøgersen & Ölander, 2003).

Barriers to ERB

Despite clear scientific warnings of the imminence of global climate change, it appears that humans, collectively and individually, are not doing enough to mitigate this threat (IPCC, 2014b). While this may in part be due to people not believing in the science of climate change, and therefore feeling no compulsion to act, the great majority of people do actually believe that climate change is occurring and that it is due to anthropogenic causes (Garnaut, 2011a; IPCC, 2007a; Leviston & Walker, 2011). However, as many researchers have previously referred to, there exists a value-action gap, whereby people do not behave in a manner consistent with their beliefs or values (e.g. Barr, 2006; Barr et al., 2005; Blake, 1999; Kollmuss & Agyeman, 2002; Whitmarsh et al., 2011). As such, an investigation into the barriers to ERB is warranted.

Barriers to environmentally responsible consumption behaviour have been attributed to the "motivational and practical complexity of green consumption" (Moisander, 2007, p. 404). Moisander (2007) argues that "consumers' primary motive for green consumerism can be expressed or manifested with numerous different selective motives and behaviours" (p. 406). It

has become increasingly accepted that ERB is multiply determined, that is, there are multiple antecedents and motives underlying people's behaviour at any given time and place (De Young, 2000; Schultz, 2000; Stern & Dietz, 1994; Stern et al., 1995).

Similarly, numerous barriers exist for any particular behaviour or set of related behaviours, and these barriers tend to be behaviour specific. Additionally, research has indicated that it is more difficult to change and maintain a repetitive behaviour, such as switching off lights, than it is to produce a once-off change in behaviour (Kempton et al., 1992). Lorenzoni et al. (2007) have argued that for the public to engage with climate change, individuals need to become involved at the cognitive, affective and behavioural levels. These authors were able to identify a range of common barriers to engagement operating at both individual and wider social scales.

Other reported barriers to changing behaviour to reduce individual contributions to climate change include not knowing how to change; the belief that changing one's own behaviour will not make any difference; and financial and time restrictions (Semenza et al., 2008). Interestingly, very few people report concerns that changing one's own behaviour would affect other's opinions of them (Semenza et al., 2008).

This thesis will now give an overview of a number of issues that have been identified within the literature, which act as barriers to people engaging in ERB, or lessen the impact of their behaviour.

Rebound effect

Hopes have been expressed that technological innovation would improve the efficiency, and therefore environmental impact, of many commonly used products, such as electrical items and vehicles. It appears however that a rebound effect occurs, where costs saved through efficient appliances are then 'taken back' by consumers purchasing more or larger products; or using them more often (Brännlund, Ghalwash, & Nordström, 2007; Greening, Greene, & Difiglio, 2000; Herring & Roy, 2007; Midden, Kaiser, & Teddy McCalley, 2007).

Tragedy of the Commons

The 'tragedy of the commons', also referred to as a public goods games, was first termed by Hardin (1968) to describe what he saw as a tragic flaw in human nature. This phrase refers to the phenomenon of over-use of collective goods, which initially is in a person's own self-interest but that in the longer-term results in detrimental effects for all concerned. Hardin's theory assumes that people will act only in their own self-interest and must be coerced into acting in the interest of the larger society when that is counter to their immediate self-interest. This term has been applied within an environmental framework, referring to the over-consumption of resources such as food, water and energy use and the need for cooperation to mitigate these impacts (e.g. Lant, Ruhl, & Kraft, 2008; Raihani & Aitken, 2011; Tavoni, Dannenberg, Kallis, & Loeschel, 2011; Wilkinson & Salvat, 2012).

Free-riding phenomenon

Quimby and Angelique (2011) suggest also that the phenomenon of 'free-riding' acts as a barrier to ERB. Free-riding refers to the tendency to benefit from the collective efforts of other people, and is similar to the tragedy of the commons, whereby an individual's self-interest (such as not changing their behaviour) may not be in the overall best interests of the community (Raihani & Aitken, 2011).

It has been suggested that the postponement of specific binding agreements in the Kyoto and Copenhagen Protocols have given countries an incentive to free-ride, leading to excessive greenhouse gas emissions (Beccherle & Tirole, 2011; Heitzig, Lessmann, & Zou, 2011; Tavoni et al., 2011). However, Walsh and Warland (1983) suggest that free-riders tend to take action only when it becomes convenient and socially expected. Quimby and Angelique (2011) suggest an example of this is increased recycling in communities where there is a curbside recycling program.

Psychological biases

Johnson and Levin (2009) argue that it is the 'tragedy of cognition', rather than the tragedy of the commons, which places us globally at risk from climate change. They identify five of the most important psychological biases, which act as barriers to people acting pro-environmentally. These five biases are: positive illusions, cognitive dissonance, the fundamental attribution error, prospect theory and in-group/out-group bias. Other researchers have also investigated how reducing these biases can enhance people's ERB (e.g. Goleman, 1989; Sparks, Jessop, Chapman, & Holmes, 2010)

Habits

Many of the behaviours that could be changed to reduce our impact on global warming, such as turning off lights, recycling, and car use, are automatic, or habitualized, behaviours. Once a habit has been established, it becomes a greater influence on behaviour than intention and mediates the influence of personal norms and perceived behavioural control (Bamberg & Schmidt, 2003; Klöckner & Matthies, 2004, 2012; Klöckner & Verplanken, 2013). As such, habits are generally considered to be barriers to people engaging in ERB, at least until new, environmentally conscious, habits are formed. However the formation of new habits can be difficult.

Research has shown that deactivation of habits occurs best when combined with other strategies and occur at natural periods of change in consumer's lives, such as moving house (Verplanken & Wood, 2006). Verplanken and Wood refer to these as "downstream-plus-context-change" interventions, to indicate that not only do they provide new information, but they do so when consumers are undergoing natural shifts in the performance environment. Verplanken and Wood also refer to "upstream" interventions, which aim to prevent potentially harmful effects of consumer's habits and include interventions such as economic incentives and policy. Both upstream and downstream interventions can be applied to the same habit behaviour.

Measurement Issues within Environmental Psychology

In order to gauge the effect of constructs such as values, attitudes and norms, it is necessary to be able to accurately measure them. However, measurement issues continue to plague researchers within the environmental psychology field. As mentioned previously, a key feature of research in the environmental domain has been concerned with the value (or behaviour) – action gap, however, some researchers have argued that this gap is over-inflated and is, in fact, a measurement and statistical artefact (e.g. Kaiser & Wilson, 2004). Three general issues regarding the measurement of environmental behaviour have been identified, that is, what to measure, how to measure it and how to conceptualise it (Gatersleben, 2013). This thesis will now explore these areas in more detail.

What to measure

Kollmuss and Agyeman (2002) define pro-environmental behaviour, also known as environmentally responsible behaviour (ERB), as "behaviour that consciously seeks to minimize the negative impact of one's actions on the natural and build world" (p.240). By this definition, ERB can be seen as goal-directed behaviour in that people make conscious choices to act in ways that benefit the environment. It has been suggested that this form of goal-directed behaviour is the only type of behaviour environmental psychology can and should be concerned with (Greve, 2001; Kaiser & Wilson, 2004).

Other definitions of pro-environmental behaviour are much broader, seeing ERB as "behaviour that harms the environment as little as possible, or even benefits the environment" (p. 309, Steg & Vlek, 2009a). Under this definition, no conscious effort need be made to benefit the environment, and an environmental benefit may, in fact, be an unintended side-effect of behaviour (such as cycling to work because it is cheaper and healthier).

Kaiser (1998) claims that "whether the goal of the research is behaviour change or the evaluation of different determinants of ecological behaviour, the accurate measurement of ecological behaviour is a precondition" (p.395). Consistent with this view, Osbaldiston (2013)

also claims that how behaviour is measured is one of the greatest drawbacks of current environmental psychology research. In reviewing behaviour measurement, these authors highlight various issues with existing methods of measurement. These include the variety of domains over which assessment of behaviour is made, with some measures using only single sources and others several independent sources of behaviour. Additionally, some measures collapse ecological behaviour into one aggregate measure, which may obscure significant differences in behaviour within different domains, such as car use and recycling. However, as Kaiser points out, increased specificity of behaviour results in less generalizability of the results.

It is interesting to note that in their meta-analysis of studies using the TPB, Armitage and Conner (2001) identified that relatively few studies actually measured behaviour as a variable. Only 19 studies out of the 185 analyzed employed independently rated or observed measures of behaviour, while 44 examined self-reported behaviour.

Numerous concerns exist with regard to the use of self-reports of behaviour (Osbaldiston, 2013). These include that self-report data is unreliable compared to more objective behavioural measures and subject to the effects of social desirability.

In Armitage and Conner's (2001) meta-analytic review, they found that the TPB variables were better able to predict self-reported behaviours than observed behaviours. However, Kaiser, Frick and Stoll-Kleemann (2001) compared self-reported behaviour with observed behaviour, and concluded that self-reports represent fairly stable and valid indicators of ecological behaviour. This was particularly so when self-reported behaviours represented dichotomized practices or circumstances.

Choa and Lam (2011) claim that their research findings appear to suggest that people's self-reported ERB is directly linked to their behavioural preferences, leading the authors to suggest that "sometimes when people claim they have enacted an ERB, they may simply say so because they "like" that behavior" (p. 61). In their study, which compared self-report behaviour with observed behaviour, they found that self-report of behaviour was correlated with observed

behaviour, but conclude that people's self-reported behaviour may still overestimate the frequency of ERB.

One of the reasons proposed for the unreliability of self-report measures is that they are subject to social desirability biases. Socially desirable responding has been defined as "the tendency of subjects to attribute to themselves in self-description, personality statements with socially desirable scale values, and to reject those with socially undesirable scale values" (p. vi, Edwards, 1957, as cited in Milfont, 2009). The results from Choa and Lam's (2011) study suggests that social desirability affects people's ERB when those behaviours are easily observed by others. In a study that compared student's self-report and their spouse's report of the students ERB, Lam and Cheng (2002) found that social desirability bias in self-reports seemed to be weak. Similarly, Milfont (2009) found that social desirability bias did not have a strong effect on the way people respond to anonymous environmental questionnaires, and claims that social desirability is not a serious problem in environmental issues research.

Impact of Behaviour

In contrast, some researchers have preferred to focus on the environmental impact of the behaviour, rather than on the behaviour itself (Abrahamse & Steg, 2009; Gatersleben et al., 2002; McKenzie-Mohr, 2000a, 2000b; Oskamp, 2000a, 2000b). One of the reasons for investigating the impact of behaviour is to avoid any inaccuracies with self-report and social desirability biases.

One way researchers have developed to avoid these is to use unobtrusive measures, or disguised observation. Researchers can use these methods to measure people's behaviour without their awareness. Some studies into energy use have used meter reading as an unobtrusive measure of energy use (e.g. Katzev & Johnson, 1984; Schultz et al., 2007). However, it is difficult to determine in these studies what behavioural changes had brought about energy savings and which specific individual within a household has made the savings (Gatersleben et al., 2002).

Another reason for investigating impact is that measures of behaviour may not include those behaviours that have the greatest environmental impact. Additionally, measures of behaviour do not weight these behaviours differentially according to their environmental impact (Gatersleben, 2013).

In addition to the difficulties related to self-reported measures of behaviour, a further criticism of these types of behavioural measures is that the behaviours they include, such as recycling household waste and turning off lights, do not have a significant environmental impact. Consequently, respondents who indicate they perform a high number of these behaviours would score highly on ERB measures, although their actions may actually have little beneficial impact on the environment (Gatersleben et al., 2002). Whitmarsh (2009) highlighted the discrepancy between behaviours identified by policy makers to reduce global warming, such as energy conservation, and the behaviours taken by the general public, such as recycling.

Research has shown that people are generally unaware of the environmental impact of the behaviours they undertake. In a study measuring householder's direct and indirect energy use, Gatersleben, Steg and Vlek (2002) found that respondents were not accurate in their estimations of the energy use, or impact, of various household activities, such as heating and washing. Their results showed that those respondents who self-reported high levels of ERB did not necessarily use less energy and that it was variables such as income and household size which were more strongly related to energy use. Similarly, in a study which looked at the impact of various behaviours on causing global warming (Truelove & Parks, 2012), the authors found that some behaviours that are major contributors to global warming (such as leaving on lights, heating/cooling homes and eating meat) were not identified by many participants, while other behaviours (such as littering) which do not contribute to global warming were rated as being strong contributors.

In summary, research has differed in many ways regarding 'what' to measure when measuring behaviour. This has ranged from broad views of ERB to measurement of specific pro-

environmental behaviours. Researchers have also varied in whether they measure self-reported behaviour, observed behaviour or both. Other researchers have instead focused on the impact of the behaviour, rather than the behaviour itself.

How to measure ERB

Measurement issues are a concern within both the Theory of Planned Behaviour (TPB; Ajzen, 1991, 2002; Ajzen & Fishbein, 1977; Ajzen & Madden, 1986; Ajzen et al., 1982; Doll & Ajzen, 1992; Fishbein & Ajzen, 1975) and the Value-Belief-Norm theory (VBN; Stern, 2000b; Stern & Dietz, 1994; Stern et al., 1999; Stern et al., 1995) as well as in the later studies based on these theories (e.g. Abrahamse & Steg, 2011; Chao, 2012; de Groot & Steg, 2007a, 2009, 2010; Harland, Staats, & Wilke, 1999; Kaiser et al., 2005; Matthies, Selge, & Klöckner, 2012; Steg & de Groot, 2010; Steg et al., 2011; Steg et al., 2005; Tonglet, Phillips, & Read, 2004; Wall et al., 2007).

There are no widely accepted forms for measuring many of the constructs within these theories and measurement tools have largely been created or adapted by individual researchers to suit the purposes of their study.

As different studies employ different measures of the constructs underlying the TPB and the VBN, they may not reflect the construct accurately. Indeed, Armitage and Conner (2001) suggest that measurement issues may underlie weak correlation between TPB factors, such as between subjective norm and intention.

Measuring norms

The research regarding the role of norms in people's environmental behaviour is similarly inconclusive and contested. However, norms are an important element within a number of the key theories of environmental behaviour, such as the TPB, NAM and the VBN. The following discussion will cover the operationalization and measurement of norms across all these theories.

Within the TPB, subjective norms, seen as an individual's normative beliefs about the social expectations of others, are held to be one of the determinants of behavioural intention. In this sense, a subjective norm has also been referred to as a social norm.

More recently however, researchers have suggested that the TPB should include a distinction between injunctive and descriptive norms, as they appear to be conceptually different constructs that exert different influences on behaviour (Armitage & Conner, 2001; Manning, 2009; Nigbur et al., 2010).

Two types of social norms have been identified - injunctive and descriptive norms (Cialdini, Reno, & Kallgren, 1990). Injunctive norms refer to the social pressure to engage in behaviour based on an individual's perception of the social rules of behaviour, as can be seen as a socially shared rule of conduct. Descriptive norms refer to social pressure to engage in behaviour based on the observed or inferred behaviour of others. As Cialdini, Reno and Kallgren (1990) state, "In contrast to descriptive norms, which specify what is done, injunctive norms specify what ought to be done" (p. 1015). More recently, Ajzen and Fishbein (2005) have also recommended including descriptive and injunctive norms in the same measure.

In a meta-analytic review of the effect of subjective norm on behaviour, Manning (2009) identified 152 studies in the decade from 1996-2006 which included a measure of injunctive and/or descriptive norms. Of these, the majority of studies (142) used injunctive items to measure normative beliefs, nineteen assessed both injunctive and descriptive norms, while only two studies used solely descriptive norms.

Manning's (2009) meta-analysis found that the effect of descriptive norms on behaviour was greater than the effect of injunctive norms. The effect of descriptive norms also appears to be greater when there is more time between measures of cognition and behaviour, although this effect was not apparent for injunction norms. Additionally, descriptive norms have a greater effect on behaviour than injunctive norms when behaviour is not socially approved and when behaviours are socially motivated.

Personal norms

While some researchers have looked at the role of individual's subjective beliefs about the norms of society or groups they belong to, referred to as perceived or subjective social norms, other researchers have looked at internalized norms, also referred to as moral or personal norms (Thøgersen, 2009). As Thøgersen (2009) reflects, it is usually believed that individuals comply with social norms due to external social pressure, and to personal norms for internal reasons, that is, because they feel it is the moral or right thing to do.

Summary

This chapter has followed the meta-theoretical framework developed by Vining and Ebreo (2002) to review a number of influential theories and models that have arisen from the research and continue to inform thinking on ERB. Researchers have found a role for psycho-social determinants of ERB, such as norms, values, beliefs, attitudes, intentions and goal. Other researchers have considered the individual within their social context, looking at variables such as personality, identity and political orientation as a way of explaining and predicting people's engagement with pro-environmental behaviours.

A number of significant points are apparent from this brief overview of the measurement issues within the environmental psychology field. Firstly, there are a staggering number of measures and adaptations that are currently in use. As well as differences in views regarding *what* to measure, there is great diversity in opinions regarding *how* to measure it. This multiplicity of measures appears largely due to differences in how the underlying constructs are interpreted. A result of this is that there are, as yet, no gold standard tools available for measuring and quantifying the constructs related to individual's ERB.

In contrast, stage models, such as the Transtheoretical model, seek to understand *how* people change in order to facilitate desired behaviour change. Arguably, a great deal of the Transtheoretical Model's popularity is attributable to the simplicity of its concepts and its user-friendliness as a tool for practitioners. Therefore, this current research will focus on the

Transtheoretical model and its application to one specific area of ERB, namely that of household energy use. Consequently, the next chapter in this thesis will look in further detail at interventions aimed specifically at reducing energy usage, before moving to a discussion of the TTM and ERB in more detail.

Chapter 4: Energy conservation: What works for households?

How wonderful is it that nobody need wait a single moment before starting to improve the world – Anne Frank

As discussed in the previous chapter, there are numerous models and factors that have been proposed to explain and predict individuals' pro-environmental behaviour. Stern (2000a) argued that as a discipline, psychology needed to look beyond psychological variables and begin with a problem-oriented approach. That is, he urged psychologists to identify "environmentally important human activities and, for each determine whose actions and which actions matter most" (p.527).

In a similar vein, amongst their identified topics for further research, Steg and Vlek (2009a) claim that "it is important to study for which types of behaviour and under which conditions which intervention strategy is most effective for encouraging pro-environmental behaviour. In particular, the role of various types of rewards and punishments needs further scrutiny" (p. 315).

This sentiment has again been expressed by Osbaldiston and Schott (2012) who argued that "The most important conclusion from these data—and a unique contribution to the literature—is that there is no one treatment (a "silver bullet") that is highly effective across all the possible pro-environmental behaviours. Certain treatments seem to be more effective for certain behaviours. For example, treatments that are effective for promoting home energy conservation are social modelling and commitment. In contrast, treatments that are effective for promoting curbside recycling are making it easy and rewards. To effectively promote certain pro-environmental behaviours, practitioners need to match the treatment to the behaviour" (p.280).

On the basis of these considerations, and the review in the foregoing chapter this thesis now moves to address issues related specifically to individuals' household energy use, in an attempt to identify 'whose actions and which actions matter most'.

Types of energy savings

Researchers have recently begun to differ in terms of how 'energy-savings behaviour' is viewed. Karlin et al. (2014) argues that traditional approaches viewed energy conservation behaviour as either a holistic behaviour, that is, the behaviour of energy conservation; or focused on multiple single behaviours that each contribute to energy conservation. It is recognised that holistic views of energy conservation behaviour include a range of specific behaviours, relating for example to lighting, heating/cooling, and use of appliances. These can be further differentiated to specific actions, such as turning off appliances at the wall when not in use and purchasing energy-efficient appliances.

When discussing the use or saving of electricity, researchers (e.g. Abrahamse, Steg, Vlek, & Rothengatter, 2005; Barr et al., 2005; Gardner & Stern, 2003; Karlin et al., 2014; Stern, 2000a) have more recently begun to distinguish between two distinct forms or dimensions of energy-saving behaviour:

1. Efficiency, or purchase related, behaviours such as purchasing low energy light bulbs, energy efficient household appliances, home insulation and solar electricity. These are related to primarily once-off purchases that do not require the individual to change their regular behaviour, whilst still effecting a reduction in power use. These measures are aimed at improving the energy efficiency of existing behavioural choices.

2. Curtailment, or consumption, behaviours such as turning off lights and using appliances less frequently. These behaviours require a change in everyday, habitual consumption behaviour with the intention of using less power.

Both these types of behaviours also encompass direct and indirect energy use components. Direct energy requirements include the use of electricity for example for space heating or

cooling, cooking, washing, and lighting. Indirect energy requirements by households encompass the energy needed for the production, distribution, and waste disposal of consumer goods and services.

Energy use within the home is strongly related to socio-demographic variables, such as income, household size and age of occupants. As a general rule, households with higher incomes use more energy, as do larger households. There are also income-related differences in the types of energy used. Less affluent households use more direct energy through consumption, while higher-income households use more indirect energy, such as through the purchase of more and larger appliances (Mills & Schleich, 2012; Moll et al., 2005; Vringer, Aalbers, & Blok, 2007).

Factors influencing household energy conservation behaviours

Three general factors have been identified that influence household energy conservation behaviour (Steg, 2008). Briefly, these three factors are:

1. Knowledge/Information - this factor relates to knowledge about a number of issues, principally the role of energy use in causing climate change; the energy use requirements of various household appliances; and the knowledge of how to change to more energy efficient behaviours;
2. Motivation – to change their behaviour and/or to engage in new behaviours which conserve energy;
3. Alternatives – the ability for people to adopt alternative behaviours.

The following discussion will focus on effective or promising interventions within each of these three broad areas. A detailed discussion of the theoretical foundations underpinning each of these types of intervention is beyond the scope of this paper.

Knowledge/Information

Many interventions proceed from an information-deficit theoretical approach (albeit sometimes implicitly). A key assumption of information-deficit models is that greater knowledge will lead to a change in behaviour. While these models have largely been shown to be too

simplistic and ineffective, it has been argued that they still underlie many political approaches to environmental issues and public awareness campaigns (Blake, 1999; Burgess et al., 1998; Owens, 2000). However, while the provision of knowledge about a behaviour does not significantly increase motivation to engage in that behaviour, a lack of knowledge can be an important barrier (Schultz, 2002).

A number of interventions based on theories of social influence are also discussed within the literature. Social influence refers to the process whereby other people or groups exert influence on an individual's thoughts, feelings and/or behaviours. Social influence and informational approaches often overlap, and hence will be discussed jointly.

Encouragingly, there have been a number of interventions based on informational and social influence strategies that have proven successful in changing energy use behaviours. Whilst the provision of general information does not result in significant changes in permanent behaviour (Stern, 1999), targeted or individualized information has been found to be effective (e.g. Abrahamse, Steg, Vlek, & Rothengatter, 2007; Litvine & Wüstenhagen, 2011). The behaviours that are more likely to be changed by informational interventions are simple behaviours that can be changed with little cost in terms of time or convenience (Stern, 1999). A number of these prominent informational and social influence strategies will now be reviewed.

Knowledge about energy use and climate change

Despite the overwhelming weight of scientific opinion and evidence (Garnaut, 2008, 2011a; International Federation of Red Cross, 2012; IPCC, 2007b, 2012, 2013, 2014a, 2014b; National Academy of Sciences and the Royal Society, 2014; National Research Council, 2013; The Royal Society, 2010; United Nations Framework Convention on Climate Change, 2012), there is not universal acceptance that climate change is occurring, that it is human-induced, the role of energy use in producing global warming, and/or that climate change will have devastating impacts (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010; Leviston & Walker, 2011; Poortinga et al., 2011).

Milfont (2012) summarizes the reasons that the provision of information is important in tackling climate change. He states that information can help people begin to think about climate change and the associated risks; that it taps in to a human need for understanding and that the provision of information has a role in both top-down and bottom-up interventions.

Hopes have been expressed that technological innovation would improve the efficiency of electrical products and therefore lead to lower energy consumption rates. It appears however that a rebound effect occurs, where costs saved through efficient appliances are then 'taken back' by consumers purchasing more, or larger, appliances; or using these appliances more often (Berkhout, Muskens, & Velthuijsen, 2000; Brännlund et al., 2007; Greening et al., 2000; Herring & Roy, 2007). Additionally, efforts to design and build low or zero carbon houses have met with criticism that greater efficiency simply leads to greater consumption, and in fact detract from the need for the householder to engage with energy efficient behaviours (Reid & Houston, 2013; Steg & Vlek, 2009a).

A recent study investigated the energy-usage of householders in a new zero-carbon home estate in South Australia, where the houses were designed to reduce energy and water usage, and greenhouse gas emissions (Berry, Whaley, Davidson, & Saman, 2014). The researchers found that the households in the estate used significantly less energy than similar homes in a nearby estate, however, there was a large variation in total household energy use between individual households. While some households achieved the goal of zero net energy usage, many other households failed to reach a balance between energy generation and energy usage, due to the number and size of appliances and heating/cooling options in the house.

Information about energy consumption and reduction

Research has shown that people are generally unaware or inaccurate regarding the energy consumption of household appliances and the consumption behaviours they undertake. In the main, people assume that the larger an appliance is, the more energy it uses, which is not always accurate (Baird & Brier, 1981).

In a study measuring householders direct and indirect energy use, Gatersleben, Steg and Vlek (2002) found that respondents were not accurate in their estimations of the energy use of various household activities, such as heating and washing. Their results showed that those respondents who self-reported high levels of pro-environmental behaviour did not necessarily use less energy and that it was variables such as income and household size (number of occupants) that were more strongly related to energy use.

Similarly, other researchers have found that the general public underestimates the role of various behaviours in causing global warming (Attari, DeKay, Davidson, & Bruine de Bruin, 2010; Bord, O'Connor, & Fisher, 2000; Truelove & Parks, 2012). Behaviours that are major contributors to global warming (such as leaving on lights, heating/cooling homes and eating meat) were not identified by many participants, while other behaviours, such as littering, using insecticides and aerosols (which do not contribute to global warming) were rated as being strong contributors.

Additionally, it is not commonly known that the energy-saving potential of efficiency behaviours (such as energy-efficient appliances) is usually greater than that of curtailment behaviours (such as reducing appliance usage) (Abrahamse et al., 2005; Attari et al., 2010; Gardner & Stern, 2003). Gardner and Stern (2003) stress the importance of improving the general public's awareness of the energy-saving impact of efficiency behaviours, and encourage both curtailment and efficiency measures to reduce overall energy-use. It has been recommended that "well-designed efforts to improve the public's understanding of energy use and savings could pay large dividends" (Attari et al., 2010, p. 1).

Social Networks

Utilizing peoples' existing social networks has also been found to be an effective means of social influence. It has been proposed that this is due to the 'liking' principle, whereby the more a person is liked, the more others will try to emulate them (Cialdini & Goldstein, 2004).

Traditionally this has taken the form of 'block leaders' or 'kitchen table' discussions, whereby volunteers help inform others within their neighbourhood about an issue and encourage particular pro-environmental behaviours (Abrahamse, 2010). With the recent popularity of the Internet, the influence of social networks now extends to peoples' online networks (Dickinson, Crain, Reeve, & Schuldt, 2013).

Energy-rating systems

Energy- rating systems, or eco-labeling, of electrical appliances was introduced to assist consumers to make informed decisions regarding the energy-use requirements of new appliances. These include programs such as the 'Energy Star' program (United States Environmental Protection Agency, 2013), which was originally developed in the USA and is now in place throughout Australia and New Zealand. The use of this form of labeling has been found to be useful to consumers and to influence their purchasing choices, even when that choice involved greater financial cost (Banerjee & Solomon, 2003; Sammer & Wüstenhagen, 2006; Shen & Saijo, 2009; Ward, Clark, Jensen, Yen, & Russell, 2011).

As such, the use of a standard, well-recognized energy-rating system appears to assist in providing a level of information to consumers that then enables them to make financial decisions based, at least in part, on environmental considerations.

Tailored Information and Feedback

Interventions that use tailored information, often also in conjunction with commitment-making, goal-setting and/or the provision of tailored feedback, have been found to be effective in reducing household energy use (Abrahamse et al., 2007; Haq, Cambridge, & Owen, 2013; McKenzie-Mohr, 1994).

Personalized feedback on individual behaviour has also been found to be effective in reducing energy consumption (Abrahamse et al., 2007; Benders, Kok, Moll, Wiersma, & Noorman, 2006; Grønhøj & Thøgersen, 2011; Hyvönen, Saastamoinen, Hongisto, Kallio, & Södergård, 2012). The rationale behind the provision of this form of information is that

householders are largely unaware of their electricity use, or the effectiveness of their energy savings measures, at the time of consumption, with this form of feedback only being provided by their electricity supplier after some considerable delay. Consumer self-report has indicated that the use of a feedback system was appealing and useful in that it provided concrete feedback on their consumption and empowered them to take action to reduce their energy use (Grønhøj & Thøgersen, 2011; Hyvönen et al., 2012).

Energy-consumption displays could potentially give feedback to householders on their energy use in a variety of formats, such as energy use by room, by appliance, in a time period, by an end user, or during an activity (Wood & Newborough, 2007). Whilst initially the use of these energy monitors may reduce energy consumption and increase consumer awareness, over time this tended to plateau out with ongoing savings not being found (Faruqui, Sergici, & Sharif, 2010; Hargreaves, Nye, & Burgess, 2010, 2013; Ueno, Sano, Saeki, & Tsuji, 2006). In their review of informational strategies to encourage energy conservation, Delmas, Fischlein, and Asensio (2013) conclude that "informational feedback alone (e.g., for example, via smart metering) may be a necessary but not a sufficient condition to produce conservation" (p.735).

Recent research has looked at the differing ways of presenting or 'framing' information on energy consumption and feedback on energy reductions. It has been found that presentations of costs (over a period of time), appliance specific breakdown, and historical comparison with their own prior consumption were all preferred methods (Fischer, 2008; Karjalainen, 2011). Jain, Taylor, and Culligan (2013) found that representing energy use in environmental terms, in this case "trees needed to offset emissions", was an effective alternative to traditional methods of representing energy use such as in kWh or CO_2 emissions. Similarly, Spence, Leygue, Bedwell, and O'Malley (2014) found that framing energy reductions in terms of CO_2 production lead to a greater likelihood that people considered climate change as a motivation to reduce energy consumption.

Social marketing

McKenzie-Mohr (1994) initially proposed using social psychological principles to design social marketing campaigns. Social marketing has also been proposed as a framework for applying research within the social sciences to the problem of changing behaviours on a large-scale (e.g. Anable, Lane, & Kelay, 2007). Social marketing has been defined as the "systematic application of marketing, alongside other concepts and techniques to achieve specific behavioural goals, for a social good" (French & Blair-Stevens, 2010, p. 35). Social marketing focuses on benefits for the consumer to whom the behaviour is marketed, rather than on the benefits to the producer of products or services (Kurani, 2002, as cited in Anable et al., 2007; Ewing, 2001; McKenzie-Mohr, 1994, 2000a, 2000b, 2005; Truss, Marshall, & Blair-Stevens, 2010). Personal contact is central in social marketing initiatives, which both allows participants to interact with the project leaders instead of having a top-down, one-way approach, and between community members to reinforce emerging social norms. Incentives are sometimes also used to overcome barriers.

Audience segmentation is an essential element of social marketing and refers to the concept of dividing the potential audience ('everyone') into smaller groups or segments that are similar in key characteristics. It has been argued that the value of social marketing is in "strategically delivering programs so that they target specific segments of the public and overcome the barriers to this segment's engaging in the behaviour" (McKenzie-Mohr, 2000b, p. 546). Segmentation may occur based on factors such as demographics, while "deeper segmented approaches focus on what 'moves and motivates' the relevant audience" (French & Blair-Stevens, 2010, p. 40.).

Driven by a desire to enable better marketing of environmentally-responsible products to consumers, and mindful of the 'value-action gap' (Blake, 1999), some researchers have attempted to develop a profile of the environmentally-responsible consumer. Such consumers have also become known as 'green' consumers within the literature (e.g. Cleveland, Kalamas, & Laroche, 2012; Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003; Hartmann & Apaolaza-

Ibáñez, 2011; Hartmann & Ibáñez, 2006; Jansson, Marell, & Nordlund, 2010; Litvine & Wüstenhagen, 2011; Moisander, 2007; Young, Hwang, McDonald, & Oates, 2010).

Rather than focusing on one type of behaviour, some researchers have attempted to segment individuals or communities into 'lifestyle' categories, based on a range of environmental practices, such as energy and water conservation, 'green' consumption and travel and tourism behaviours (e.g. Barr, 2006; Barr & Gilg, 2006; Barr, Gilg, & Shaw, 2011; Haq et al., 2013; Hine et al., 2013; Newton & Meyer, 2013).

Summarizing the findings of previous research, Anable, Lane and Kelay (2007) conclude that "not only do efforts to promote pro-environmental behaviours have to overcome a large number of inter-related psychological and social barriers, they have to account for, and capitalize on the complexity of modern lifestyles and social networks" (p. 150).

Recently, a number of studies have been conducted that successfully employ social marketing initiatives specifically focusing on energy-use behaviours (Chan, Dolderman, Savan, & Wakefield, 2012; Sütterlin, Brunner, & Siegrist, 2011). Additionally, social marketing initiatives have been found to lower barriers associated with alternative energy options (Viardot, 2013). Within Australia, community-based social marketing has been used as a framework to promote environmentally responsible behaviours, including reducing energy usage (Anda & Temmen, 2014) and water consumption (Lowe, Lynch, & Lowe, 2014).

Motivation

A second general factor that has been identified to influence energy-saving behaviour relates to people's motivation to change their behaviour (Steg, 2008). It would be easy to assume that people with little interest or concern about climate change would be greater consumers of electricity. However, research has shown that high levels of concern for the environment do not necessarily equate to low energy-use within the household (Newton & Meyer, 2013; Tabi, 2013; Thøgersen & Grønhøj, 2010), with many other factors, such as household size, income, habit and convenience playing a greater part.

It has become increasingly accepted that environmental behaviour is multiply determined. That is, there are multiple antecedents and motives underlying people's behaviour at any given time and place (De Young, 2000; Schultz, 2000; Stern & Dietz, 1994; Stern et al., 1995; Szmigin, Carrigan, & McEachern, 2009). Barriers to environmentally responsible consumer behaviour have been attributed to the "motivational and practical complexity of green consumption" (Moisander, 2007, p. 404). Referring to the complexity of motives underlying green consumption, and the amount of information needed to make individual purchasing decisions, Young and colleagues (2010) conclude that "green consumers can use their buying power to make a difference, but at a high cost in terms of effort and time, which is a significant barrier….More fundamentally, 'being green' needs time and space in peoples' lives that is not available in increasingly busy lifestyle" (p. 30). They suggest that the use of incentives and widely used labels, such as energy star ratings, will help potential green consumers to narrow the range of options available to them.

One reason individuals may not take action is because they believe their small contribution will not make a significant difference, prompting some researchers to suggest that greater research and policy focus should be at the level of the community and corporation (e.g. Moisander, 2007). Additionally, it is recognized that a change in behaviour requires a trade-off between the pros and cons of the behaviour and, for some people, the 'cost' in terms of comfort, convenience and finance is too high (Freestone & McGoldrick, 2008; Newton & Meyer, 2013; Szmigin et al., 2009).

Personal and Social Norms

It has been argued that social norms regarding sustainable energy-use have not yet been established in affluent countries such as Australia (Newton & Meyer, 2013). Thøgersen and Grønhøj (2010) found personal norms were one of the factors that affected energy saving efforts, prompting them to suggest that household energy savings could be promoted through social norms marketing, communicating social expectations and information regarding others' energy

saving achievements. The use of electricity feedback systems were also found to be appealing in part when they provided normative information on other household's energy use (Hyvönen et al., 2012).

Perceived benefit

It has been suggested that one of the barriers to green consumption is the reduced individual benefit perceived by consumers and, therefore, the challenge for green marketing is to strengthen individuals' perception of the personal benefit of 'green' consumption (Hartmann & Ibáñez, 2006). Research has suggested that consumers experience emotional (or psychological) benefits from green purchasing which affects their attitude towards the brand or product and thereby increases their motivation and intention to purchase green products (Hartmann & Apaolaza-Ibáñez, 2008, 2009; Hartmann & Apaolaza-Ibáñez, 2011; Hartmann & Ibáñez, 2006).

Follows and Jobber (2000) found that the individual consequences of a purchase were as important as the environmental consequences in predicting intention to purchase an environmentally friendly product. From their research, they suggested that marketing should address both environmental and individual product consequences. That is, in order to change environmental attitudes, marketing communications must explain the positive environmental consequences of the specific product. Additionally, marketing should attempt to reduce any negative individual consequences of purchasing the product.

Other research has shown that people's reluctance to pay a premium for electricity, such as through increased cost or inconvenience, is related to their view that the benefits do not warrant such a cost (Wang, Zhang, Yin, & Zhang, 2011; Wiser, 1998, 2007). In a study specifically addressing the purchase of green electricity, Litvine and Wüstenhagen (2011) found that information that increased the perceived benefit to the potential consumer, combined with activating social norms, produced a significant increase in purchase. There were three types of information that most effectively influenced a move from intention to action with respect to purchasing green electricity. These were:

1. Information on the social benefits of green electricity;
2. Information on the opportunity to privately benefit from green electricity; and
3. A mixture of information addressing behavioural, normative and control beliefs.

Similar to approaches that look at the benefits a consumer receives from their energy-use behaviours, Mirosa, Lawson, and Gnoth (2013) addressed how energy consumption is related to underlying values. This can be viewed as the benefit a person achieves by addressing or being consistent with their values. Whilst much research has previously been conducted on the role of values and environmental behaviour (e.g. De Groot & Steg, 2007b; de Groot & Steg, 2008; Nordlund & Garvill, 2002, 2003; Poortinga et al., 2004), Mirosa and colleagues' work identified that the same value can underlie both efficient and inefficient behaviours. Their results showed that values related to achievement, in terms of being capable and in control, were the most influential on the way people used energy within the home. The implications of these results are the need to identify the underlying value or benefit of particular behaviours, as well as the costs or values that may be barriers to changing, and address these specifically.

Goal-setting

Goal-setting entails giving, or households setting, a specific energy-saving goal, and is often used in conjunction with other strategies, such as proving feedback and commitment-making. Research has found that the provision of a specific goal plus feedback resulted in greater energy savings than the provision of feedback only (McCalley, 2006; McCalley & Midden, 2002).

The informational benefits of providing feedback to consumers regarding their electricity use have been discussed previously above. In addition to these benefits, research has shown that the provision of feedback also increases motivation to save electricity and reach a set goal when it becomes easier to monitor how electricity consumption is related to their everyday household behaviour (McCalley, 2006), which again underlines the usefulness of an electricity feedback system.

Goal-setting has been found to be more effective when provided in conjunction with feedback, and especially for more difficult to achieve behaviours (Abrahamse et al., 2007; Becker, 1978; McCalley, 2006; McCalley & Midden, 2002).

Commitment-making

The making of a commitment to engage in a behaviour, frequently linked to a specific goal and combined with the provision of feedback, has been found to be effective in reducing energy use (Katzev & Johnson, 1983, 1984; Lokhorst et al., 2013). This strategy has been found to be most effective when the commitment is made publicly or to another person. Commitment-making has been linked to the activation of norms; either personal norms when a private commitment is made or social norms when a public commitment is made (Abrahamse et al., 2005).

Additionally, commitment-making has been linked to people's desire for consistency in their behaviour (Cialdini, Trost, & Newsom, 1995). It has also been suggested that public commitments are effective in facilitating behaviour change through social pressure to maintain the commitment once made (Lokhorst et al., 2013). Lokhorst et al. (2013) review a number of intervention strategies to increase the effectiveness of commitment-making, including the activation of social norms and the increased motivation associated with making the new behaviour fun.

Cost savings

The price of electricity in Australia has risen dramatically, with an increase of over 80% during the period 2008 – 2014 (Australian Government, 2015). These price increases have been partly linked to residential reductions in electricity use (e.g. Chester, 2013; Saddler, 2013), such that environmental benefits are an unintended byproduct. In a recent West Australian study, economic and environmental concerns were the primary reasons given for trying to save energy (Sweeney et al., 2013). However, environmental concerns were explicitly expressed by many as

secondary to economic reasons. Similar results have been found internationally (e.g. Vassileva & Campillo, 2014; Whitmarsh, 2009).

Conversely, whilst cost saving is often cited as a motivation to reduce energy (e.g. Brandon & Lewis, 1999; Sütterlin et al., 2011), other research has found little effect for financial incentives as a motivation to reduce energy use (Abrahamse et al., 2005; Fischer, 2008; Spence et al., 2014; Wolak, 2011). Financial benefits from energy savings are often quite small in actual dollar amounts, providing little incentive when compared to the impact on quality of life, also referred to as 'costs', of the behaviours required to achieve those savings (Gatersleben, 2001).

While some researchers have cited potential emissions savings by reductions in household energy use with little or no impact on quality of life, reports are now emerging that indicate this isn't the case, particularly for low-income households in Australia (Chester, 2013; Chester, 2014; Chester & Morris, 2011). In a report on the impacts and consequences for low-income Australian householders of electricity price rises, Chester (2013) found that many low-impact reduction behaviours had already been implemented without a commensurate bill reduction, presumably due to the rate at which the electricity price has risen. In these low-income households, further measures aimed at reducing consumption will have a greater impact on quality of life. The report found that 75% of these households had cut back on food in order to pay higher household energy bills, with resultant changes in diet and health. Chester (2014) claims that "an increasing number of low-income households, who have a limited capacity to reduce their energy use, are experiencing deprivation and social exclusion directly attributable to the payment of higher household energy costs" (p. 395).

In these situations, motivation to save money on electricity bills serves as the incentive to reduce household electricity consumption, rather than any pro-environmental desire. It is doubtful whether these reductions in electricity use will be maintained if electricity prices become more affordable, or household income rises.

Incentives

The provision of incentives that appeal to self-interest may fail when they undermine the moral values that lead people to act altruistically or in other public-spirited ways (Bolderdijk, Steg, Geller , Lehman, & Postmes, 2013; Bowles, 2008; de Groot & Steg, 2009; Evans et al., 2013). Thøgersen and Crompton (2009) also found that appeals to financial self-interest or social status resulted in less spill-over to other pro-environmental behaviours than appeals to environmental concerns.

While financial incentives may not be sufficient to overcome barriers to changing, non-monetary incentives may be more effective, as has been found with other types of environmentally significant behaviour (Stern, 1999). Given that the cost in terms of time and inconvenience is often cited as a barrier to changing behaviour, incentives associated with increased convenience can also have an effect on changing people's energy-use. A combination of financial and convenience incentives could therefore increase program effectiveness (Stern, 1999).

Identity

An individual's identity can be understood both in how they refer to themselves, and how they are influenced by social interaction with others, the expectations of others, and the various roles they play (Ellemers, Spears, & Doosje, 2002; Stryker & Burke, 2000). People's identity regarding the environment has been found to explain and predict their pro-environmental behaviour (Kashima et al., 2014; Matsuba et al., 2012; Nigbur et al., 2010; Stets & Biga, 2003; Whitmarsh & O'Neill, 2010). There has been a corollary rise in 'green' marketing to meet this potential market of the 'green' consumer (Cherian & Jacob, 2012; Cleveland, Kalamas, & Laroche, 2005; Hartmann & Ibáñez, 2006; Thøgersen, 1999a; Wiser, 1998).

However, some seemingly unrelated identities can work at cross-purposes with environmental behaviour. It has been established that materialistic people are more likely to engage in environmentally damaging behaviour (Hurst, Dittmar, Bond, & Kasser, 2013).

Similarly, affluent identities have been found to be consistent with high energy consumption patterns, even when the individual may also hold pro-environmental beliefs and attitudes (Hurth, 2010; Newton & Meyer, 2013).

It has been argued that the function of consumption is not primarily to satisfy physical needs, but rather that material goods are used to satisfy psychological and social needs, such as expressing identity and attaining status amongst peers (Thøgersen, 2005). In keeping with this view, Griskevicius, Tybur, and Van den Bergh (2010) found that the status associated with the purchase or use of certain 'green' products lead to greater pro-environmental choices.

In this respect, the ultimate goal to promote energy-savings behaviour will be achieved when this behaviour is seen as consistent with affluent identities and materialistic values (most likely through efficient design rather than curtailment) and when this is seen as conferring high status on the consumer.

Alternatives

The third of Steg's (2008) general factors that have been identified to influence household energy conservation behaviour refers to the ability to adopt alternative behaviours. This encompasses the ability to replace existing behaviours with alternative, environmentally friendly behaviours, as well as the ability to engage with renewable, or alternative, forms of energy.

Capability and capacity

Understandably, a person's ability to adopt energy-savings behaviours relies not just on a willingness to do so, but also on their ability to engage in required behaviours. This includes householders knowing what behaviours they can change and how to change them, and any technical skills or abilities to do so. Additionally, as well as knowing what to do, householders may need to have particular equipment to enable them to make the change. Stern (2000b) identified a number of personal capabilities, including the availability of time to act, literacy, and power over the decision, as well as demographic variables such as income and age of household occupants. Additional capability factors include whether the householder is renting or owns the

house they live in, and the capacity for the house to have energy-efficiency measures installed, such as insulation or double-glazing of windows. That is, capabilities include both perceived and actual control over the behaviour, as well as very real socio-demographic constraints.

Financial constraints also impact on householders' ability to make energy-efficient changes within their homes. Low-income householders arguably have less capacity to make energy-efficient changes, due to financial restrictions, their status as renters and/or the poor quality of their existing housing (Chester & Morris, 2011).

Many psychological theories of environmental behaviour include an element of behavioural control or self-efficacy, and numerous studies and reviews have shown the predictive and explanatory power of this construct (e.g. Ajzen, 2002; Armitage & Conner, 2001; Hines et al., 1986/87; Madden et al., 1992). Cleveland et al. (2012) have gone further and developed the novel construct of internal environmental locus of control to reflect individuals' personal responsibility towards, and ability to affect, environmental outcomes.

Looking specifically at self-efficacy and energy-saving behaviours, Thøgersen and Grønhøj (2010) found support for the importance of self-efficacy related factors in householders' electricity savings efforts. In a study by Litvine and Wüstenhagen (2011), researchers found that by providing targeted information aimed at changing individual's attitudes, social norms and perceived behaviour control regarding purchasing green electricity, significant increases in the purchase of green electricity resulted. Furthermore, the researchers were able to significantly increase action when they were able to increase perceived benefit by providing targeted information. In this study, the perception of benefit moderated the impact of willingness-to-pay, such that the importance of price decreased when benefits were clearly understood and social norms were activated.

It is apparent that individuals' perceived and actual ability to perform the behaviour, often constrained by socio-demographic factors, is a key determinant in their subsequently engaging in that behaviour. As such, interventions that specifically address efficacy factors, by promoting

people's sense of their ability to perform the new behaviour and removing or providing solutions to overcome obstacles, will be more likely to succeed.

Knowledge and acceptability of sustainable alternatives

Globally, the growth of renewable energy investment has steadily risen throughout the 2000's, reaching 30% in 2010 (Wüstenhagen & Menichetti, 2012). Research has identified a number of socio-political, technical, economic and cultural factors to explain national differences in the acceptance and take-up of renewable energy sources, such as wind and solar power (Jacobsson & Lauber, 2006; Laird & Stefes, 2009; Sovacool & Lakshmi Ratan, 2012). Additionally, research has looked at psychological factors underlying consumers' willingness to pay a premium for 'green' electricity (a 'green tariff), and the acceptance of alternative energy sources such as wind or solar power.

There is strong evidence that despite high numbers of consumers stating a willingness to pay a green tariff, the actual take-up of green energy provision is much lower (Diaz-Rainey & Tzavara, 2009; Rowlands et al., 2003; Zarnikau, 2003). In a report addressing willingness-to-pay and actual adoption of green energy tariffs, Diaz-Rainey & Tzavara (2009) state that "The existing empirical evidence on green energy markets points to a large and persistent divergence between actual adoption rates and the number of consumers claiming a willingness to pay" (p. 2). Several explanations have been proposed for this gap, including consumer confusion about the range of options, perceptions that switching energy supplier is difficult or time-consuming, and the 'free-rider' phenomenon. Additionally, issues regarding the trustworthiness of the green energy supplier and their source of alternative energy can be a barrier, with some researchers calling for a green energy accreditation scheme (Bird, Wüstenhagen, & Aabakken, 2002; Bronfman, Jiménez, Arévalo, & Cifuentes, 2012; Diaz-Rainey & Ashton, 2008; Diaz-Rainey & Tzavara, 2009). Willingness to pay for green energy also appears to be influenced by the type or source of green energy, with solar evidencing the greatest level of consumer support (Borchers, Duke, & Parsons, 2007).

Attempts to understand and profile potential adopters of green energy tariffs have also been made. Huijts, Molin, and Steg (2012) proposed a comprehensive framework for understanding householders' intentions to act towards sustainable energy technologies. This framework included many psychological concepts such as attitudes, social and personal norms, perceived behavioural control, perceived costs, risks and benefits, trust and fairness.

Perhaps not surprisingly, research has shown that willingness to pay a green tariff increases with a general positive attitude to green electricity. This research has found that attitudinal variables were more important than demographic factors in determining willingness to pay a green tariff. A positive attitude to green electricity is more specifically influenced by an awareness of, and concern about, the consequences of environmental problems and perceived consumer effectiveness (Diaz-Rainey & Ashton, 2011; Ek, 2005; Hansla, Gamble, Juliusson, & Gärling, 2008a; Wiser, 2007). The implications of this research is that policy and corporate efforts to increase the consumption of green energy need to target information about energy and environmental issues, as well as perceived consumer effectiveness, in addition to addressing the barrier to adoption.

It has also been found that people who engage in more pro-environmental behaviours are more accepting of alternative energy sources, prompting the researchers to suggest that promoting these everyday behaviours as 'green' may prepare householders to accept innovations with a greater environmental impact, such as wind farms (Thøgersen & Noblet, 2012). It is, however, outside the scope of this paper to review the factors underlying acceptance of large, commercial renewable energy projects, such as is possible with wind, solar, geothermal and tidal power.

An alternative to paying a tariff for green electricity is the option to install micro-generational systems within the household. Within Australia, these options are primarily solar (hot water and/or electricity) or wind, while geothermal and hydro systems are generally less viable options. It is estimated that 2.6 million Australians use solar power in their homes, with

more than 1 million rooftop solar PV systems installed as of 2013 (Climate Council of Australia Limited, 2015).

Once again, the behaviour and support of others (social norm) is an important factor affecting consumers willingness to adopt micro-generation energy systems, with consumers being more willing to install such a system in their home if their family or friends encouraged this (Sardianou & Genoudi, 2013); although concern regarding others' disapproval of the aesthetics of the system has also been found to be a barrier to installation (Faiers & Neame, 2006; Palm & Tengvard, 2011).

The environmental benefit of a micro-generation systems have been found to be a significant factor in the decision to install these systems (Leenheer, de Nooij, & Sheikh, 2011; Palm & Tengvard, 2011), although decisions appear to be primarily based on cost rather than environmental benefit (Wimberly, 2008).

A lack of clear information regarding the different systems available and the technology involved, and the complications associated with installation of these systems, have been cited as a significant barrier to adoption of micro-systems (Baskaran, Managi, & Bendig, 2013; Islam, 2014; Sweeney et al., 2013). A recent initiative across many countries has been the introduction of subsidized home energy audits, to assist householders to make informed decisions regarding retrofitting energy efficient renovations. The effectiveness of these audits however is poor, indicating that while the audit may improve householder's knowledge of their energy consumption and options, they have little effect on investment in energy efficient renovations and may actually elicit a negative response in a small number of householders (Frondel & Vance, 2013; Schleich, 2004).

Unsurprisingly, cost plays a significant role in the decision to install a household energy system. The initial costs to retro-fit household energy systems are prohibitive and a stated barrier for many consumers, while uncertainty about the energy efficiency and cost payback period also negatively affect consumer willingness to adopt these technologies (Balcombe, Rigby, &

Azapagic, 2013; Faiers & Neame, 2006; Palm & Tengvard, 2011; Sardianou & Genoudi, 2013; Scarpa & Willis, 2010; Sweeney et al., 2013). On the other hand, innovative financing plans and financial incentives, in the form of tax deductions, rebates, feed-in tariffs and reduced electricity bills, have been found to be significant factors in the willingness to adopt renewable energy systems (Balcombe et al., 2013; Baskaran et al., 2013; Reddy, 1991; Sardianou & Genoudi, 2013; Sweeney et al., 2013).

In summary, a number of interventions have been recommended with regard to addressing the knowledge and acceptability of sustainability options. These include initiatives that:

- Address consumer confusion and concern regarding the trustworthiness of the supplier, such as through an accreditation scheme;
- Highlight the link between energy use, environmental issues and how householders can make a difference such as through purchasing green energy;
- Promote household miro-generation systems and create social norms that support their installation;
- Provide clear and specific information for householders on the range and benefits, both financial and environmental, of micro-generation systems;
- Provide innovative and appealing financial inducements that help to cover the initial instalment costs as well as provide ongoing incentive for their use.

Summary

Pro-environmental attitudes and values alone are not always sufficient motivation to engage in energy-savings behaviours. Barriers such as cost, convenience and availability can be stronger influences on resultant action. Social influence approaches, in combination with incentives and strategic marketing, have been found to be effective mechanisms to produce energy-savings behaviour change, but need to be sensitive to the context-specific factors that inhibit behavioural change (Abrahamse & Matthies, 2013; Abrahamse & Steg, 2013; Lokhorst et al., 2013).

Cost features strongly as both a motivation to reduce energy usage (cost-savings), and as a

barrier to adopting efficiency measures. In additional to financial cost considerations, there is also a cost in terms of time and effort, particularly with attempts to reduce consumption behaviours, which require ongoing behaviour change such as turning off lights. This is in contrast to efficiency measures, which usually require only a once-off change in behaviour.

It is clear that there is no single intervention (or as Osbaldiston and Schott (2012) claim, no 'silver bullet') that is highly effective across any and all behaviours. As has been suggested by numerous researchers, different strategies will be required for different households and target behaviours (Abrahamse & Matthies, 2013; Osbaldiston & Schott, 2012; Sweeney et al., 2013; Thøgersen & Grønhøj, 2010). The results of Osbaldiston and Schott's (2012) meta-analysis reveal that "low-engagement treatments are appropriate for low effort behaviours and that high-engagement treatments are effective for high effort behaviours" (p.280).

Following the guidelines outlined by Abrahamse et al. (2005), the first step in designing and implementing an intervention is a thorough analysis of the problem. This includes identifying the environmentally significant behaviours to target, then examining the factors that contribute to and maintain the behaviour. It is important within this problem diagnosis to identify and address factors that make change unappealing and are thus barriers to change. This can be achieved through interventions that use a social marketing approach to integrate what is already known about strategies to reduce energy usage and tailor this to the consumer.

Having reviewed prominent theories and models of ERB, and explored a range of interventions aimed specifically at energy-use reduction, this thesis will now examine the TTM and its application, particularly as a form of social marketing, in the area of ERB.

Chapter 5: The Transtheoretical Model and Environmentally Responsible Behaviour

Everyone thinks of changing the world, but no one thinks of changing himself – Leo Tolstoy

The Transtheoretical Model (TTM; Prochaska & DiClemente, 1982; Prochaska & DiClemente, 1983; Prochaska & DiClemente, 1986; Prochaska, DiClemente, & Norcross, 1998) is a stage-based model of intentional behaviour change that can be utilized to categorize individuals' stage of change and identify stage-specific strategies to overcome resistance in order to encourage and maintain behaviour change. Stage models are beneficial in understanding how change occurs, and provide an opportunity to develop tailored interventions consistent with a social marketing approach (French & Blair-Stevens, 2010; French et al., 2010; Peattie & Peattie, 2009) that can encourage greater environmentally responsible behaviour. This thesis will now move to an overview of the TTM and its more recent adoption within the field of environmental psychology.

The Transtheoretical Model

The Transtheoretical Model (TTM) was originally developed by DiClemente and Prochaska (1982; DiClemente et al, 1991; Prochaska & DiClemente, 1983, 1986, 1992; Prochaska, DiClemente, Velicer, Ginpil, & Norcross, 1985) as a model for intentional individual behaviour change in relation to smoking, alcohol and other drug use. The TTM originated from an analysis of leading psychotherapy approaches, in an attempt to develop a more comprehensive, eclectic model of change (Prochaska, 1979, as cited in Prochaska & DiClemente, 1982).

The TTM is explicitly concerned with *intentional* behaviour change. That is, change that involves the cooperation and participation of the individual in order to produce and maintain the desired change. This is in contrast to imposed or developmental changes, which do not require

the participation of the individual (DiClemente, 2007). Furthermore, the TTM views behaviour change as a process that occurs over time as a result of various tasks, not as the result of inherent motivation. These tasks are seen as representing different stages that an individual passes through in the process of changing.

One of the assumptions of the TTM is that there is a common set of stages and processes people can apply across a broad range of behaviours (Prochaska & Velicer, 1997). Consequently, since its development, the TTM has continued to be applied to behaviour change in a vast array of problem areas including:

- Assessing emotional readiness for child adoption (Prochaska, Paiva, et al., 2005);
- Encouraging consistent oral self-care behaviours (Astroth, Cross-Poline, Stach, Tilliss, & Annan, 2002);
- Advanced care planning (Fried et al., 2012);
- The retirement from sport decision-making process (Park, Tod, & Lavallee, 2012);
- Treatment of patients with eating disorders and other diet-related issues (Dunn, Neighbors, & Larimer, 2003; Franko, Jenkins, & Rodgers, 2012; Hasler, Delsignore, Milos, Buddeberg, & Schnyder, 2004; Hoke & Timmerman, 2011);
- Increasing the consumption of fruit and vegetables (Di Noia & Thompson, 2012; Henry, Reimer, Smith, & Reicks, 2006; Hildebrand & Betts, 2009; Horwath, Nigg, Motl, Wong, & Dishman, 2010; Mao et al., 2012);
- Encouraging exercise in various populations(Bezyak, Berven, & Chan, 2011; Blaney et al., 2012; Dishman, Jackson, & Bray, 2010; Kosma, Ellis, & Bauer, 2012; Sarkin, Johnson, Prochaska, & Prochaska, 2001; Xu & Mao, 2012);
- HIV/AIDS and teenage pregnancy prevention (Hacker, Brown, Cabral, & Dodds, 2005; MacDonell, Naar-King, Murphy, Parsons, & Huszti, 2011; Prochaska, Redding, Harlow, Rossi, & Velicer, 1994);
- Treatment of sex offenders (Tierney & McCabe, 2001); and

- Intervention with domestic violence victims and offenders (Babcock, Canady, Senior, & Eckhardt, 2005; Brodeur, Rondeau, Brochu, Lindsay, & Phelps, 2008; Burke, Denison, Gielen, McDonnell, & O'Campo, 2004; Burkitt & Larkin, 2008; Cluss et al., 2006; Dienemann, Neese, & Lowry, 2009; Eckhardt, Babcock, & Homack, 2004; Eckhardt & Utschig, 2007; Levesque et al., 2008; Levesque, Gelles, & Velicer, 2000; Polaschek, Anstiss, & Wilson, 2010).

Important constructs within this model include stages of change, processes of change, self-efficacy and decisional balance. These will be further explored below.

Stages of Change

An important element of the TTM, the Stages of Change concept delineates five stages that are believed to reflect the sequential and motivational aspects of change (DiClemente et al., 1991; Prochaska & DiClemente, 1982; Prochaska & DiClemente, 1983; Prochaska & DiClemente, 1986; Prochaska et al., 1985).

It has been asserted that the stages of change concept combines the cognitive and motivational aspects of change, such as in attitudinal/intention theories, with the behavioural learning elements of change to create a more complex and credible picture of the process of change (Prochaska, Norcross & DiClemente, 1994, as cited in DiClemente, 2007).

Within this model, each of the stages of change represent both a period of time as well as a set of critical tasks, knowledge and/or beliefs which are important at that stage to allow progression to the next stage (Prochaska & DiClemente, 1986). Although the time within each stage may vary between individuals, the model assumes that the tasks to be accomplished at each stage to achieve movement to the next stage do not. Originally conceptualized as a linear progression through the stages, it was later modified to represent a spiral pattern in response to the recognition that most people relapse as they move through the stages (Prochaska, DiClemente, & Norcross, 1992). Individuals may also cycle through several of the stages a number of times before they achieve long-term change (the maintenance or termination stage). This model is depicted in Figure 5.1 below.

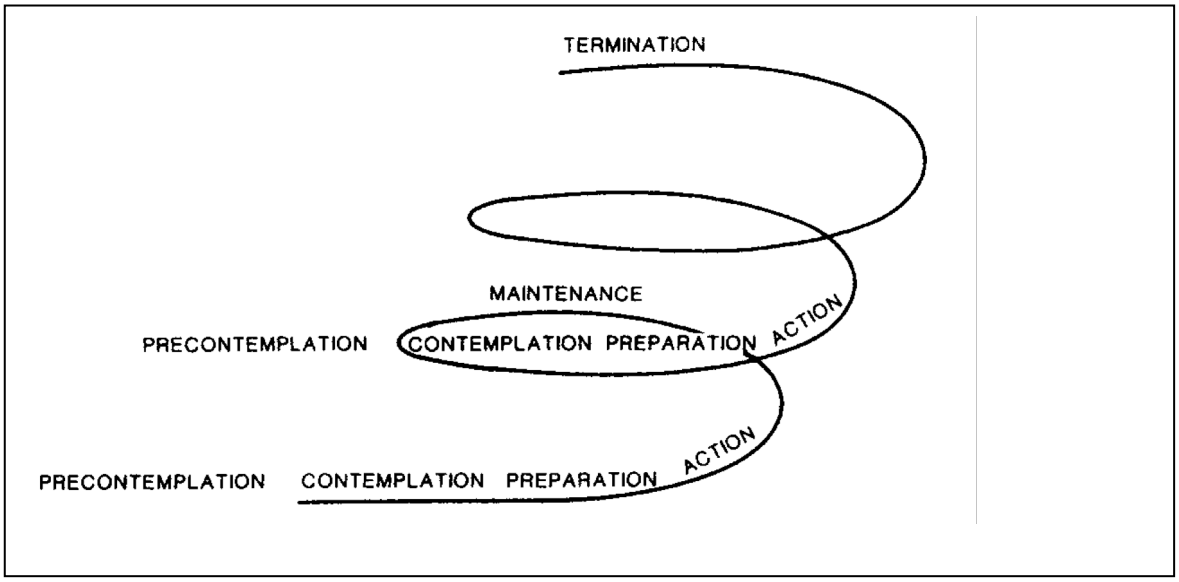


Figure 5.1: A spiral model of the stages of change (Prochaska, DiClemente, & Norcross, 1992)

The five stages of change are listed below and then described in further detail:

1. Precontemplation;
2. Contemplation;
3. Preparation;
4. Action;
5. Maintenance.

In some applications of the model (e.g. Prochaska, 1999), a sixth stage is included to encompass Termination, whereby individuals experience no temptation and are completely confident that they will not return to their previous pattern of behaviour.

Precontemplation stage

In the Precontemplation stage, the individual is not considering making a change to their behaviour within at least the next 6 months. People at this stage may be unaware or under-informed regarding the harmful consequences of their behaviour. They may also be defensive of their behaviour, deny that their behaviour is problematic and avoid references to their behaviour (such as in the media). Individuals within this stage may also underestimate the benefits of change and overestimate the difficulty of changing (DiClemente, 2003a; Prochaska, 1999; Prochaska, Redding, & Evers, 1997).

Two types of naturally occurring events have been identified that can motivate people in this stage to progress to the next stage. The first of these are developmental events, such as turning 40 or having a baby. The second type of event is environmental events, referring to circumstances within the natural environment of the person. These events prompt a re-evaluation of current behaviours and can provide the impetus to consider change (Prochaska, 1999).

The task required within this stage to progress to the next stage is for individuals to become conscious of, and concerned about, their existing pattern of behaviour, and/or to envision the possibility of change (DiClemente, 2003b).

Contemplation stage

In the Contemplation stage, there is an intention to change behaviour within the next 6 months. People within this stage are more aware of the benefits of changing, but also of the costs of changing. This stage is characterized by a weighing up of the pros and cons of change, which can result in high levels of ambivalence. Individuals may seek information to assist with their consideration of the positive and negative aspects of the behaviour, and may look to peers and role models regarding how they managed their behavioural change (DiClemente, 2003a; Prochaska, 1999; Prochaska et al., 1997).

The tasks to achieve at this stage to move to the next are to gather information in order to weigh the pros and cons of the behaviour until a decision is reached to move forward to the Preparation stage or to return to the Precontemplation stage (DiClemente, 2003a, 2003b).

Preparation stage

At this stage, people actively intend and are committed to take action, usually defined as within the next month. They develop a plan and strategy for change, and may have already made some significant preparatory moves such as purchasing necessary equipment. The tasks required at this stage are to increase commitment to change and devote the time and energy required to make the change (DiClemente, 2003b; Prochaska, 1999).

Action stage

At this stage, people have made specific changes to their behaviour, usually within the last 6 months. This stage generally represents the implementation of the plan developed within the Preparation stage. This stage represents a shift from the previous stages that emphasized intention, consideration and planning to observable behaviour change. It has been argued that this stage is what is often equated with behaviour change (DiClemente, 2003b; Prochaska, 1999).

As the behaviour must be repeated over time to create true behavioural change, this stage is usually seen as lasting from three to six months, although it may take longer for less frequently occurring behaviours.

The tasks at this stage are for individuals to continue to engage in their changed behaviour despite barriers and challenges, which may include revisions of the initial plan. This stage also represents a shift in focus from generating behaviour change to now continuing with the change in the longer term (DiClemente, 2003b).

Maintenance stage

Within the TTM, it is believed that for true behaviour change to occur, the new behaviour must become habitual and integrated into the individual's lifestyle. Within the Maintenance stage, the new behaviour becomes automatic, requiring little or no conscious thought or effort to sustain it. There is, however, always the risk that individuals will revert to their previous behavioural patterns (relapse), with the new behaviour only becoming fully maintained when there is little or no effort to maintain it and the person can exit the cycle of change. The tasks required at this stage are to maintain the change in behaviour across different situations and in the face of challenges (DiClemente, 2003b).

Relapse

Although not technically a separate stage within the TTM, relapse occurs when an individual moves backward at any stage. The TTM recognizes that successful linear progression

through the five stages is rare. When relapse occurs, the individual must recycle through the stages and tasks in order to produce behavioural change (DiClemente, 2007).

Processes of Change

It was the recognition that people use different processes of change as they move through the stages that lead to the development of the Transtheoretical model. It is claimed that "the stages of change represent *when* people change; the process of change entail *how* people change" (Norcross, Krebs, & Prochaska, 2011, p. 144). A total of ten processes of change have been identified, with 5 being cognitive/experiential and 5 behavioural processes.

Experiential processes include activities related to thinking and feeling about changing behaviour; while behavioural processes are activities hypothesized to be helpful for changing behaviour. The TTM theorizes that individuals use the experiential process of change in the early stages of change, facilitating a move from not thinking about changing behaviour to imminently intended behaviour change. However, if an individual is imminently intending to change their behaviour, the behavioural processes of change will initiate and maintain that behaviour. This proposition, that the approach taken to intervene to motivate behavior change depends upon stage of change, is the most important proposition in the TTM. The underlying assumption is that what the individual is experiencing, thinking and/or doing is what facilitates movement through the stages (DiClemente & Prochaska, 1982; Prochaska & DiClemente, 1986; Prochaska et al., 1997). These ten processes are described below.

1. Consciousness raising

This process involves increased awareness about the current or new behaviour, or about the need for change. This may involve gaining information about the causes, consequences and remedies for a particular problem, as well as the individual finding and learning new facts, ideas and tips that support the behavioural change (DiClemente, 2003b; Prochaska, 1999; Prochaska & DiClemente, 1986; Prochaska et al., 1997).

DiClemente (2003b) claims that consciousness raising is fundamental to behaviour change theories and is a key intervention used by most prevention and treatment programs. Part of the goal in applying conscious raising processes is to increase the pros of changing. Interventions based on this process of change include feedback, confrontation, bibliotherapy, and educational and media campaigns (Prochaska, 1999; Prochaska et al., 1997).

2. Dramatic relief

This process involves emotional arousal regarding the impact of an individual's current behaviour, and a reduction of arousal that can be achieved through behavioural change. The emotions of fear, inspiration, guilt and hope are identified as some of the emotions that can move people to contemplate changing (Prochaska, 1999). Interventions based on this process include role-playing, grieving, personal testimonies and media campaigns (Prochaska, 1999; Prochaska et al., 1997). Prochaska (1999) draws attention to the fact that interventions such as fear arousal and educational campaigns do not directly motivate behaviour change. Instead, he stresses, the processes of consciousness raising and dramatic relief are intended to move people into the contemplation stage, not to direct action.

3. Environmental re-evaluation

Similar to self-re-evaluation, this process also combines both emotional and cognitive assessments of how an individual's own behaviour affects others and their social environment. It can also include the awareness that the individual can serve as a role model for others. Interventions within this process include values clarification and family or community interventions (Prochaska, 1999; Prochaska et al., 1997).

4. Self-re-evaluation

This process combines both emotional and cognitive assessments of how an individual's own behaviour affects their identity and how changing would affect their self-image. This process involves evaluating how the current or the new behaviour corresponds with their personal

values. Interventions based on values clarification, identifying role models, and using mental imagery are utilized (Prochaska, 1999; Prochaska et al., 1997).

5. Self-liberation

The process refers to an individual's belief that they can change and the commitment to act on that belief. It includes making choices and taking responsibility for behavioural change. Most often referred to as 'willpower', interventions aimed at this process to increase willpower include giving choices for behavioural change and making public (rather than private) testimonies or commitments (Prochaska, 1999; Prochaska et al., 1997).

6. Counterconditioning

This process involves the individual learning new behaviours as replacements for the old and making new connections between cues and behaviour/s. The counterconditioning techniques are therefore specific to the particular behaviour (DiClemente, 2003b; Prochaska, 1999; Prochaska et al., 1997).

7. Contingency management

This process involves providing consequences for making behavioural changes. Prochaska and DiClemente (DiClemente, 2003b; Prochaska, 1999; Prochaska et al., 1997) claim that rewards have been found to work better than punishments and as such, strategies such as contingency contracts, incentives and group recognition can be used within this process.

8. Stimulus control

This process involves modifying the individual's environment to increase cues for the desired behaviour and decrease cues for the non-desired behaviour. Interventions based on this process include avoidance, environmental modification and self-help groups (DiClemente, 2003b; Prochaska, 1999; Prochaska et al., 1997).

9. Social liberation

This process emphasizes noticing and increasing social alternatives and norms that support the desired behaviour. Strategies based on this process include advocacy, empowerment procedures, and policy measures (DiClemente, 2003b; Prochaska et al., 1997).

10. Helping relationships

This process involves seeking out and using social supports, such as family, friends, peers or self-help groups, to maintain the changed behaviour. Interventions based on this process would be aimed at increasing the availability and use of social supports (DiClemente, 2003b; Prochaska, 1999; Prochaska et al., 1997).

Stage-matched processes of change

The TTM theorizes that the processes of change are differentially effective in certain stages of change. Proponents of the TTM contend that the ten processes of change outlined above provide important guides for intervention programs when matched to the individual stage of change (Prochaska, 1999; Prochaska et al., 1997). DiClemente and Prochaska (1982) found that the use of the ten processes of change varied depending upon which stage of change an individual was in. So important is it to match an individual's stage of change to the processes of change, that Prochaska, Norcross, and DiClemente (2005) highlight the need to "do the right things (processes) at the right time (stages)" (p. 229) and "avoid mismatching stages and processes" (p. 230) in their ten prescriptive guidelines for interventions based on the TTM. The processes used most effectively in various stages, taken from Prochaska (1999) are shown below in Table 5.1.

Table 5.1: The stages of change in which particular processes of change are emphasized

Precontemplation	Contemplation	Preparation	Action	Maintenance
Consciousness raising				
Dramatic Relief				
Environmental re-evaluation				
	Self re-evaluation			
		Self liberation		
			Contingency management	
			Helping relationships	
			Counter conditioning	
			Stimulus control	
			Social liberation	

Decisional Balance

This concept refers to an individual's relative weighing up of the pros and cons of changing. The TTM posits that for any contemplated change, the existing and the proposed behaviour have their own set of pros and cons. It is the individual's personal reasons for and against the current behaviour, or for and against the new behaviour, which results in their overall decisional balance. This two-factor structure (pros and cons) of decisional balance has received extensive research support (Grimley et al., 1996; Grimley, Riley, Bellis, & Prochaska, 1993; Prochaska et al., 1985; Prochaska, Velicer, et al., 1994; Velicer, DiClemente, Prochaska, & Brandenburg, 1985).

In the early stages of change, an individual's decisional balance is an important indicator of change. Based on previous research (e.g. Migneault, Pallonen, & Velicer, 1997; Migneault, Velicer, Prochaska, & Stevenson, 1999; Plummer et al., 2001; Prochaska, Velicer, et al., 1994), several principles related to decisional balance have been developed (Prochaska, 1999; Prochaska, Norcross, et al., 2005). These principles state that in order to move from Precontemplation to Contemplation, the pros for the new behaviour must be increased, while to move from Contemplation to Action, the cons of changing must be decreased. Additionally, in order for people to take action, there need to be more pros than cons.

Self-efficacy

Within the TTM, self-efficacy is seen as comprised of two parts – confidence and temptation. The confidence construct was adapted from Bandura's (1977) earlier work on self-efficacy, which referred to an individual's confidence about performing a specific behaviour. Temptation refers to the strength of a desire to perform a particular behaviour in a given situation. In most, although not all, cases temptation is negatively correlated with confidence (DiClemente, 2003b; Prochaska et al., 1997).

Self-efficacy appears to be a stronger predictor once the individual begins to engage in behaviour change and as a predictor of maintenance of that change. Temptation however predicts relapse better than confidence. Self-efficacy has been found to be an important marker of the transition from the Preparation stage through the Action and Maintenance stages. Self-efficacy has also been found to play a role in the Precontemplation stage, as individuals who feel little confidence in their ability to make the required behavioural change do not progress to Preparation (Carbonari & DiClemente, 2000; DiClemente, Carbonari, Montgomery, & Hughes, 1994; DiClemente & Hughes, 1990; DiClemente et al., 1991). These results suggest that tailoring self-efficacy interventions to individual's stage of change may accelerate progress through the stages.

Coaction

Coaction (also known as co-variance) has been defined as occurring when:

Taking effective action on one behaviour increases the odds of taking effective action on a second behaviour. This phenomenon is different from co-occurrence where groups of particular behaviours are more likely to have higher prevalence in particular populations. Co-variation reflects behaviours changing together rather than behaviours occurring together. (Prochaska, 2008, p. 282).

Prochaska (2008) has proclaimed that "co-variation is wide open for innovative research" (p. 282). He outlines three forms coaction can take:

1. When effective action on one treated behaviour increases the odds of effective action on a second treated behaviour with the odds ratio being greater in the treatment group than the control group;
2. When treatment of a target behaviour is accompanied by significant change in an untreated behaviour; or
3. When full and effective treatment on a single behaviour is accompanied by significant changes in other behaviours that received minimal treatment.

Early research by Johnson et al. (2008) found that the impact of multiple behaviour interventions was more than three times that of single behaviour interventions. Later research by Paiva et al. (2012) has further supported the efficacy of coaction.

Measurement of TTM constructs

Refinement and measurement of the constructs within the TTM, across a range of behaviours, ages and disciplines, continues to this date (e.g. Callaghan, Khalil, & Morres, 2010; Dishman et al., 2010; Guo, Fielding, Sutton, & Aveyard, 2011; Hoeppner et al., 2012; Kirk, MacMillan, & Webster, 2010; Paiva et al., 2012; Park et al., 2012; Polaschek et al., 2010). Outlined below is a summary of key research regarding the measurement of TTM constructs.

Decisional Balance

In their early studies, TTM researchers developed a Decisional Balance scale for smoking cessation (Prochaska & DiClemente, 1984; Prochaska et al., 1985; Velicer et al., 1985), based on Janis and Mann's (1977, as cited in Velicer et al., 1985) model of decision making. Their research supported a two-factor structure, with the final scale consisting of two subscales, labeled the Pros of Smoking and the Cons of Smoking. Each subscale had 10-items, with respondents required to rate how important each item is for their decision to smoke, on a 5-point Likert scale of importance (where 1 = not important to 5 = extremely important). It is of note that on this scale, respondents can scores highly on both subscales. Items included statements such as "*smoking cigarettes is pleasurable*" (Pro) and "*my smoking can affect the health of others*" (Con).

Based on their results, Velicer et al. (1985) concluded that the Decisional Balance scale "appears to hold considerable promise in assessing, describing, and predicting behaviour change in various contexts on the basis of the perceived advantages and disadvantages of the decision" (p. 1288). Prochaska, Velicer, et al. (1994) investigated the generalizability of the decisional balance construct across 12 problem behaviours, concluding that their results showed strong support for the generalizability of the construct across a variety of populations and behaviours.

Decisional Balance scales have subsequently been developed and used to determine the perceived cost/benefit ratio, incorporating the two components of Pros and Cons, across a range of health behaviours including continued research on smoking (Hoeppner et al., 2012; Schumann et al., 2005); condom use (Grimley et al., 1996; Grimley et al., 1993); alcohol use and adolescent drinking (Migneault et al., 1997; Migneault et al., 1999); adolescent smoking (Hoeppner et al., 2012; Plummer et al., 2001); prescription drug use (Braun, Bischof, & Rumpf, 2012); exercise behaviour (Callaghan et al., 2010); eating disorders (Blake, Turnbull, & Treasure, 1997); and a range of dietary behaviours including fat reduction and increasing fruit and vegetable consumption (Greene et al., 2004; Ling & Horwath, 2001; Plotnikoff et al., 2009; Robinson et al., 2008; Rossi et al., 2001).

Self-efficacy

DiClemente (1986) raised concern with operationalizing the self-efficacy construct, claiming that "applying self-efficacy theory to addictive-behaviour change is not a straightforward matter. The first challenge is to define the target behaviour for which self-efficacy is to be assessed." (p. 303). He discusses that there are a range of types of self-efficacy, including treatment behaviour self-efficacy, recovery self-efficacy and control self-efficacy. However, abstinence self-efficacy, which focuses on the subject's confidence in their ability to abstain from engaging in the addictive behaviour in various situations that are cues or triggers to perform that behaviour, is the type most typically assessed (DiClemente, 1986).

Early research utilizing the self-efficacy construct within the TTM used a measure of self-efficacy for smoking avoidance, which consisted of 31 separate situations or events that were strong cues to smoke (DiClemente, 1981; DiClemente, Prochaska, & Gibertini, 1985; Prochaska & DiClemente, 1984; Prochaska et al., 1985). These situations included a variety of tasks at various levels of difficulty, which the authors claim satisfy Bandura's (1977) criteria of magnitude and generality. For each item, respondents were asked to rate both their degree of certainty that they could avoid smoking and their degree of temptation to smoke in that situation along a 5-point Likert scale, from 1 = not at all tempted /confident to 5 = extremely tempted/confident. The confidence and temptation ratings were summed to give a total score indicative of their confidence and their temptation respectively, which then combined to give a total self-efficacy score.

Similarly, an Alcohol Abstinence Self-Efficacy (AASE; DiClemente et al., 1994; DiClemente & Hughes, 1990) scale was developed, consisting of two subscales that measure confidence and temptation. Respondents are required to rate their confidence to abstain from alcohol across 20 different high-risk situations on a 5-point Likert scale from 1 – not at all confident to 5 = extremely confident. For the temptation measure, respondents are asked to rate how tempted they are to drink in the same situations, again on a 5-point Likert scale from 1 = not

at all tempted to 5 = extremely tempted. The authors claim that the AASE represents a brief, easy to use and psychometrically sound measure of an individual's self-efficacy to abstain from drinking alcohol (DiClemente et al., 1994). This measure has since been used in further research on alcohol use and abstinence, including research using data from Project MATCH, a large nationwide study in the United States into the treatment of alcohol dependence and abuse (Carbonari & DiClemente, 2000; Nochajski & Stasiewicz, 2005; Project MATCH Research Group, 1997).

Subsequent research using the self-efficacy construct within the TTM have assessed different situations and recorded the measure as a single self-efficacy score (e.g. Velicer, DiClemente, Rossi, & Prochaska, 1990), while other researchers have utilized confidence and temptation scores separately (e.g. Redding & Rossi, 1999).

Although original measures of self-efficacy included assessment of both confidence to perform (or not perform) a behaviour and temptation to perform the behaviour, other researchers have relied more heavily on the confidence aspect of the self-efficacy construct and not included a measure of temptation (e.g. Callaghan et al., 2010; Greene et al., 2004; Grimley et al., 1996; Ôunpuu, Woolcott, & Rossi, 1999; Pallonen, Timpson, Williams, & Ross, 2009).

The temptation aspect of the self-efficacy construct has, in some research, been measured separately. A Situational Temptations measure was constructed to assess the degree of temptation to smoke in particular situations (DiClemente, 1986; DiClemente et al., 1985; Hoeppner et al., 2012; Prochaska, Velicer, Guadagnoli, Rossi, & DiClemente, 1991; Velicer et al., 1990). The adult version of the temptations to smoke measure has also been modified for adolescents (Ding, Pallonen, & Velicer, 1995; Ding, Pallonen, Migneault, & Velicer, 1994; Hoeppner et al., 2012; Pallonen, 1998; Plummer et al., 2001). Research addressing temptation to smoke has continued (e.g. Breitling, Twardella, Raum, & Brenner, 2009; Schumann et al., 2005), while the situational temptation measure has also been adapted to other health behaviours,

including various dietary behaviours (Plotnikoff et al., 2009; Robinson et al., 2008; Rossi et al., 2001) and HIV medication adherence (MacDonell et al., 2011).

Stages of Change

Staging algorithms

There are a number of methods used in the literature to classify people's stage of change. One method is the use of staging algorithms which result in discrete categorization of the individual into a stage of change (e.g. Blake et al., 1997; Callaghan et al., 2010; Greene & Rossi, 1998; Grimley et al., 1993; Hargreaves et al., 1999; Hoeppner et al., 2012; Hoeppner et al., 2006; Migneault et al., 1997; Pallonen et al., 2009; Plotnikoff et al., 2009). These categorical staging algorithms involve either asking respondents a series of questions in various steps, or giving behavioural descriptions representative of each stage, where the respondent is required to select the one most characteristic of their current behaviour.

Stages of change algorithms have been criticized as being illogical and/or with arbitrary time periods (Sutton, 2001). Sutton (2001) argues that the use of arbitrary time periods questions the assumption that the stages as measured by staging algorithms are qualitatively distinct, that is, that they are true stages rather than pseudo-stages. He claims that "precontemplation, contemplation and preparation may behave as if they were arbitrary segments of an underlying continuum that could be labeled 'planned time to action'. Similarly, action and maintenance, which are distinguished purely and arbitrarily by whether or not the duration of abstinence exceeds 6 months, may behave like pseudo-stages." (2001, p. 176). The distinction between true stages and pseudo-stages is important, since if the stages (or subsets of them) behave like pseudo-stages, then it cannot be assumed that different factors will influence different stage transitions and therefore there would be no basis for matching interventions to stage, which is one of the basic doctrines of the TTM.

SOCRATES

The Stages of Change and Treatment Eagerness Scale (SOCRATES) was designed to assess motivation for change in problem drinkers (Miller & Tonigan, 1996). The SOCRATES is a 19-item scale, on which respondents rate their agreement with the item statements on a 5-point Likert scale. The SOCRATES produces three continuous scales, labeled Ambivalence, Recognition and Taking Steps. Sample items include statements such as "*I have serious problems with drinking*" (Recognition); "*Sometimes I wonder if I am in control of my drinking*" (Ambivalence) and "*I want help to keep from going back to the drinking problems that I had before*" (Taking Steps). Miller and Tonigan (1996) state that, rather than assessing an individual's stage of change, "the scales of SOCRATES seem better understood as continuously distributed motivational processes that may underlie stages of change" (p. 84).

The SOCRATES has since been translated into other languages (e.g. Anatchkova, Redding, & Rossi, 2007; Chun, Cho, & Shin, 2010; Demmel, Beck, Richter, & Reker, 2004; Evren, Dalbudak, & Cakmak, 2008; Figlie, Dunn, & Laranjeira, 2005; Kobayashi et al., 2010; Lopes, Prieto, Delgado, Gamito, & Trigo, 2010; Zullino et al., 2007)and used as a measure of readiness to change in different age groups such as adolescents(Maisto, Chung, Cornelius, & Martin, 2003; Maisto et al., 2011a, 2011b) and college students (Vik, Culbertson, & Sellers, 2000).

Research using the SOCRATES has also been conducted across a variety of problem areas and settings, predominantly alcohol use (Demmel et al., 2004; Hewes & Janikowski, 1998; Maisto et al., 1999; Nochajski & Stasiewicz, 2005), but also including alcohol use in medical settings (Bertholet, Cheng, Palfai, Samet, & Saitz, 2009; Bertholet, Dukes, et al., 2009); alcohol use and mental illness (Zhang, Harmon, Werkner, & McCormick, 2004); alcohol use and serving military members (Mitchell & Angelone, 2006; Mitchell, Angelone, & Cox, 2007; Mitchell, Francis, & Tafrate, 2005); and drug use (Burrow-Sanchez & Lundberg, 2007; Gossop, Stewart, & Marsden, 2007; Lopes et al., 2010; Maisto et al., 2011b).

Stages of Change Questionnaire

DiClemente and Hughes (1990) argue that while staging algorithms allow for clean stage assignment, they do not take into account more subtle attitudinal differences that could identify within or between stage categories. McConnaughy, Prochaska and Velicer (1983) developed the Stages of Change Questionnaire (SOCQ, also referred to as the University of Rhode Island Change Assessment Scale, URICA) which provides a continuous measure of attitudes representing each of the stages of change in relation to a problem behaviour. The SOCQ refers to 'problems' as a generic term, rather than a specific problem behaviour. It includes statements such as "*It might be worthwhile to work on my problem*" and "*I am actively working on my problem*". A modified version of the SOCQ will be developed, validated and utilized in this present study.

The SOCQ has shown high internal consistency (McConnaughy, DiClemente, Prochaska, & Velicer, 1989; McConnaughy et al., 1983), however, factorial evidence for the validity of the SOCQ has been mixed. Whilst there has been evidence supporting the initial four factors which map to the stages of Precontemplation, Contemplation, Action and Maintenance (DiClemente & Hughes, 1990; McConnaughy et al., 1989; McConnaughy et al., 1983; Polaschek et al., 2010), other research has supported a three-factor model which conceptually combines Action and Maintenance into a single factor (Eckhardt & Utschig, 2007; Hemphill & Howell, 2000; Yen, Huang, Chang, & Cheng, 2010).

Further evidence supports a one-factor or composite score, which is a single continuous variable construed as measuring 'readiness to change' and calculated by summing an individual's Contemplation, Action and Maintenance scores, then subtracting their Precontemplation score (Amodei & Lamb, 2004; Derisley & Reynolds, 2002; Hunt, Kyle, Coffey, Stasiewicz, & Schumacher, 2006; Project MATCH Research Group, 1997).

Other interpretations of the SOCQ have moved away from allocation to stages and toward identifying 'profiles' based on cluster analysis of responses. Again, research into cluster analysis

of the SOCQ has been inconclusive, with the number of identifiable profiles appearing to be highly variable and dependent on the sample (Carey, Purnine, Maisto, & Carey, 1999; DiClemente & Hughes, 1990; McConnaughy et al., 1989; McConnaughy et al., 1983).

Despite debate regarding it's factorial structure, the SOCQ has been used to assess individuals' stage of change in a diversity of areas such as: addressing client readiness and outcomes in psychotherapy (Derisley & Reynolds, 2002; Ilagan, 2009; McConnaughy et al., 1989); alcohol use (DiClemente & Hughes, 1990); drug use (Abellanas & McLellan, 1993; Callaghan et al., 2008); criminal offenders (Polaschek et al., 2010); and patients with eating disorders (Hasler et al., 2004).

Adaptations of the SOCQ have also been developed and used to suit different populations, such as: the Pain SOCQ (PSOCQ) and adaptations for adolescents (PSOCQ-A) and their parents (PSOCQ-P) (Guite, Logan, Simons, Blood, & Kerns, 2011; Kerns & Rosenberg, 2000; Kerns, Rosenberg, Jamison, Caudill, & Haythornthwaite, 1997); the Anorexia SOCQ (Rieger et al., 2000; Rieger, Touyz, & Beumont, 2002); the URICA-S as a short form for use with psychotherapy patients (Mander, Teufel, Keifenheim, Zipfel, & Giel, 2013); the URICA-A for use with clients with alcohol problems (Carbonari & DiClemente, 2000; Migneault et al., 1999); the URICA-T for use in assessing attitudes and behaviours related to addressing trauma issues (Hunt et al., 2006) and the URICA-DV for use with perpetrators of domestic violence (Levesque et al., 2000).

These modifications to the original SOCQ/URICA measures were commonly devised by changing the wording of items to better reflect the problem behaviour and/or the target population, based on input from relevant expert professionals and pilot testing within a representative sample. This study uses a similar method to develop a modified version of the SOCQ applicable to household electricity use behaviours, which is then validated through confirmatory factor analysis to ensure fit with the Transtheoretical model.

Processes of Change

The processes of change have been found to integrate empirically within the stage dimension of change showing that these processes are emphasized differentially by individuals in specific stages of change (Prochaska & DiClemente, 1983).

The Change Process Questionnaire was developed to measure the 10 processes of change (DiClemente & Prochaska, 1982). This questionnaire consisted of three items to measure each of the 10 processes of change. It was later modified to the Processes of Change test (and afterwards renamed as a questionnaire). Confusingly, the questionnaire is sometimes abbreviated as the PCQ or the POC.

The original questionnaire consists of 40 items, with four representing each of the 10 processes of change (Prochaska & DiClemente, 1983, 1984; Prochaska, Velicer, DiClemente, & Fava, 1988). A 20-item short form version has also been produced, which uses two items for each process of change (Fava, Velicer, & Prochaska, 1995). Respondents are required to rate on a 5-point Likert scale how frequently they employed each item in the past month from 1 = not at all to 5 = repeatedly. Sample items include:

Consciousness raising:	"*I look for information related to smoking*";
Self-liberation:	"*I tell myself I am able to quit smoking if I want to*";
Social liberation:	"*I notice that public places have sections set aside for non-smokers*";
Self-reevaluation:	"*My depending on cigarettes makes me feel disappointed in myself*";
Environmental re-evaluation:	"*I stop to think that smoking is polluting the environment*";
Counter-conditioning:	"*I do something else instead of smoking when I need to relax*".
Stimulus control:	"*I remove things from my place of work that remind me of smoking*"
Reinforcement management:	"*I am rewarded by others if I don't smoke*"

Dramatic relief: "*Warnings about health hazards of smoking move me emotionally*";

Helping relationships: "*I have someone who listens when I need to talk about my smoking*".

Although the Processes of Change questionnaire was initially developed to address smoking and continues to be used in this area (e.g. Guo et al., 2011; Kristeller, Rossi, Ockene, Goldberg, & Prochaska, 1992; Schumann et al., 2005), it has since been used in research addressing other problem behaviours such as alcohol use (Carbonari & DiClemente, 2000; Freyer et al., 2006). More recent research has also seen assessment of processes of change within the exercise (Dishman et al., 2010; Kosma et al., 2012; Plow, Finlayson, & Cho, 2011; Xu & Mao, 2012); weight management (Andrés, Saldãa, & Gómez-Benito, 2009; Andrés, Saldaña, & Gómez-Benito, 2011; Keller, Allan, & Tinkle, 2006) and consumption of fruit and vegetable domains (Di Noia & Thompson, 2012; Hildebrand & Betts, 2009; Mao et al., 2012); and the field of partner violence (Babcock et al., 2005; Cluss et al., 2006; Eckhardt et al., 2004).

Consistent with other TTM construct measurement, the Processes of Change questionnaire has been modified for use in other areas, commonly by changing the wording of questions or by adding or leaving out certain processes of change. In these cases, the modified version is piloted on a representative sample. For example, Blake et al. (1997) used a modified version of the questionnaire for eating disorders, where only 8 of the 10 processes were deemed relevant, leaving out the processes of 'environmental re-evaluation' and 'social liberation'. Other researchers have developed the processes of change for condom use, which included an additional process of change, that of 'assertiveness for condom use' (Grimley et al., 1993). Callaghan and Herzog (2006) used only six processes of change in a short form version of the original questionnaire for smoking. A total of 17 items were developed to represent five processes of change ('consciousness raising',' self-re-evaluation', 'helping relationships',

‘stimulus control’ and ‘self-liberation’) in research on advanced care planning (Fried et al., 2012).

The research reviewed above has in common that it uses the theoretical basis of the TTM to develop measures of the constructs suited to the particular problem area and population group of interest. However, there is also disagreement regarding the number of processes used in the change process for different behaviours, as well as a lack of clarity on what processes people use when changing their energy-use behaviours. In order to gain a greater understanding of the processes used, this study will analyze themes in participants’ responses to explore the stage-matched processes of change for household electricity use behaviour.

Criticisms of the TTM

In addition to receiving a great deal of empirical support, the TTM has also been the subject of much criticism within the literature (e.g. Adams & White, 2005; Bridle et al., 2005; DiClemente, Schlundt, & Gemmell, 2004; Etter, 2005; Herzog, 2005, 2008; Herzog & Blagg, 2007; Hodgins, 2005; Littell & Girvin, 2002; Sutton, 2000, 2001, 2005a, 2006; Weinstein et al., 1998; West, 2005; Whitelaw, Baldwin, Bunton, & Flynn, 2000). Some researchers have criticized stage models in general, of which the TTM is one, while others have focused their criticisms on the TTM specifically. The following section will look at both critical approaches to the TTM.

Criticisms of the TTM specifically

The TTM has been criticized for a lack of systematic research in the development of the model, which has then lead to difficulties with the conceptualization and measurement of its constructs (Herzog, 2005; West, 2005). Herzog (2005) has claimed that the “popularity of the TTM had come to outstrip the scientific evidence” (p. 1040).

West (2005) has argued that the model assumes people make rational, coherent plans regarding their behaviour change and does not account for how people can change with apparent suddenness. ‘Spontaneous’ stage progression has been found in some studies, where participants

progress through the stages without receiving a planned intervention or spending the requisite time period in each of the stages (De Nooijer, Van Assema, De Vet, & Brug, 2005; De Vet, De Nooijer, De Vries, & Brug, 2005; Hughes, Keely, Fagerstrom, & Callas, 2005). It has been suggested in these studies that participants may have been exposed to interventions external to the study, and that measurement of the stages is not sufficiently reliable.

Additionally, West (2005) argues that the model focuses only on conscious decision-making and intentional motivation, and does not encompass other factors associated with behavioural change such as the role of habits, rewards and punishment. It has also been argued that proponents of the model have been reluctant to incorporate the criticisms and to refine the model accordingly (Etter, 2005)

Perhaps the main criticism of the TTM has been regarding the operationalization of its constructs, and corollary to this, the validity of the measures to accurately and consistently tap the constructs, primarily that of the stages of change. As stated by Adams and White (2005), "unless investigators can confirm that they are able to accurately identify participants 'stage of activity change, their ability to deliver stage-specific interventions and accurately evaluate the effect of these on stage of activity change becomes questionable and of limited utility" (p. 240).

As mentioned previously, the model has been criticized for making arbitrary divisions between the different stages, which perhaps are not reflective of the true state of the individuals (Sutton, 2001; West, 2005). The stages of change construct has also been described as "a haphazard mixture of current behaviour, intention to change, past quit attempts and durations of abstinence" (Etter, 2005, p. 1041.) In a review of stage of change measures, Littell and Girvin (2002) found that stage criteria and categorization were not consistent across different scales and algorithms. Furthermore, these authors refer to previous research that has used factor analysis and found a range of different clusters, profiles or stages, and conclude that clear stage differentiation is not achieved.

While acknowledging critiques of the model, DiClemente (2005) warns against discarding the entire model due to difficulties with one aspect of it (the stages of change), and highlights the importance not to "confuse the construct with the assessment and confound operationalizing a construct with the phenomenon that the construct is supposed to help explain" (p. 1046).

Concern has also been raised that adherence to a TTM framework can lead to ineffective treatment, due to ineffective stage-matched (processes of change) interventions, with the potential for depriving clients of treatment/intervention based on categorization within the stages (Etter, 2005; Hodgins, 2005; West, 2005; Whitelaw et al., 2000). Others have argued that an adherence to a TTM framework has restricted research and development of alternative models, while research on TTM-tailored interventions has diverted resources away from other methods of tailoring (Herzog, 2005). DiClemente (2005) has challenged these claims, pointing out that practitioners and researchers have made many creative changes to the way in which they implement the model and provide services.

Criticisms of the TTM as a stage model

Many popular public health theories, such as the Theory of Reasoned Action (Ajzen & Fishbein, 1977; Fishbein & Ajzen, 1975)and the Theory of Planned Behaviour (Ajzen & Madden, 1986; Madden et al., 1992), are termed continuum theories. That is, the variables that under these theories are believed to influence behaviour, exist along a continuum. For example, an individual's beliefs regarding their behaviour may be seen to fall at any point along the continuum from 'strong - weak' or 'positive – negative'. Additionally, the way the variables combine to influence behaviour is expected to be the same for everyone. In contrast, stage-based theories (such as the TTM), believe that people pass through discrete stages, with different factors being differentially important at the different stages.

Weinstein, Rothman and Sutton (1998) developed a framework by which stage-based models of health behaviour can be designed and evaluated. The four defining properties of a stage theory, as outlined by Weinstein et al are:

1. A classification system to define the stages;
2. An ordering of the stages;
3. Common barriers to change facing people in the same stage;
4. Different barriers to change facing people in different stages.

A review of the criticisms of the TTM according to these principles will follow next.

Principle 1 – A classification system to define the stages

Each stage model requires a set of criteria, which assigns an individual to one of a limited number of stages. Although some differences between individuals within each stage is to be expected, these should only be relatively small, with relatively large differences expected between individuals in different stages (Weinstein et al., 1998). Criticisms of the TTM have been regarding both the process of allocation to stages as well as the discreteness of the stages.

Within the TTM, allocation to a particular stage of change is primarily through the use of either a staging algorithm or a questionnaire such as the SOCQ/URICA (McConnaughy et al., 1983). As reviewed previously in this paper, these methods of classification have been criticized for their use of arbitrary timeframes, factorial structure and validity in differentiating individuals between stages (Herzog, 2008; Sutton, 2001; West, 2005).

The majority of evidence claiming to support the TTM arises from cross-sectional studies, showing differences in TTM variables and other social cognitive variables (e.g. intention, subjective norms) across the stages of change (Armitage & Arden, 2002, 2007; Armitage, Povey, & Arden, 2003; Armitage, Sheeran, Conner, & Arden, 2004; DiClemente & Hughes, 1990; DiClemente et al., 1991; Prochaska, Velicer, et al., 1994). As Armitage (2009) states, "at the very least, these studies suggest that the stages of change possess concurrent validity with variables that form the basis of many attempts to change behaviour" (p. 197).

However, opponents of the theory warn that linear patterns of differences on variables between stages do not necessarily provide support for the TTM, as some variables would be expected to be differentially important at different stages, thereby showing a nonlinear, or

discontinuous, pattern of change across the stages of change (Sutton, 2001). Sutton calls on future researchers to specify their hypotheses concerning the pattern of means for variables that are expected to be theoretically important.

Additionally, some researchers have found that the use of the stages of change classification systems results in groups of individuals who vary greatly on relevant variables, as measured by alternative tools (Etter & Sutton, 2002; Herzog, Abrams, Emmons, & Linnan, 2000; Herzog & Blagg, 2007). For example, Herzog and Blagg (2007) tested the stages of change algorithm against several measures of motivation in a cross-sectional design, finding that the stages of change measure underestimated motivation to change. In their study, 65% of individuals classified by the algorithm as being in the precontemplation stage, were measured as having medium or high motivation to quit. However, it is possible that this result was due to measurement issues with the stages of change algorithm and/or the measures of motivation, rather than undermining the validity of the stages of change construct itself.

Nevertheless, these large within-stage differences undermine the validity of the stages of change construct, as theoretically there should only be small differences between individuals within each stage.

Principle 2 – An ordering of the stages

Under this principle, the stages within a stage-based theory should follow a specific sequence. The requirement of a sequence of stages does not imply that progression between the stages is either inevitable or irreversible, or that people need to spend a set or minimum amount of time in any stage (Weinstein et al., 1998), although Bandura (1998) has stated that within a true stage model the sequence of stages should be irreversible and inevitable. However, if there are many alternative pathways, and few people follow the sequence of stages out prescribed by the theory, then the theory is undermined. Sutton (2005b) further states that a stage model should exhibit discontinuities of stage transition probabilities. That is, the probability of a specific stage transition should not simply be a linear function based on the proximity of the beginning stage to

the outcome stage. A pattern such as this would be more consistent with a pseudo-stage or continuum model.

Longitudinal data can be used to identify whether people pass through a series of stages in the order hypothesized by the theory. A study by Prochaska, Velicer, Guadagnoli, Rossi and DiClemente (1991), which measured respondents stage of change at 6-monthly intervals over 2 years, found support for movement between stages as predicted by the model. However, critics (e.g. Littell & Girvin, 2002; Sutton, 2001) of the model point to an insufficient body of research to support the sequential progression through the stages, as well as research that has shown progression to change with no evidence of moving through contemplation and preparation (Stotts, Diclemente, Carbonari, & Mullen, 1996). Additionally, in research such as that mentioned above that has found spontaneous stage progression, it is impossible to ascertain whether people progressed through each of the stages in sequence.

Principle 3 - Common barriers to change facing people in the same stage and

Principle 4 - Different barriers to change facing people in different stages

As mentioned above, within a stage-model it is assumed that people in the same stage are similar, and therefore would be expected to face similar barriers to changing. Following on from this principle, the barriers to changing for people in one stage are expected to be different to the barriers to changing for people in other stages. Additionally, it should be possible to predict the transition between stages as a result of theoretically relevant variables (Weinstein et al., 1998).

One of the basic tenets of the TTM is that the application of stage-matched processes of change produces movement through the stages. If it were not possible to predict an individual's stage transitions, based on the provision of a specific set of processes, this would undermine the theory. Longitudinal studies can also be used to predict transitions between the stages of change. This research design can be used to test the assumption that different causal variables are differentially important at different stages of change. Herzog (2008) and Sutton (2001) have reviewed the small number of studies which have utilized this research design, claiming that

inconsistent findings emerged and that methodological issues make interpretation of the findings difficult.

Previous reviews of stage-based interventions have produced conflicting results. In 2002, a review of the use of the TTM in smoking cessation and prevention concluded that "evidence for the validity of the TTM as it applies to tobacco use is strong and growing" (Spencer, Pagell, Hallion, & Adams, 2002, p.7). However, in that same year, Littell and Garvin (2002) stated that "research findings suggest that the proposed stages are not mutually exclusive and that there is scant evidence of sequential movement through discrete stages in studies of specific problem behaviours" (p. 223) and concluded that "stage-matched interventions seem premature and ill advised" (p. 255). A year later, Riemsma et al (2003) concluded that "limited evidence exists for the effectiveness of stage based interventions when compared with non-stage based or no interventions in changing smoking behaviour" (p. 1177). Similarly, Adams and White (2005) state that "there is little evidence, to date, that individualized stage-based exercise promotion interventions are successful in improving exercise levels" (p. 2402). These conclusions were again reiterated by Bridle et al. (2005) who noted in their review of the research that "the methodological quality of research was variable, and in some cases poor, but across a range of health behaviours there was only limited evidence for the effectiveness of interventions based on the TTM….irrespective of whether effectiveness was assessed as behaviour change or stage progression" (p. 295).

Weinstein et al. (1998) claim that stronger evidence to support the contention that behaviour change follows a stage process would be to demonstrate in experimental studies that stage-matched interventions are more effective than stage-mismatched interventions in moving individuals to the next stage in the model. The rationale is that matched interventions should facilitate behaviour change, whereas mismatched interventions should either inhibit or produce no behaviour change. This is called a match-mismatch research design.

Again, the few studies that have been conducted using this experimental design have produced conflicting results. Quinlan and McCaul (2000) compared a stage-matched intervention, a stage-mismatched intervention and no-intervention across a sample of college students who were all classified as being in the precontemplation stage of quitting smoking. Their results failed to support the concept of stage-matched processes of change, instead finding that more of the subjects who had received the mis-matched intervention then progressed to attempt to quit smoking (action stage). However, in a recent similar study using a stage-based model regarded as a variant of the TTM, the stage-matched interventions were significantly more effective in producing stage transition than were mismatched interventions (Dijkstra, Conijn, & De Vries, 2006). In a match-mismatch study on fruit intake, De Vet, De Nooijer, De Vries, and Brug (2008) also found that "increased process use appears to be associated with more advanced stages of change" (p. 613), although they concluded that "the pattern of experiential and behavioural processes was not as straightforward as outlined by the TTM" (p. 614).

Armitage (2009) identified a number of methodological inconsistencies which may account for some of the differences in these findings. Additionally, as he notes, the inconclusive findings of these match-mismatch studies may be the result of the researchers using ineffective interventions rather than being indicative of problems with the stages of change concept and the TTM.

Various authors (e.g. Armitage, 2009; Herzog, 2008; Sutton, 2001; Weinstein et al., 1998) have reviewed the TTM and found it to be severely lacking. However, despite calls by some to abandon the model (e.g. West, 2005), these authors have suggested that the problem more accurately lies with how stage models have been proposed and tested and with the operationalization and measurement of the TTM constructs. Armitage (2009) claims to agree with many of the criticisms of the TTM, but argues that there is still value in the model. He claims that the way in which it is researched needs urgently to be addressed, with a preoccupation

with the stages of change concept having "diverted attention away from potentially useful – but under-researched – aspects of the model" (p. 196).

The TTM and social marketing

The application of social marketing to promote ERB was discussed in the previous chapter, and will now be discussed in relation to the TTM. The aim of social marketing is to influence social behaviours in order to benefit the target audience and the general public (Andreasen & Kotler, 2003).

Andreasen (1995) delineates between high and low involvement decisions regarding behaviour change, where high involvement decisions are those that are important to the consumer, may require a large amount of information and often involve an emotional element. Andreasen states that change in these high involvement behaviours can be difficult and time-consuming. Several social marketing proponents have suggested that for high-involvement behaviours, consumers change gradually and move through clearly definable stages (Andreasen, 1995; Maibach & Cotton, 1995). Andreasen (1995) refers to the Transtheoretical model as "The most useful model for social marketing applications" (p. 144). He states that the three features of the TTM that are significant for social marketing are:

1. The ability to separate consumers into one of the five stages by asking a relatively few simple questions;
2. The ability to apply a different intervention strategy to each stage; and
3. The focus on movement from one stage to the next rather than permanent behaviour, which would entail all consumers reaching the Maintenance stage.

Within the TTM, each of the stages entails a set of critical tasks, knowledge and/or beliefs, which are important at that stage to allow progression to the next stage (Prochaska & DiClemente, 1986). Similarly, Andreasen (1995) proposed that the marketing tasks required at each stage differ. The marketing tasks required at each stage of the TTM are outlined below in

Table 5.2, although in this conceptualization, Andreasen collapsed the Preparation and Action stages.

Table 5.2: Social Marketing tasks at each stage of the TTM

Stage of Change	Social Marketing task
Precontemplation	Create awareness and interest
	Change values
Contemplation	Persuade, motivate
Action	Create action
Maintenance	Maintain change

As reviewed above in this chapter, there is a vast body of literature on applications of the TTM to a variety of health related behaviour change. There is also, albeit smaller, a body of research that has applied the TTM framework to social marketing in the health sphere (e.g. Cismaru, Lavack, Hadjistavropoulos, & Dorsch, 2008; De Gruchy & Coppel, 2008; Gallivan, Lising, Ammary, & Greenberg, 2007; Logie-MacIver & Piacentini, 2011; Long, Taubenheim, Wayman, Temple, & Ruoff, 2008; Richert, Webb, Morse, O'Toole, & Brownson, 2007; Tweneboah-Koduah, 2014). Recently, a West Australian project used the TTM within a social marketing approach to increase physical activity and public transport usage in the City of Cockburn (http://b-designworks.com/yourmove.html). Paralleling the popularity of this model within the health behaviour change field, a systematic review found that the TTM was the most frequently used theory in social marketing health interventions (Luca & Suggs, 2012).

In a study of particular interest to this current thesis, Logie-MacIver, Piacentini, and Eadie (2012) used the TTM framework within a qualitative approach to develop a greater understanding of the lived experience of trying to change dietary behaviour. Traditionally, as detailed previously in this chapter, the stages of change have been measured using quantitative methods. In contrast, Logie-MacIver and colleagues categorized the participants in their study into stage of

change groups based on three interviews conducted over an 18 month timespan, and used these interviews to gather a more detailed understanding of the change process for each stage group. The authors concluded that there is a need to combine motivational processes with the TTM framework to develop a deeper understanding of how people make and maintain change.

This thesis utilizes a similar qualitative approach to understanding the factors that householders in each of the stage of change report as being important in the decision to make a change to their energy use behaviour. The implications of the results for social marketing interventions are discussed.

The TTM and ERB

Researchers such as Bamberg (2007) and Nisbet and Gick (2008) have suggested that stage-models, such as the TTM, are beneficial in understanding how people change and in developing tailored interventions to facilitate desired pro-environmental behaviour change. The TTM, and other stage-based models, have recently been applied in a growing number of studies on ERB.

The Stages of Change concept from the TTM was used as a framework to investigate cycle commuting and attitudes and perceptions of barriers to change (Gatersleben & Appleton, 2007; van Bekkum et al., 2011). These studies found that perceptions of barriers to change were related to the different stages of change. Gatersleben and Appleton (2007) concluded that different strategies (process of change) are necessary to move people in different stages of change.

Freestone and McGoldrick (2008) used the decisional balance construct from the TTM to investigate consumers' ethical motives with the aim of determining whether a decisional balance shift operates as individual move through the stages of change. Based on their sample of nearly 1,000 respondents, they concluded that the decisional balance scale and Stages model are a useful construct in understanding ethical decision-making. They also found that the relative strengths of various ethical motivations remained stable across ethical issues.

A recent study by Weller et al. (2014) developed and validated an instrument to assess environmentally conscious eating behaviour, also known as 'green eating', using constructs from the TTM. This study found that eating behaviour, decisional balance and self-efficacy scores differed significantly by stage of change. The authors suggest that their instrument provides a basis for assessment of green eating, and the development of tailored interventions by stage of change.

Bamberg (2007, 2013b) used constructs from the Theory of Planned Behaviour, the Norm Activation Model, and the model of action phases, to develop his stage model of self-regulated behavioural change (SSBC), discussed in Chapter 2. Central to this model is the belief that behaviour change occurs as a person moves through a series of four stages. Similar to the TTM, within each of the SSBC's four stages the person is required to resolve a specific task to successfully change their behaviour.

Bamberg (2013a) applied this model to develop tailored interventions in a social marketing campaign to reduce car use. The results of this study found that the stage-based interventions did significantly reduce car use, while the standardized (non stage-based) intervention had no significant effect. Klöckner (2014) sought to improve research on stage models, using the SSBC model in particular to explore how people move through stages in the decision to purchase an electric car. His results supported a stage model, with different constructs being important at difference stages. Klöckner identified the prospect of distinguishing specific points in time during each stage where an intervention is most likely to trigger stage progression.

Summary

The Transtheoretical model represents a framework for understanding how people make conscious and intentional changes in their behaviour. The Stages of Change concept within this model outlines a series of five stages through which people move in a sequential fashion in the behaviour change process. Additionally, this framework identifies that at each stage of change, different motivations are at work and therefore different strategies will be required to facilitate

progression through the stages. This has paved the way for stage-matched, or tailored, interventions. Social marketing professionals have utilized the TTM's stage framework for audience segmentation and to develop tailored interventions.

The time spent in each stage and the sequential progression through the stages, as well as the distinctness of each of the five stages and the validity of stage-matched interventions, have been sources of criticism of the model. Despite the weight of criticism it has received, the Trantheoretical model and its constructs, such as the Stages of Change, remain an immensely popular and accessible paradigm for understanding the change process across a variety of behaviours. The Transtheoretical model is currently one of the most commonly used heuristics for understanding human behaviour change. It has been used as a framework for studying human behaviour change over several decades, and across many different behaviours. This is evidenced by statements such as "In the USA, Australia and the UK, the so-called transtheoretical 'stages of change' model has, since 1985, become a prominent feature of health promotion practice. Application of the model has affected service planning, provision and training agendas at local, regional and national levels in Europe and North America" (Bunton, Baldwin, Flynn, & Whitelaw, 2000, p. 55). Moreover, it continues to be promoted as a tool for behaviour change in academic texts (e.g. Mozdzierz, Peluso, & Lisieck, 2014).

Recently, researchers in the ERB field have extended the TTM and developed models that are more complex and, arguably, able to more fully explain and predict individual's ERB (e.g. Bamberg, 2013a; Klöckner, 2014). However, this increased complexity and predictive power comes at a cost. There is also greater difficulty in understanding the models, combined with difficulty in assessing all the variables and in implementation of the models in everyday situations. That is, while these models may be useful within a research setting, they are of limited use in a practical setting. In this sense, the TTM achieves a desirable balance between preciseness and practicality.

On the basis of it's immense popularity as a model of behaviour change, and it's potential to guide tailored programs to promote desired behaviour change, the TTM is the theoretical model chosen for use in this research project. This project represents an initial step in the application of the TTM framework to understanding how people change their residential electrical energy use behaviour. Specifically, this project is interested in whether these changes can be understood within the framework of the Stages of Change component of the TTM. This is of interest to the researcher, because if residential electricity use reduction behaviour change can be understood in terms of the Stages of Change, this then allows for the development of tailored programs to promote specific behavioural changes.

This thesis paper will now detail the development and validation of a stage of change measure for household energy use behaviour, and explore the themes expressed by householders as important factors in their decision to change their household energy use behaviour.

Chapter 6: Research Aim and Methodology

Failure is not fatal, but failure to change might be – John Wooden

This thesis has provided an integrative review of the literature regarding pro-environmental behaviour generally, household energy use specifically, and the Transtheoretical Model, establishing a rationale for its use as a framework for understanding householder's electrical energy use behaviour. The research design and methodology used in this thesis are now detailed.

Specific aims of this research project were to:

- Provide an integrative review of the literature regarding pro-environmental behaviour generally, and household energy use specifically;
- Modify and validate the original Stages of Change Questionnaire to assess individual's stage of change regarding their household electrical energy use;
- Identify stage-matched process of change for household energy use.

Due to the cross-sectional design of this study, no inferences can be made as to whether people have passed through prior stages of change, or will continue to move through further states.

Methodology and Research Design

In this research an embedded concurrent mixed method design was used. With this design type, both quantitative and qualitative data is gathered and analyzed within the context of a larger experimental design. This method provides an avenue for understanding the experimental results by including individual perspectives and provides a stronger understanding of the research questions than either qualitative or quantitative methods alone (Creswell, 2014). Inferences from the results of each strand are then unified to form 'meta-inferences' upon completion of the study (Mertens, 2015). An embedded concurrent mixed method design was chosen for this study to enable the development and validation of a stages of change measure through quantitative

methods, with a qualitative follow-up to provide an understanding of the perspectives of individuals regarding the processes they see as important in changing their behaviour.

Adaptation of SOCQ

The first step in this research project involved adapting the existing Stages of Change Questionnaire (SOCQ; McConnaughy et al., 1989; McConnaughy et al., 1983) to focus on an environmental behaviour (household electrical energy consumption). The original Stages of Change Questionnaire consists of 32 items, with eight items for each of four stages. The pilot Energy Behaviour Stages of Change Questionnaire (EBSOCQ) consisted of 75 items across the theorized five stages of the Transtheoretical Model (TTM). DeVellis (2012) suggests that having a large pool of items in the initial scale is a form of 'insurance' against poor internal consistency. He suggests an initial pool of from two to four times as large as the final intended scale, although he also cautions against an item pool that is too large to administer. Attempts were made within the pilot EBSOCQ to balance the need for a large item pool with the need for the survey to be a manageable length for respondents to complete.

Adaptation of the SOCQ included both changing the wording of existing items as well as adding and deleting items. These adaptations were informed by the theoretical underpinnings of the Transtheoretical Model. Following the recommendations of DeVellis (2012), a subset of the study sample group operated as an expert panel to refine the questions in the adapted questionnaire. The pilot EBSOCQ that subsequently emerged consisted of 75 items across the theorized five stages. Table 6.1 provides examples of adapted and new items within each stage.

Table 6.1: Example modifications and new items.

Stage	Original	Adapted	Deleted	Added
Precontemplation	As far as I'm concerned, I don't have any problems that need changing.	As far as I'm concerned, my energy-use does not need changing.	I'm not the problem one. It doesn't make sense for me to be here.	I don't really know whether I need to change my energy use
Contemplation	It might be worthwhile to work on my problem.	I think it could be worthwhile to change my energy use	I'm hoping this place will help me to better understand myself.	I don't really know whether or not it's worth changing my energy use
Preparation	This stage was not included in the original SOCQ			I am making plans to change my energy use
Action	I am doing something about the problems that had been bothering me	I am doing something to change my energy use	I have started working on my problems but I would like help	I am actively working on reducing my energy use
Maintenance	It worries me that I might slip back on a problem I have already changed, so I am here to seek help.	It worries me that I might slip back into my old habits regarding my energy use	I'm here to prevent myself from having a relapse of my problem	The changes I've made to reduce my energy use are now just a part of everyday life

Web-based survey

A self-administered questionnaire in the form of a web-based survey was then developed and launched. Qualtrics (www.qualtrics.com) was used as the web-based survey host, due to an existing license with Monash University. The full questionnaire consisted of four elements,

outlined sequentially here and described in further detail in the Measures section below. The full questionnaire is also included as Appendix A.

1. Demographic information;
2. EBSOCQ;
3. Open-ended questions;
4. BFI.

Participants could elect to leave the survey at any point. As such, some participants completed the EBSOCQ and did not continue on to provide answers to the open-ended questions and/or the BFI. Only people who completed all questions were included in the analysis for that survey.

It is acknowledged that both self-administered questionnaires and web-based surveys have advantages and disadvantages (Creswell, 2014; Mitchell & Jolley, 2013; Sue & Ritter, 2012), which will be discussed in more detail in the Discussion section of this thesis.

Operationalization

Within this research, participants were asked about their household energy use behavior. As a way of operationalizing this term, respondents were informed that "energy use behaviours within the household fall into two categories:

1. Efficiency behaviours – these are the things you do that require the purchase of a product. Examples include: installing solar hot water or electricity panels, buying energy efficient light bulbs, or buying energy efficient household appliances. Normally, these behaviours are once-off purchases. They don't require you to change your regular behaviour, but mean that you can still reduce your power use.
2. Consumption behaviours – these are the everyday, habitual things that you do with the intention to use less electricity. Examples include: turning off lights when you leave a room, using less heating or cooling, using the washing machine, dryer, dishwasher etc. less often or

only with a full load. These behaviours may have initially required you to change the way you previously acted and need you to continually keep that change going on a day-to-day basis."

Respondents were asked to consider their behaviour in both these categories when answering the questions.

Measures

Demographic Information

Essential demographic information regarding gender, year of birth, English-language skills, education, occupation, and living situation details were gathered. These data are used to ascertain the representativeness of the convenience sample to that of the Australian adult population, as well as to identify socio-demographic differences in the data collected.

EBSOCQ

The pilot Energy Behaviour Stages of Change Questionnaire (EBSOCQ) consisted of 75 statements about household energy use. Respondents were asked to rate their agreement with each statement on a 7-point Likert scale. The statements were presented to participants in a random order generated by the Qualtrics program.

Open-ended questions

An embedded design was used in which survey respondents were also asked to answer three open-ended questions centered on the factors involved in their decision-making regarding changing their household energy-use. These questions were:

1. What sorts of things helped you make, or would help you to make, that decision to change?
2. What was, or would be, the biggest or most influential factor in making this decision to change?
3. What sorts of things would you find helpful to make, or maintain, that change?

BFI

The Big Five Inventory (BFI: John et al., 1991) was included in the survey as a brief, highly reliable and well validated measure of personality factors to leave open an option to

explore potential moderating effects of personality as part of this study or at a later stage . The 44-item BFI uses short phrases based on the trait adjectives known to be prototypical markers of the Big Five personality domains. Respondents rate how much they agree with each statement on a 5-point Likert scale. In the end, any considerations of the impact of personality traits were considered outside the scope of this research project, and the option left to further research.

Participants

The target population for this research was the Australian adult population aged 18 years and over. This age range was sought as this study was seeking individuals who were making decisions regarding energy use that affect the household. A sample size in excess of 300 participants was sought. Tabachnick and Fidell (2013) caution that it is important that the sample size is large enough to ensure that correlations are reliable, and recommend sample sizes in the range of 100-200.

Participants were sought through advertising in community and workplace newsletters, and word of mouth referrals. The final pool of participants were a sample of convenience who either volunteered to complete the online questionnaire or were paid panel members sourced through Qualtrics. As such, the data were not weighted to represent the demographic composition of the target population. All data was screened and checked for error, and assumptions of normality were met, prior to analysis.

Comparison between sample groups

In order to determine whether there was a significant difference between the participants sourced through the Qualtrics panel and those who volunteered, an independent samples t-test was conducted between the two groups on the age variable.

There was a significant difference in age between the voluntary respondents ($M = 44.71$, $SD = 13.64$) and the paid panel respondents ($M = 48.08$, $SD = 15.39$; $t(363) = 2.175$, $p = 0.03$, two-tailed). However, the magnitude of the differences in the means (mean difference = 3.368, 95% CI: -6.414 to -3.23) was small (eta squared = .013).

Examination of the differences between the two sample groups on state of residence, current living situation, and urban vs. rural living also indicated few differences. Considering that the differences were relatively small, the paid and voluntary respondents were grouped together into one sample for analysis.

Demographics

A total of 386 people completed the EBSOCQ. The age of participants ranged from 19 – 81 years, with a mean age of 46 years (std. error = .771). As shown in Table 6.2, a little over half of the respondents were female, most spoke English as their first or fluent language, three-quarters lived in urban settings and the majority lived in owner-occupied housing.

Table 6.2: Demographics of sample.

What is your gender?

	Female	Male	No answer	Total
N	231	153	2	386
%	59.8	39.6	0.5	100

Do you speak English as your first or fluent language?

	Yes	No	Did not answer	Total
N	366	17	3	386
%	94.8	4.4	0.8	100

Would you describe where you are currently living as urban or rural?

	Urban	Rural	Unsure	Did not answer	Total
N	293	86	5	2	386
%	75.9	22.3	1.3	0.5	100

What is your current living situation?					
	Renting	Owner-occupied	Living with parents or family	Did not answer	Total
N	112	248	25	1	386
%	29	64.2	6.5	0.3	100

Participants were asked to state the postcode of their current residential address. This was then computed to give a state of residence. As shown in Table 6.3, each Australian state was represented within the survey, with most participants coming from Victoria, New South Wales and Queensland respectively. Approximately three-quarters (75.9%) of all respondents came from one of these three states.

Table 6.3: State of Residence

What is the postcode of your current residential address?		
State	**N**	**%**
New South Wales	99	25.6
Victoria	120	31.1
Queensland	74	19.2
South Australia	25	6.5
Western Australia	16	4.1
Tasmania	36	9.3
Northern Territory	1	0.3
Not stated	15	3.9
Total	386	100

Most respondents' highest level of formal education was completion of Secondary school (23.1%), followed by a Bachelor degree (20.5%) or a Certificate or Apprenticeship (17.9%). Nearly one-third of respondents indicated that they worked in a professional or managerial occupation (33.4%). The education levels and occupation types of respondents are shown in Table 6.4.

Table 6.4: Education and Occupation

What is your highest completed level of formal education?	**N**	**%**
Secondary school	89	23.1
Certificate or Apprenticeship	69	17.9
Diploma	52	13.5
Bachelor degree	79	20.5
Postgraduate Diploma	38	9.8
Masters degree	46	11.9
PhD	8	2.1
Other	4	1
Not stated	1	0.3
Total	386	100
Which occupation type describes you best?	**N**	**%**
Professional (e.g. lawyer, doctor, lecturer)	89	23.1
Manager/Executive (e.g. senior/executive management)	40	10.4
Technician/Associated Professional (e.g. veterinary assistant)	19	4.9
Clerical/Administration (e.g. bank teller, secretary)	51	13.2
Craft or Trades-person (e.g. plumber, electrician)	10	2.6
Service or sales (e.g. hairdresser, shop assistant)	15	3.9
Plant or machine worker (e.g. plant operator, bus driver)	1	0.3
Agricultural worker (e.g. farmer, fisherman)	2	0.5

Elementary occupation (e.g. cleaner, labourer)	11	2.8
Armed forces	3	0.8
Student	25	6.5
Unemployed	38	9.8
Retired	70	18.1
Prefer not to answer	12	3.1
Total	386	100

Comparison with the 'average' Australian

The Australian Bureau of Statistics (2013), based on the 2011 census data, report that just over half of all Australians were female, with an average age of 37 years. In 2011, 81% of people reported only speaking English at home. Nearly 90% of Australians lived in an urban area, with nearly two-thirds (68%) living in owner-occupied housing. This study's sample of participants was demographically similar to the national average, although the average age of participants was slightly higher than the national average (46 years compared to 37). The national average however included *all* ages, whereas this study only included those aged 18 years and over, which may account for the higher mean age reported in this study.

Most Australians lived in a capital city, with just over one-third living in either Sydney or Melbourne. In this study's sample, nearly three-quarters of the participants came from the states of Victoria, New South Wales or Queensland, which again is consistent with national figures.

The ABS report that the 'average' Australian had finished Year 12 (52%) with the most common highest level of qualification being a Certificate (40%). This is consistent with this study's sample, in which the highest level of formal education completed was Secondary school. This sample was more highly educated than the national average, with a Bachelor degree being the next most commonly completed level of qualification, followed by a Certificate or Apprenticeship.

Based on this comparison with the 2011 census data, it is considered that this study's sample is sufficiently representative of the 'average' Australian to suggest an adequate basis for assuming general applicability of the results.

Comparison between stages

In order to determine whether there were any demographic differences between participants in the different stages, a series of chi-square tests for independence were conducted using the short-form version of the EBSOCQ to allocate participants to one of the five stages of change.

A significant association was found between Stage of Change and the demographic factors Gender and Living Situation. More males were within the Precontemplation and Contemplation stages, while more females were in the Action and Maintenance stages. There were more people living in owner-occupied housing in the Maintenance stage, while people who were living in rented housing were more highly represented in the Precontemplation, Contemplation and Preparation stages.

There was no significant association between Stage of Change and Urbanity or State, indicating that neither the state of residence, nor living in either a rural or urban area, influenced the stage of change of the respondent. These results are shown in Table 6.5.

Table 6.5: Stage by demographic factors

Demographic	df	No. of cases	Value	*p*	*Cramer's V*
Living situation	5	360	14.424	.013	.200
Urbanity	5	379	1.749	.883	.068
Gender	5	384	13.560	.019	.188
Education	40	386	45.552	.252	.344
Occupation	65	386	65.984	.443	.413
State	35	386	38.052	.332	.314

Sample source	5	386	10.168	.071	.162

These results indicate there was a trend for females, and people living in owner-occupied housing, to be in the later stages of change, i.e. Action or Maintenance. On the other hand, males and people living in rented housing, tended to be in either the Precontemplation, Contemplation or Preparation stages.

Summary

This study used a mixed method design in which both quantitative and qualitative data was gathered through the use of a web-based survey. A sample of convenience was gathered from the Australian adult population. The participants in this study were demographically similar to the national average based on the 2011 census data. Importantly, this provides confidence in the generalizability of the findings from this study to the greater Australian population.

There were significant differences between the stages of change based on the demographic factors of gender and living situation. The implications of these differences will be explored in the final chapter of this thesis.

Chapter 7: Energy Behaviour Stages of Change Questionnaire – Refinement and Validation

Yesterday I was clever, so I wanted to change the world.
Today I am wise, so I am changing myself - Rumi

As mentioned in a previous chapter, this research project involved adapting and validating the existing Stages of Change Questionnaire (SOCQ; McConnaughy et al., 1989; McConnaughy et al., 1983) to focus on an environmental behaviour (household electrical energy consumption). Adaptation included both changing the wording of existing items as well as adding and deleting items. These adaptations were informed by the theoretical underpinnings of the Transtheoretical Model (TTM), which postulates that people move through a series of five stages in the change process. The pilot Energy Behaviour Stages of Change Questionnaire (EBSOCQ) consisted of 75 items across the theorized five stages.

Internal Reliability and Principal Components Analysis

To assess the reliability of the EBSOCQ, the internal consistency of each of the five stages was assessed using various statistical routines available in SPSS, including single-factor modelling using Principal Components Analysis (PCA) of each scale for item selection. The reliability of a scale indicates how reliably it measures what it measures. The more reliable the more it is assumed to be free from random error. However, reliability is not necessarily an indicator that there is a single unitary construct, but simply that as a reliable instrument all the items are in sufficient agreement and will perform in a consistent and predictable way. It is conceivable that each of the items within a set of items is capturing two highly correlated finer grained and related constructs. The most commonly used way of determining a scale's reliability is by ascertaining its internal consistency (Pallant, 2010). As the items within a scale are all supposedly related to the underlying variable they are measuring, it is also expected that they will have a strong relationship to each other (DeVellis, 2012). Internal consistency refers to the degree

to which the items that make up the scale or factor are all homogenous and measuring the same underlying attribute or attributes. Pallant (2010) refers to this as the extent to which the items 'hang together'.

A scale that has high internal consistency is one in which the items of the scale are highly inter-correlated (DeVellis, 2012). In this study, for the purpose of analysis, each stage was considered to be the equivalent to a single factor. The internal consistency of each factor within the EBSOCQ was first evaluated by calculating Cronbach's Coefficient Alpha (Alpha). Alpha provides an indication of the average correlation among all the items that make up the factor or scale. Values can range from 0 to 1, with higher values indicating greater reliability. The established 'rule of thumb' is that the Cronbach's Alpha coefficient of a scale should be above 0.7, and ideally between 0.8 and 0.9, however, in scales with fewer than ten items, Cronbach's Alpha may be lower (DeVellis, 2012; Pallant, 2010).

PCA is a particular approach to Factor Analysis (FA). Various factor analytic routines are used by scale developers to identify a set of reasonably independent or discriminant components or factors that can sensibly explain the majority of variance of a set of items. PCA can thus be used to reduce and refine an initially large number of items to a smaller set of items that reflect the same underlying factors (DeVellis, 2012; Tabachnick & Fidell, 2013). Jöreskog (1971) and Raykov (1997)have provided a rationale and process whereby individual factors can be evaluated for internal consistency and refined as single factor congeneric models. While this is generally carried out on the basis of Factor Analysis within Structural Equation Modelling, it can also be carried out using PCA with single factors.

As the EBSOCQ was based on an established theory, and the items within each stage were informed by this theory, the model was taken as an a priori model of identifiable stages. This assumes that each stage, although related, is sufficiently distinct to able to be discriminated from the others (discriminant validity), yet internally convergent. A single-factor PCA, taking in only those items within a single stage as recommended by Jöreskog (1971), was deemed an

appropriate way of selecting the items within each factor. The PCA Component Matrix indicates the loading on each item of the respective factor. The strength of each item's loading from this factor is useful in determining its value for retention.

The communality of an item refers to the amount of variance that item shares with other items within that factor (DeVellis, 2012). Extracted communalities indicate how much of the factor's variance is accounted for by each item. Items with a low communality therefore do not explain much of the variance within that factor and can be deleted without greatly effecting the reliability of the factor (DeVellis, 2012)

Each item was considered for retention or deletion on the basis of the amount of variance it contributed to the single factor. Those items that contributed the least were deleted until eight items per factor remained. Retaining eight items was considered to provide a sufficiently balanced set of items across the entire model, with a balanced set of items being important so as to avoid bloated specificity or construct under representation (Messick, 1995).

Pallant (2010) outlines two main issues in determining the suitability of a data set for analysis. These are the sample size and the strength of the relationship among the items. SPSS generate two statistical measures to help assess the factorability of the data. These are Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. It is recommended that Bartlett's test of sphericity should be significant ($p<0.05$) and the KMO value should be above 0.6 (Tabachnick & Fiddell, 2013). In all the PCA undertaken below, the Bartlett's test of sphericity remained below 0.00 and the KMO value remained about 0.6, which were all within respectable ranges for these analyses. The analyses conducted at each stage are described below.

Precontemplation stage

Within the pilot EBSOCQ, this factor contained thirteen items. The initial Cronbach's Alpha with all thirteen items was 0.934. A series of principal component analyses were undertaken to reduce the number of items in this factor down to a final number of eight. Table 7.1

shows the component matrix loading, the amount of variance explained by the item (communality) and the resultant Alpha for each step of the item selection process. The Cronbach's Alpha with the retained eight items was 0.927, indicating high correlation between all eight items.

Table 7.1: Results of principal components analysis – Precontemplation stage

Item/s deleted	Component loading	Extracted Communality	Cronbach's alpha after item/s deleted	No. of items remaining
Other people say I should change my energy use but I don't agree	0.621	0.386	.933	12
I'm not worried about my energy use	0.667	0.445	.932	11
I'm happy with my energy use as it is rather than change it;	0.692	0.479	.930	9
I don't think my energy use is an issue	0.671	0.450		
I'd rather deal with my energy use as it is than change it	0.714	0.510	0.927	8

The initial variance explained by a 1-component analysis with all 13 items was 56.546%. After reduction, the final variance explained by a 1-component analysis improved to 66.361%. The items retained in this factor, along with their Component Matrix loadings are shown in Table 7.2.

Table 7.2: Retained items – Precontemplation stage

Item	Component Matrix loading
I've never thought about changing my energy use	.796
I don't see why I should change my energy use	.859
There is no reason for me to change my energy use	.798
Other people may think about changing their energy use, but I don't see any need	.867
I guess I could change my energy use, but I don't see the point	.847
I don't understand what the benefits would be of changing my energy use	.774
I may be using too much energy, but I'm not really concerned about it	.794
I don't really know whether I need to change my energy use	.775

According to the TTM, individuals in the Precontemplation stage are not considering making a change to their behaviour within at least the next 6 months, and may be unaware or under-informed regarding the harmful consequences of their behaviour. They may also be defensive of their behaviour, deny that their behaviour is problematic and avoid references to their behaviour. Individuals within this stage may also underestimate the benefits of change and overestimate the difficulty of changing (DiClemente, 2003a; Prochaska, 1999; Prochaska et al., 1997).

The items that were deleted from this factor appear to indicate a greater degree of consideration of changing, or awareness of a need to change, than did the retained items, which is not reflective of the intent of this factor. In contrast, the item that loaded most heavily on this

factor ('Other people may think about changing their energy use, but I don't see any need'), reflects the lack of awareness of a need to change that is characteristic of this stage.

Contemplation stage

This stage was assessed using 17-items. Table 7.3 shows the component matrix loading, the amount of variance explained by the item (communality) and the resultant Alpha for each step of the item selection process. The initial Cronbach's Alpha with all seventeen items was 0.842, however this improved to 0.900 with the retained eight items. After reducing to eight items, a single factor solution accounted for nearly 60% of the variance. The items retained in this factor, along with their Component Matrix factor loadings are shown in Table 7.4.

Table 7.3: Results of principal components analysis – Contemplation stage

Items taken out	Component loading	Extracted Communality	Cronbach's alpha after item/s deleted	No. of items remaining
I think it might be time to start doing something about my energy use;	0.090	0.008	0.906	12
I've thought about changing my energy use;	-0.306	0.094		
I think it could be worthwhile to change my energy use;	-0.326	0.106		
I would like some ideas on how to change my energy use;	0.035	0.001		
I guess I could change my energy use;	0.027	0.001		

I am considering whether or not to change my energy use;	0.512	0.262	0.900	8
It seems like my energy use is important to consider but I'm not sure;	0.612	0.375		
I don't want to change my energy use just because I feel like I have to;	0.601	0.361		
I'm undecided about what to do to change my energy use.	0.657	0.432		

Table 7.4: Retained items – Contemplation stage

Item	Component Matrix loading
I've given some thought to changing my energy use, but I'm not really sure	.758
I probably could change my energy use, but I'm not sure	.700
I've thought about changing my energy use, but it's all too hard	.799
I know I probably should change my energy use, but it seems too difficult to do	.766
I've been thinking about changing my energy use, but I haven't made any decisions yet	.773
I'm still deciding if I want to change my energy use	.812
I'm undecided about changing my energy use	.785

I don't really know whether or not it's worth changing my energy use	.748

In the Contemplation stage, there is an intention to change behaviour within the next 6 months. People within this stage are more aware of the benefits of changing, but also of the costs of changing. This stage is characterized by a weighing up of the pros and cons of change, which can result in high levels of ambivalence. The TTM suggests that individuals may seek information to assist with their consideration of the positive and negative aspects of the behaviour, and may look to peers and role models regarding how they managed their behavioural change (DiClemente, 2003a; Prochaska, 1999; Prochaska et al., 1997).

The items that were removed from this factor do not appear to have adequately reflected the sense of weighing up of the pros and cons and ambivalence that is a hallmark of this stage. Additionally, some of the items that were deleted appear to have been complicating the sense of *whether* to change (e.g. 'I'm still deciding if I want to change my energy use') with confusion over *how* to change (e.g. 'I would like some ideas on how to change my energy use'), which is more reflective of the Preparation stage.

Preparation stage

In the pilot EBSOCQ, this stage was assessed using 16-items. Table 7.5 shows the component matrix loading, the amount of variance explained by the item (communality) and the resultant Alpha for each step of the item selection process. The final 1-component analysis with eight items accounted for 67% of the variance, with Alpha remaining at a respectable 0.929.

Table 7.5: Results of principal components analysis – Preparation stage

Items taken out	Component loading	Extracted Communality	Cronbach's alpha after item/s deleted	No. of items remaining
I am nearly ready to change my energy use;	0.480	0.231	0.943	12
I'd like to change my energy use and I'd like to know the best way to change;	0.657	0.432		
I am getting ready to change my energy use;	0.660	0.436		
I am doing things now so that I can change my energy use.	0.669	0.447		
I want to change my energy use;	0.697	0.486	0.935	9
I am putting in place measures so that I can change my energy use;	0.708	0.501		
I am gathering the information and resources that I need to change my energy use.	0.753	0.567		
I am looking at finding out more about my current	0.784	0.615	0.929	8

energy use so that I can
know how I can change it

The items retained in this factor, along with their Component Matrix loadings are shown in Table 7.6.

Table 7.6: Retained items – Preparation stage

Item	Component Matrix loading
I am making plans to change my energy use	.834
I am finding out ways I can change my energy use	.813
I am exploring new ways to change my energy use	.838
I am looking for ways to change my energy use	.850
I am investigating my options to change my energy use	.822
I plan to change my energy use	.783
I am considering different ways of changing my energy use	.793
I want to change my energy use and I'm looking at ways to change it	.813

In the Preparation stage, people actively intend and are committed to take action, usually defined as within the next month. They develop a plan and strategy for change, and may have already made some significant preparatory moves such as purchasing necessary equipment. The tasks required at this stage are to increase commitment to change and devote the time and energy required to make the change (DiClemente, 2003b; Prochaska, 1999).

The item "I am nearly ready to change my energy use" did not explain much of the variance within this factor, presumably as it doesn't accurately reflect the active intent and commitment to change. A number of the other items are lengthy and are potentially confusing or

involve other elements within the decision to change. As such, these deleted items may appear less directly focused on active intent and commitment to change, compared to the retained items.

Action stage

This stage was assessed using 16-items. The initial Cronbach's alpha with all sixteen items was 0.904, which improved to 0.912 with the retained eight items. The component matrix loading, the amount of variance explained by the item (communality) and the resultant Alpha for each step of the item selection process can be seen in Table 7.7. The total variance accounted for by the eight items with a 1-factor solution was 62.433%.

Table 7.7: Results of principal components analysis – Action stage

Items taken out	Component loading	Extracted Communality	Cronbach's alpha after item/s deleted	No. of items remaining
Even though I'm trying, I could do with some help to change my energy use;	0.376	0.141	0.918	12
I'm trying hard, but I still need help to change my energy use;	0.342	0.117		
Maybe I've done some things to change my energy use, but there is still more I could do;	0.490	0.240		
I am consciously trying to change my energy use, even though sometimes I'm not consistent with it.	0.465	0.216		

I've definitely made some changes, but I could do more to change my energy use;	0.578	0.334	0.915	9
I might not always do the changes, but I feel I am starting to make a positive change to my energy use;	0.665	0.442		
I might be inconsistent, but mostly I am following through on the changes I've made to my energy use.	0.590	0.348		
At times it is difficult, but I am making changes to my energy use	0.683	0.467	0.912	8

Table 7.8 shows the items retained in this factor and their Component Matrix loadings.

Table 7.8: Retained items – Action stage

Item	Component Matrix loading
I am doing something to change my energy use	.827
I am making changes to the way I use energy	.851
I am working hard at making changes to my energy use	.781
Even though I sometimes slip up, I am making positive changes to reduce my energy use	.783

Even though there is more I can do, I have made a start at reducing my energy use	.706
While other people may think or talk about changing, I am actually doing something about reducing my energy use	.817
I am actively working on reducing my energy use	.820
After thinking and planning it for some time, I am now finally actively working on reducing my energy use	.724

In the Action stage, people have made specific changes to their behaviour, usually within the last 6 months. This stage generally represents the implementation of the plan developed within the Preparation stage. This stage represents a shift from the previous stages, which emphasized intention, consideration and planning, to observable behaviour change (DiClemente, 2003b; Prochaska, 1999).

Within the TTM, the Action stage incorporates the need for vigilance and continued effort to maintain change. To reflect this aspect, the original SOCQ measure included items such as "Even though I'm not always successful in changing, I am at least working on my problem" (McConnaughy et al., 1983). Despite this, it was the items within the pilot EBSOCQ that reflected a lack of consistency, or the need for assistance in changing, that did not load heavily on this factor. That is, it was the items that more 'purely' addressed active change that best fit this factor.

Maintenance stage

This stage was initially assessed using 14-items. With the all these initial items, this stage had relatively poor internal consistency, with a Cronbach's alpha of 0.656. After item-reduction and with the remaining eight items, Cronbach's alpha improved to 0.869. Whilst this evidenced improved internal consistency, this factor remains as the weakest of the five stages. With the retained eight items, a single factor solution accounted for 53.581% of the variance.

The component matrix loading, the amount of variance explained by the item (communality) and the resultant Alpha for each step of the item reduction process can be seen in Table 7.9. The items retained in this factor and their Component Matrix loadings are shown in Table 7.10.

Table 7.9: Results of principal components analysis – Maintenance stage

Items taken out	Component loading	Extracted Communality	Cronbach's alpha after item/s deleted	No. of items remaining
It worries me that I might slip back into my old habits regarding my energy use;	-0.483	0.233	0.859	10
Every now and then I am tempted to do something that I know isn't helping me to reduce my energy use;	-0.285	0.081		
Sometimes I find it difficult to maintain the energy use reduction measures that I've put in place;	-0.375	0.141		
Sometimes I am tempted to go back to my old energy use behaviour, even though I am trying to	-0.575	0.330		

change.				
I couldn't imagine not doing the things I do now to minimize my energy use;	0.432	0.186	0.869	8
While there may be more that I could do to minimize my energy use, I am happy with the changes I've made so far	0.550	0.303		

Table 7.10: Retained items – Maintenance stage

Item	Component Matrix loading
Every day, I am doing something to help me reduce my energy use	.762
Most of the time, I am doing really well with my attempts to reduce my energy use	.816
I hardly even think about reducing my energy use now - it just comes naturally	.552
The changes that I have made to reduce my energy use are now just a part of everyday life	.800
I know what I need to do to reduce my energy use and I usually do it	.775
I've made some really permanent changes to reduce my energy	.798

use	
I want to keep my energy use low	.688
Sometimes it is not convenient, but I still stick with the changes I've made to reduce my energy use	.620

Within the TTM, it is considered that for true behaviour change to occur, the new behaviour must become habitual and integrated into the individual's lifestyle. Within the Maintenance stage, the new behaviour becomes automatic, requiring little or no conscious thought or effort to sustain it. There is, however, always the risk that individuals will revert to their previous behavioural patterns (relapse), with the new behaviour only becoming fully maintained when there is little or no effort to maintain it and the person can exit the cycle of change. The tasks required at this stage are to maintain the change in behaviour across different situations and in the face of challenges (DiClemente, 2003b).

In the main, the items that were deleted from this factor reflected a degree of temptation and negativity about the prospect of maintaining the behavior change. Whilst this is in keeping with how this stage is conceptualized within the TTM, it appears that these items do not reflect the stage well, similar to the results from the Action stage. Rather, items that are more positively worded toward maintaining changes loaded more heavily on this factor.

Summary

The initial items in the pilot EBSOCQ were selected for retention or deletion based on a series of single-factor principal components analyses on each of the five factors (stages), such that eight items were retained within each stage. Each of these final factors had high internal consistency, as detailed in Table 7.11.

Table 7.11: Cronbach's alpha for each factor

Factor/stage	Cronbach's alpha
Precontemplation	0.927
Contemplation	0.900
Preparation	0.929
Action	0.912
Maintenance	0.869

Dimensionality and Fit of the 40 Item Model

Using Structural Equation Modelling (SEM) for confirmatory analysis is often considered overly stringent for related constructs such as in personality where factors are reasonably correlated (Browne, 2001). Similar to personality factors, the factors that form the stages in the TTM are also theoretically related. The more appropriate confirmatory procedures for personality research were thus adopted for this research, that is, a standard form of factor analysis (PCA) with Procrustes rotation (McCrae, Zonderman, Bond, Costa, & Paunonen, 1996). This method compares a targeted rotated solution to an ideal matrix (i.e. where items either load completely or not at all) providing an estimate of how well the items fit.

The 40 items were subjected to principal components analysis (PCA) using SPSS version 21. A Kaiser-Meyer-Olkin value of .958 (Kaiser, 1970, 1974), and a significant Bartlett's Test of Sphericity (χ^2 =10974.56, df = 780, $p < .001$; Bartlett, 1954) were found, supporting the factorability of the correlation matrix. Cattell's (1966) scree test and Parallel Analysis (Watkins, 2000) provided support for the retention of five components, which explained 38.72%, 13.59%, 6.47%, 3.46%, and 2.65% of the variance respectively. A Varimax rotation revealed the presence of simple structure (Thurstone, 1947), however a number of items loaded primarily on theoretically incorrect components. The results of the PCA are presented in Table 7.12.

Table 7.12: PCA of 40 Item Scale with Procrustes Rotation

Items	COMM	1	2	3	4	5	CC
PRE_1	.64	**.71**	.17	-.07	-.31	-.10	.80
PRE_2	.74	**.78**	.10	-.24	-.24	.06	.86
PRE_3	.71	**.72**	-.01	-.30	-.24	.20	.85
PRE_4	.71	**.78**	.24	-.13	-.10	-.13	.83
PRE_5	.46	**.61**	.24	-.04	.02	-.14	.80
PRE_6	.61	**.74**	.18	-.06	-.11	-.15	.85
PRE_7	.66	**.76**	.19	-.11	-.14	-.13	.85
PRE_8	.61	**.67**	.27	-.27	-.09	-.07	.76
CON_1	.63	.36	**.70**	.02	-.03	-.08	.96
CON_2	.64	.20	**.72**	-.07	-.07	-.27	.93
CON_3	.65	.46	**.64**	.08	-.17	-.06	.88
CON_4	.64	.34	**.67**	-.01	-.20	-.16	.91
CON_5	.59	.39	**.64**	.04	-.14	-.08	.92
CON_6	.64	**.60**	.50	.02	-.17	-.08	.76
CON_7	.65	**.66**	.43	-.10	-.03	-.10	.70
CON_8	.66	**.71**	.32	-.17	-.09	-.13	.56*
PREP_1	.69	-.15	.03	**.78**	.24	.04	.89
PREP_2	.67	-.08	-.13	**.74**	.30	.12	.84
PREP_3	.74	-.04	-.14	**.75**	.40	.07	.80
PREP_4	.73	-.22	.07	**.77**	.28	.04	.84
PREP_5	.71	-.01	-.13	**.81**	.19	.07	.92
PREP_6	.66	-.15	.21	**.74**	.21	-.03	.86
PREP_7	.68	-.18	.10	**.79**	.14	.06	.91
PREP_8	.67	-.16	-.02	**.77**	.10	.20	.92

ACT_1	.68	-.36	-.07	.43	**.53**	.28	.63*
ACT_2	.73	-.28	-.10	.44	**.66**	.11	.80
ACT_3	.66	-.03	-.19	.44	**.64**	.14	.81
ACT_4	.62	-.20	-.01	.33	**.68**	.11	.86
ACT_5	.56	-.39	.14	.33	**.48**	.21	.63*
ACT_6	.70	-.22	-.23	.28	**.63**	.36	.69*
ACT_7	.64	-.24	-.16	.42	**.54**	.31	.65*
ACT_8	.58	.02	-.14	.46	**.58**	.10	.80
MAIN_1	.63	-.16	-.12	.31	**.62**	.32	.58*
MAIN_2	.67	-.26	-.15	.20	.47	**.56**	.82
MAIN_3	.64	.07	-.12	-.02	.10	**.78**	.97
MAIN_4	.64	-.26	-.25	.11	.40	**.58**	.84
MAIN_5	.65	-.20	-.19	.32	.27	**.63**	.85
MAIN_6	.64	-.31	-.20	.18	.45	**.53**	.79
MAIN_7	.56	**-.52**	-.04	.13	.33	.41	.68*
MAIN_8	.58	-.12	-.08	.17	**.73**	.08	.32*
Factor Congruence		.79	.84	.87	.72	.77	

Note. COMM = communalities; CC = congruence coefficient; primary loading bolded; * indicates poor item congruence.

A Procrustes rotation was conducted using Orthosim version 2.01 (Barrett, 2006). The overall solution congruence with an ideal target matrix was .80, with values of .85 and above indicating similarity (Mulaik, 1972; ten Berge, 1986). Two additional measures of congruence were also calculated, with the Double-Scaled Euclidean Distance (.86) and the Kernel Smoothed Distance (.81) suggesting that the solution congruence was somewhat similar, but less than ideal (Barrett, 2005; Hastie, Tibshirani, & Friedman, 2009).

Item Response Theory and Item Selection

Item response theory allows researchers to develop research questions that are, at least theoretically, free from both test item and examinee bias (Henard, 2000). IRT therefore allows the researcher to achieve greater reliability through establishing survey item characteristics that are independent of the characteristics of the person completing the survey (DeVellis, 2012). As such, IRT approaches enhance reliability through identifying better items rather than more items, as in classical test theory (DeVellis, 2012). A further advantage of IRT is its ability to identify items that represent the full continuum of the factor being measured. This helps to assure that the final scale is reliable across a wide range of the factor being measured (DeVellis, 2012).

Item Response Theory (IRT) analysis was used to further evaluate the Stages scales, and to derive a short version for each scale. IRT uses a probabilistic model to map the response patterns of participants on each item, which allows for estimates of how well items and individuals fit (Pallant & Tennant, 2007). IRT models also provide information about how well a construct is measured across the range of responses, and how well items can discriminate between individuals of differing levels of the construct under examination, allowing for careful evaluation of items (Jacobs & Costello, 2013).

The eight item Stages scales were subjected to IRT analysis using IRTPRO (Scientific Software International, 2011) and evaluated for goodness of fit to a two-parameter graded model. Adequate fit of the facet scale was indicated by a non-significant ($p > .01$) M_2 limited information goodness of fit statistic (Maydeu-Olivares & Joe, 2006), however, inadequate fit values can be overlooked somewhat when there is also a small root mean square error of approximation value (RMSEA < .07; Cai, Maydeu-Olivares, Coffman, & Thissen, 2006). Model fit was investigated further with $S - X^2$ item level diagnostics (Orlando & Thissen, 2000, 2003), local dependency (Chen & Thissen, 1997), and differential item functioning (DIF) by gender (Cai, 2008).

Item misfit can result from poorly constructed items, while local dependency indicates redundancy in an item pair. DIF exists where response patterns differ by gender for the same estimated level of the construct, indicating the presence of bias in an item. Items that demonstrated misfit, local dependency, or differential item functioning were systematically removed until the best combination of items was achieved for each shortened Stages scale. The results of the IRT analysis are presented in Table 7.13.

Table 7.13: IRT Results for Stages Eight Item and Four Item Scales

Scale	M_2	DF	Probability	RMSEA	Marginal Reliability	Items Retained
Eight Item						
Precontemplation	3909.07	1000	<.001	0.09	0.92	-
Contemplation	6554.70	1000	<.001	0.12	0.92	-
Preparation	19937.51	1000	<.001	0.22	0.95	-
Action	9967.48	1000	<.001	0.15	0.93	-
Maintenance	4686.90	958	<.001	0.10	0.92	-
Four Item						
Precontemplation	812.78	212	<.001	0.09	0.87	3,4,7,8
Contemplation	1465.15	212	<.001	0.12	0.86	3,4,5,7
Preparation	4199.09	212	<.001	0.22	0.90	2,3,4,8
Action	1500.93	212	<.001	0.13	0.86	1,3,4,8
Maintenance	1581.90	212	<.001	0.13	0.88	2,4,5,6

From Table 7.13, it can be seen that neither the original eight item scales nor the shortened four item scales demonstrated adequate fit to the IRT 2-parameter graded model. This lack of fit is perhaps less surprising when it is considered that the scales are not measures of constructs per se; rather the scales represent a model of progress development, and the scales exist to

quantitatively determine in which stage individuals are currently operating. For the purposes of selecting the best items, the IRT analysis has been able to demonstrate significant improvements in item fit, local dependency, and differential item functioning.

Dimensionality and Predictive Validity of the Short Version

The 20 item model was subjected to principal components analysis (PCA) using SPSS version 21. A Kaiser-Meyer-Olkin value of .932 (Kaiser, 1970, 1974), and a significant Bartlett's Test of Sphericity (χ^2 =4530.32, df = 190, $p < .001$; Bartlett, 1954) were found, supporting the factorability of the correlation matrix. Cattell's (1966) scree test and Parallel Analysis (Watkins, 2000) provided support for the retention of five components, which explained 41.40%, 14.72%, 7.42%, 4.15%, and 3.61% of the variance respectively. A Varimax rotation revealed the presence of simple structure (Thurstone, 1947), with all components showing a number of strong loadings, and all variables loading substantially on only one component.

A Procrustes transformation was applied using Orthosim version 2.01 (Barrett, 2006). The overall solution congruence with an ideal target matrix was .84, with values of .85 and above indicating similarity (Mulaik, 1972; ten Berge, 1986). Two additional measures of congruence were also calculated, with the Double-Scaled Euclidean Distance (.88) and the Kernel Smoothed Distance (.85) both indicating similarity (Barrett, 2005; Hastie et al., 2009). The results of the 20 item model are presented in Table 7.14.

Table 7.14: PCA of 20 Item Scale with Procrustes Rotation

	COMM	1	2	3	4	5	CC
PRE_3	.81	**.83**	.04	-.23	-.26	.02	.91
PRE_4	.75	**.76**	.35	-.08	-.05	-.22	.85
PRE_7	.71	**.74**	.31	-.07	-.05	-.26	.86
PRE_8	.64	**.65**	.33	-.26	.03	-.20	.79
CON_3	.78	.35	**.77**	.08	-.23	-.10	.88
CON_4	.73	.17	**.79**	-.05	-.15	-.23	.93
CON_5	.65	.20	**.73**	-.06	.11	-.24	.92
CON_7	.71	.55	**.56**	-.11	.18	-.24	.69
PREP_2	.70	-.11	-.08	**.75**	.31	.17	.82
PREP_3	.78	-.05	-.11	**.78**	.35	.19	.81
PREP_4	.78	-.30	.09	**.78**	.21	.17	.84
PREP_8	.78	-.17	.00	**.84**	-.07	.23	.94
ACT_1	.70	-.35	-.07	.43	.33	**.53**	.55*
ACT_3	.65	-.03	-.18	.49	**.50**	.34	.76
ACT_4	.68	-.18	-.04	.35	**.65**	.32	.89
ACT_8	.64	-.05	-.03	.42	**.62**	.28	.89
MAIN_2	.69	-.14	-.21	.21	.19	**.74**	.85
MAIN_4	.64	-.14	-.29	.11	.21	**.69**	.82
MAIN_5	.69	-.10	-.13	.30	.07	**.76**	.89
MAIN_6	.75	-.22	-.19	.17	.15	**.78**	.87
Factor Congruences		.85	.87	.86	.76	.84	

Note. COMM = communalities; CC = congruence coefficient; primary loading bolded; * indicates poor item congruence.

Finally, reliability of the subscales in the 20-item model was investigated, and correlations between the 20 and 40 item subscales were calculated. Levy (1967) suggested that simple correlations between short-form scales and original scales were overestimated due to the shared variance in matching items across scales, and proposed a method of correction which corrects for the overestimation by accounting for the shared variance in the original scale. The results of the reliability and corrected short-form correlation are presented in Table 7.15.

Table 7.15: Reliability and Corrected Short-form Correlation for 20 item model

Scale	Cronbach's α	Inter-item correlation range	Corrected short-form correlation
Precontemplation	.85	.51-.66	.96
Contemplation	.83	.51-.64	.87
Preparation	.88	.59-.68	.90
Action	.82	.51-.57	.87
Maintenance	.85	.54-.62	.86

Discussion

This present study refined and validated the Energy Behaviour Stages of Change Questionnaire (EBSOCQ), which was adapted from the original Stages of Change Questionnaire (SOCQ) developed by McConnaughy et al. (1983). Similar to the SOCQ, the EBSOCQ uses eight items to measure each stage. A short-form, 20-item version was also developed, which uses four items to measure each of the five stages. Respondents rate their agreement with each item statement on a 7-point Likert scale. Scores within each stage are summed and stage allocation is based on the highest stage score.

Unlike the SOCQ, the EBSOCQ was found to fit a five-factor model, although this was clearer in the short-form version than the long version. That is, the EBSOCQ ostensibly can be used to discriminate between people in each of the TTM's proposed five stages of change. The original developers of the SOCQ identified four factors, which align with the stages of

Precontemplation, Contemplation, Action and Maintenance (McConnaughy et al., 1989; McConnaughy et al., 1983). However, other researchers found that the SOCQ supported a three-factor model, which conceptually combined Action and Maintenance into a single factor (Eckhardt & Utschig, 2007; Hemphill & Howell, 2000; Yen et al., 2010).

Adaptations of the SOCQ, such as the Pain SOCQ (Kerns et al., 1997) and the URICA-DV (Levesque et al., 2000) found the same four factor structure as in the original SOCQ; whereas the adolescent version of the Pain SOCQ supported the three-factor model that combined Action and Maintenance into a single factor (Guite et al., 2011). Rather than reflecting inadequacy of the TTM itself, research that has found three or four factor solutions may instead have been influenced by the times that were used in their scales and the sample itself.

McConnaughy et al. (1983) suggest that the Preparation stage (which they term Decision Making), was not apparent as a separate stage because it is "such a transitory phenomenon that people cannot be assessed when making important but quick commitments" (p. 374). In their study, subjects were adult outpatients attending their first session of psychotherapy. Similarly, in explaining why they did not find Preparation as a separate factor in the Pain SOCQ, Kerns et al. (1997) suggest that their sample group of patients were not sufficiently informed about the program to enable them to actively engage in the preparation aspects of that stage. It is possible that within these sample groups, the time and thought required to prepare to change their behaviour was minimal and therefore not distinguishable as a separate stage.

The Preparation stage is characterized by people planning for an upcoming change, which may also include buying any necessary equipment. To move through this stage, people need to devote the time and energy required to make the change (DiClemente, 2003b; Prochaska, 1999). It could be argued that changing household energy use behavior takes place over a longer period of time and requires more conscious thought, planning, and the purchasing of equipment, such that this stage appeared as a separate factor within this current study.

The implications and limitations of this study are discussed in the concluding chapter.

Chapter 8: Themes in Stages and Processes of Change

Be the change you wish to see in the world - Mahatma Gandhi

The Transtheoretical Model was the theoretical framework for this study. Within this model, change is seen as a staged process over time in which different processes exist within different stages to motivate transition to the next stage. A qualitative method was chosen to describe and interpret the experiences of the research participants within each of the identified stages, and the factors they saw as important in their decision to change. This qualitative phase complemented the collection of quantitative data, which enabled the development and validation of a stages of change measure. This research aimed to be interpretative rather than purely descriptive. It took a nomothetic perspective to allow for the identification of general patterns of behavior across groups of people (Ponterotto, 2005), and enabled the use of participants' own words to describe their behaviours. The goal of this approach is an understanding of relationships that leads to universal or large-scale predictions or explanations, based on established theory (Richards & Morse, 2013).

As mentioned in the previous chapter outlining the research methodology, three open-ended questions were included within the web-based survey. The intent of these questions was to identify the motivational elements of people's decision to initially make, and then maintain, a change in their energy-use behaviours. These questions were:

1. What sorts of things helped you make, or would help you to make, that decision to change?
2. What was, or would be, the biggest or most influential factor in making this decision to change?
3. What sorts of things would you find helpful to make, or maintain, that change?

Participants were not required to answer all three questions. A total of 926 responses across the three questions were gathered from 339 respondents.

Coding

A semantic analysis of the themes from these responses was undertaken. With a semantic approach, the themes are identified from the explicit, stated data. That is, the researcher is not looking for analysis at a deeper level beyond that which a participant has stated (Braun & Clarke, 2006).

A preliminary review of the early responses generated an initial coding tree. These themes were also informed by other research on determinants of pro-environmental behavior, such as discussed in previous chapters.

The DeDoose program (Dedoose Version 4.12.4, 2014) was used to code and analyze the responses. The coding tree was dynamic, with new parent and child codes added throughout the coding process. The same coding tree was used to code responses from each of the three questions.

Each person's response to each question was coded on the themes expressed, such that any response may have multiple codes attached to it, reflecting the multiple determinants of people's behaviour. The themes that were construed from these responses are discussed in more detail below, commencing with the most common themes. In keeping with the spirit of qualitative analysis to 'tell a story' rather than 'report data', this discussion will be more narrative in nature.

A number of people responded "*don't know", "not sure", "none",* or *"nothing"*. It is not clear whether these responses indicate that they were unaware of what factors were influential in their decision-making, or whether they were 'filler' responses within the questionnaire.

Additionally, rather than reporting what factors had influenced the decision to change, some respondents answered in terms of what changes they had already made. These changes ranged from small, everyday changes such as turning off lights when not in use, through to larger, once-off changes such as changing to LED light bulbs, buying more energy-efficient appliances, getting double-glazing and installing solar power.

Aim and interpretation of the questions

Whilst similar, the first two questions were conceptualized as targeting different factors. The aim of the first question ("what helped you make, or would help you to make, that decision to change?") was to have respondents think broadly about the range of factors that played a role in their decision to change their energy use. The intent of the second question ("what was, or would be, the biggest or most influential factor in making this decision to change?") was to move people from identifying *all* the factors in their decision to identifying the *main* factor. This question was interpreted variously by participants and was quite possibly too broadly worded to enable the identification of one key factor in the decision to change.

The aim of the third question ("what sort of things would you find helpful to make, or maintain, that change?") was to investigate the factors that motivate people to continue with their changed behavior. Fewer people responded to this question than to the first two questions, with 287 responses coded.

Discussion of themes

Cost

Overwhelmingly, cost was the most oft-cited and primary factor in the decision to change energy-use behaviour in the household. Two-thirds of the respondents identified this as the most influential factor in changing their behavior. Predominantly, respondents referred to the increasing or high costs of their current electricity bill and/or a desire to lower their energy bill.

> *"The ever rising price of our power bill has made me make the decision to conserve energy"*
>
> *"The main reason behind me making so many changes to my energy use was the ever-increasing electricity bills that my household was receiving. In order to minimize the electricity bill and therefore save money, ensuring that I practiced energy saving techniques as much as possible, was the best option to reduce the bill."*

Even when other factors were mentioned, such as environmental benefits, these were seen as being secondary, or in addition, to the financial motivation.

"Primarily the cost of electricity. Our household budget was suffering due to the increased cost and the fear of future increases prompted me to look at energy usage in our home. Environmental concerns also played a part but I would say cost was the main factor."

"The increase in world pollution i.e. greenhouse gases plus the ever increasing cost of energy. So both environmental and economic reasons."

Associated with the financial costs of electricity, a number of respondents indicated that the provision of financial assistance was, or would be, a factor in their decision to change. This financial assistance could be in terms of: subsidies or rebates to purchase energy-efficient technologies *"govt. subsidies to help purchase Solar Panels", "availability of rebate for purchase of solar electrical systems";* discounts on usage *"good discount on usage", "maybe a loyalty program with energy provider company to reward people who actually save energy";* or incentives for installing energy-efficient technologies *"positive financial incentive to switch to green options".*

Fifty percent of those who had originally nominated financial assistance (in the form of rebates or subsidies) as a factor in their decision-making identified it as the primary factor. This suggests that while there is a role for financial assistance in encouraging people to change their behavior, for most people the decision to change appears to be made on the basis of saving electricity costs, with the provision of a rebate or subsidy providing a secondary incentive. In contrast, nearly double the number of respondents who had identified rebates and subsidies as an influential factor at Question 1 identified it as a factor in maintaining change.

Interestingly, while two-thirds of the respondents nominated cost as the most influential factor in their decision to change, only approximately one-third of people indicated that cost was a factor in maintaining the behaviour change. That is, while financial factors were seen by many

as a primary factor in changing, cost was reported by far fewer people as a factor in continuing with that change:

"We have made major changes to our home and installed 24 solar panels and the benefits have been greatly reduced expenses"

The role of discounts and rebates was seen as a factor in maintaining change, however, a number of people also indicated that they would like to see greater rebates or incentives for lowered energy use. More people nominated discounts and rebates as a maintaining factor than identified it as an initial factor in the decision to change. While discounts and rebates may not be sufficient in themselves to engender behavior change, they possibly play a larger motivational role in maintaining that change, as indicated by responses such as:

"More incentive from the government to change with better rewards for people who do make the change to reduce their energy consumption"

Information

The need for more information to assist in making the decision to change was also expressed. Primarily, respondents sought information about their current energy use and/or the energy use of certain appliances within the household:

"More real-time information on how energy is being consumed whenever I used an electrical appliance"

"We have solar panels and my husband installed a system that records hourly, electricity consumption and production. Sounds nerdy but we like to look at the graph plotting our use and our production"

Some people indicated that knowledge about their own energy use compared to others would be helpful:

"Transparency about our household energy use helped a lot (benchmark against other households). Victorian government has a great website to display the usage of energy and more important: how much one can save!"

Given that cost in general was regarded by many as the primary factor in their decision to change, it is perhaps not surprising that people were also looking for information about the cost effectiveness of changing their energy-use behavior. This is reflected in comments such as:

"Price of buying different energy-saving products. Information on the benefits/savings".

The need for information about other potential benefits, such as to the environment, was also identified:

"Campaigns to create and maintain awareness. Direct link to be understood between energy use, money that it costs you, co2 production and the climate change"

"Being informed about issues such as climate change, overpopulation and over-consumption".

Additionally, the need for information about climate change and the impact of energy use on the environment was also identified directly:

"Information about the environment, where our energy supplies come from"

"A bias free consensus amongst researchers on the causal relationship between CO2 and climate change."

A number of people identified the provision of information as a factor in the decision to change, but far fewer people identified it as the main factor. It appears that for most people, the provision of information is not sufficient on its own to encourage behavior change, but rather that it assists in the process, playing more of a supporting or secondary role.

Following cost, the provision of information was the most frequently mentioned factor in maintaining, or potentially maintaining, behavior change. Two forms of information were most frequently identified: information about available options, and information about current energy usage and costs.

"A better understanding of how I can reduce my energy use even further."

"Reports of usage in comparison to previous quarters and with other consumers of similar households."

Respondent's comments appear to indicate that having an accurate understanding of current energy usage (both current vs. historical, and compared to similar households), coupled with learning more about ways to change, are motivating in themselves and are precursors to further behavior change. This is represented in comments such as:

"Constant flow of information on ways to save and how the measures already adopted save usage"

Environment

Concern about climate change specifically, or a more general concern about, or desire to protect, the environment were reported as factors in peoples decision to change their energy-use behavior in the home, although this was often also in conjunction with financial concerns:

"Acceptance of the science of human-induced climate change. Personal responsibility, particularly in a high carbon-emitting country & consumer driven economy"

"The cost of energy.....directly to me and also the environment..."

"Electricity price rises. Enhanced environmental awareness of the consequences of not changing."

However, environmental considerations were not seen by many as being a motivating factor to maintain behavior change. One possible explanation for this shift may be that once a change in behaviour has occurred, the person feels they have acted on their concern for the environment and it no longer plays a salient role in maintaining that behavior.

"Have solar panels, has made a huge impact on bill cost and feel we are doing something positive for the environment and reducing the reliance on coal for energy."

Influence of others

Not many respondents indicated that the decision about changing their energy use in the home was influenced by other people. Of those who did, most indicated a family member whose opinion they valued:

"My sister is an environmental scientist/marine biologist, and her studies and work have helped all the family in considerably reducing not only our use of power but all other environmental factors".

Others alluded to the value of getting ideas from other people, or saw a role for Government in implementing regulations to enforce energy-savings measures, such as through:.

"Discussion with people who have made investment in solar, etc. to reduce their energy use"

"Implementation of building codes to enforce reduction of energy use at home and in the work place."

The influence of others in maintaining behavior change could be either helpful in maintaining the behavior or conversely negating their efforts, as indicated by one respondent who identified:

"My families willingness to participate in reducing our energy-use."

Government was seen as having a regulatory role and also a role in providing large-scale feedback on energy-saving initiatives. Others referred to their own level of self-discipline in continuing with behavior change practices.

Values

Values were not explicitly indicated by many people as being a deciding factor in people's decision to change their energy use behaviour. Of those who did, the value of thrift and reducing wastage were the dominant theme, often resulting from an upbringing that emphasized these values, reflected in statements such as:

"I was brought up not to waste stuff"

"I have never had to change my habits as I was raised in a very conservative family. My parents lived simply and whilst it's hard these days with a family of my own and a husband and sons who are very into high-tech entertainment and devices, I can ensure that I at least live by my values."

Two people also alluded to a sense of moral obligation, or working for the collective good:

"A feeling that reducing energy use is an expectation of community, a moral obligation in a way."

Ease

This theme included level of ease in implementing their changed behaviour and behaviours being easy to perform as they became habits or with the provision of reminders or prompts:

"Reduce bureaucracy governing their installation & applying for government assistance, permits etc."

"Forming habits (e.g. turning off internet when leaving for work)."

The ease with which a change in behavior can be implemented and continued was also a factor in that behavior being maintained. Respondents indicated a preference for behaviours that were once-off or built-in, with ongoing benefits, while some people acknowledged a role for the formation of new habits of behavior:

"Changes that could be made once that do not require a continual effort"

"Daily practices turning into habits"

Physical constraints or actions

Some people indicated that the changes they wanted to make to their energy-use were outside of their control, due to physical constraints such as the location or type of current housing, natural light and owning old (inefficient) appliances:

"I would change my energy use and consumptions through having more effective heating in a new residence in a new location"

"I am building a house and making it more energy efficient. Very hard in a rental property"

Access to new technologies was also raised as a potential barrier:

"Readily available alternative technologies"

"Because I am renting, I cannot take advantage of things like solar power/grey water etc. That is all up to the owner."

The most frequently coded themes, and number of respondents per theme and per question, are listed in Table 8.1 below. Child codes are counted within the parent code count.

Table 8.1: Number of coded responses per question

Parent Code	Child Code	Q1	Q2	Q3
Cost		173	216	101
	Cost to install alternatives	1	3	2
	Increasing/reducing costs of electricity bill	120	136	40
	Time & effort	3	2	2
	Discount, rebate, subsidy, amortization	24	12	42
Information		66	16	79
	Available options	28	4	28
	Evidence	2	0	1
	Benefits of changing energy use	6	2	4
	Environment or Climate change	6	0	0
	Energy use/costs	24	10	29
	- Compared to others	2	1	4
Influence of others		9	10	23
Environment		54	56	4
Values		11	13	4
Ease		7	4	24

Stage-matched themes

The short form of the Energy Behaviour Stages of Change Questionnaire (discussed previously in Chapter 7) was used to classify participants into one of the five Stages of Change theorized within the TTM. Their responses were then analyzed to identify themes arising at each stage. Participants were not evenly distributed between the five stages, with more respondents in the Action and Maintenance stages. A summary of the factors that were most commonly stated by respondents within each stage is presented in Table 8.2 and discussed in more detail below.

Table 8.2: Common themes by stage

Stage	No. of respondents	Influential Factors
Precontemplation	11	Cost of electricity
		Information – about the benefits of changing
		Information – about climate change
Contemplation	14	Cost to install alternatives
		Information - about available options
		Information – about energy usage
Preparation	45	Cost – subsidies/discounts/rebates
		Information – available options to reduce energy use
		Information – current energy use & costs of appliances
Action	105	Cost
		Information – how to further save energy
		Information – cost effectiveness/feedback on measures taken
		Information – normative & historical
		Concern about the environment
Maintenance	155	Financial gain (cost savings)
		Feedback on cost reductions already undertaken
		Provision of subsidies/discounts
		Information on further available options
		Concern about the environment
		Values

Precontemplation stage

Within the TTM, the Precontemplation stage is characterized by a lack of awareness and knowledge about the harmful consequences of a behaviour. The model states that people in this stage may also be defensive of their behaviour, deny that their behaviour is problematic and avoid references to their behaviour (such as in the media). Individuals within this stage may also underestimate the benefits of change and overestimate the difficulty of changing (DiClemente, 2003a; Prochaska, 1999; Prochaska et al., 1997).

Only thirteen of the total 386 respondents were identified as being in the Precontemplation stage, with a total of 28 responses to the three open-ended questions.

The current cost of energy was seen as an influential factor in making a change to their behavior, although the appeal of discounts or rebates was not mentioned by any of the respondents.

The need for more information in general was also expressed. People in this stage were specifically looking for information about the benefits of changing and about climate change. More so than any other stage, people in the Precontemplation stage still felt that the science of climate change, and the link with electricity use, needed to be proven.

"A bias free consensus amongst researchers on the causal relationship between CO2 and climate change."

Given the weight of evidence that proves the science of climate change and the role of energy-use in contributing to climate change (e.g. Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2012; Garnaut, 2008, 2011b; Intergovernmental Panel on Climate Change, 2012; IPCC, 2007a, 2012; United Nations Framework Convention on Climate Change, 2014), these statements reflect a lack of awareness and information that is consistent with the Precontemplation stage of the TTM.

People in this stage were not looking for information about their own energy usage and costs, or for information about available options. In a statement that can perhaps be seen as representative of the Precontemplation stage, one respondent stated:

"*Information about the whole idea. I don't give it any thought apart from the cost it imposes on me.*"

Also reflective of this stage, which represents a state of relative ignorance and lack of awareness regarding the problem behaviour, many of the participants in this stage reported that they were 'unsure', 'didn't know', or that they would find 'nothing' helpful to make and maintain a change in their energy-use behavior.

Contemplation stage

People within the Contemplation stage are more aware of the benefits of changing, but also of the costs of changing. This stage is characterized by a weighing up of the pros and cons of change, which can result in high levels of ambivalence. Individuals may seek information to assist with their consideration of the positive and negative aspects of the behaviour, and may look to peers and role models regarding how they managed their behavioural change (DiClemente, 2003a; Prochaska, 1999; Prochaska et al., 1997). Presumably within this stage, the weighing up of pros and cons may also extend to comparing the relative benefits of different options against each other.

The cost of electricity and a desire to reduce electricity bills were again the most commonly identified factors in making a change. Interestingly, as with respondents in the Precontemplation stage, the provision of discounts or rebates was not mentioned as a factor in the decision to change.

Perhaps reflective of the weighing up of pros and cons that is characteristic of this stage, respondents identified that they were seeking information about available options and their own energy usage, as well as identifying the ease of making changes as factors in making the decision to change.

"*How easy and practical and cost effective it is to make these changes*"

None of the respondents stated that they were looking for information on the benefits of changing or about climate change, which perhaps represents a shift from the Precontemplation stage.

Within the TTM framework it would be expected that people in this stage would identify the influence of others as a factor in the decision to change. However, this was not the case, with only one person identifying their family as helping to make the decision to change.

Preparation stage

At this stage, people actively intend and are committed to take action, usually defined as within the next month. They develop a plan and strategy for change, and may have already made some significant preparatory moves such as purchasing necessary equipment. The tasks required at this stage are to increase commitment to change, and to devote the time and energy required to make the change (DiClemente, 2003b; Prochaska, 1999).

Cost again was the most frequently cited factor in making a decision to change. However, people within this stage more so than any of the other stages, indicated that subsidies, discounts or rebates were influential in making a decision to change:

"More Government assistance & incentives"

"Subsidized schemes to install solar panels and converters."

The cost to the environment was also mentioned in conjunction with financial cost:

"Consideration of environmental impact. Personal financial impact."

Following costs, people in this stage indicated that Information was a factor in making the decision to change. People in the Preparation stage indicated Information as an influential factor more so than people in other stage. Primarily, this related to information on the available options to reduce energy use and information about their current energy use and the energy usage costs of appliances in the home:

"More information on simple changes you can make around the house that are cost effective to implement"

"Smart meter showing what devices are using what power".

Within the TTM, it is theorized that in this stage, people need to devote time and energy to making the desired change in order to progress to the next stage of change. It is interesting to note that none of the respondents indicated that cost in terms of time and energy were a factor in their decision to change. One explanation for this is that respondents potentially felt sufficiently motivated that the time and energy required were not noticed as a factor in changing.

It is also theorized in the TTM that an increase in commitment to change is required at this stage. The influence of others is most pronounced at this stage, and reflected in some respondent's comments in which they seek the commitment of family members in changing:

"My families willingness to participate in reducing our energy-use."

Action stage

At this stage, people have made specific changes to their behaviour, usually within the last 6 months. This stage generally represents the implementation of the plan developed within the Preparation stage. This stage represents a shift from the previous stages, which emphasized intention, consideration and planning to observable behaviour change. It has been argued that this stage is what is often equated with behaviour change (DiClemente, 2003b; Prochaska, 1999).

As the behaviour must be repeated over time to create true behavioural change, this stage is usually seen as lasting from three to six months, although it may take longer for less frequently occurring behaviours.

The tasks at this stage are for individuals to continue to engage in their changed behaviour despite barriers and challenges, which may include revisions of the initial plan. This stage also represents a shift in focus from generating behaviour change to now continuing with the change in the longer term (DiClemente, 2003b).

Consistent across all the stages, Cost was the primary factor for people in this stage to change their energy use behavior:

"The cost of energy has helped me change my habits"

The cost to install alternatives and the cost in terms of time and energy were not mentioned as factors in the decision to change.

Respondents in this stage indicated that information on how to further save energy, as well as feedback on the effectiveness of existing measures, and historical and normative comparisons were helpful in making and maintaining a change in behavior:

"Comparison of my energy use to those of similar households in my neighbourhood and comparison of my current to my past energy use.

"Systems that enable me to monitor my use on a daily basis - that feedback is useful to see small changes."

Concerns about energy use and its impact on the environment, such as through global warming, were mentioned most frequently by people in the Action stage. Environmental concerns were again often mentioned in conjunction with financial concerns:

"The increase in world pollution i.e. greenhouse gases plus the ever increasing cost of energy. So both environmental and economic reasons."

More people living in owner-occupied housing, compared to renting, indicated physical constraints on their ability to change further:

"Moving house to a more environmentally friendly home with more effective heating for winter and cooling for summer"

Maintenance stage

Within the TTM, it is believed that for true behaviour change to occur, the new behaviour must become automatic and integrated into the individual's lifestyle. Within the Maintenance stage, the new behaviour may become habitual if it is a repeated action, requiring little or no conscious thought or effort to sustain it. There is, however, always the risk that individuals will

revert to their previous behavioural patterns (relapse), with the new behaviour only becoming fully maintained when there is little or no effort to maintain it and the person can exit the cycle of change. The tasks required at this stage are to maintain the change in behaviour across different situations and in the face of challenges (DiClemente, 2003b).

People in this stage had already made a decision to change, primarily based on cost. Financial gain and feedback on cost reductions were commonly cited as helpful in maintaining that change:

"Have solar panels, has made a huge impact on bill cost and feel we are doing something positive for the environment and reducing the reliance on coal for energy."

Increased financial savings, the provision of subsidies and discounts, and information on available options to reduce energy usage even more were stated as influential factors to make further changes:

"A big bill from the electricity company would certainly spur me on even more to change my electricity habits. Also if the government or electricity companies sent more information in the mail of ideas for changing and helpful hints to help reduce electricity consumption."

People in the Maintenance stage were second only to people in the Action stage in identifying environmental concerns as an influential factor in their decision to change.

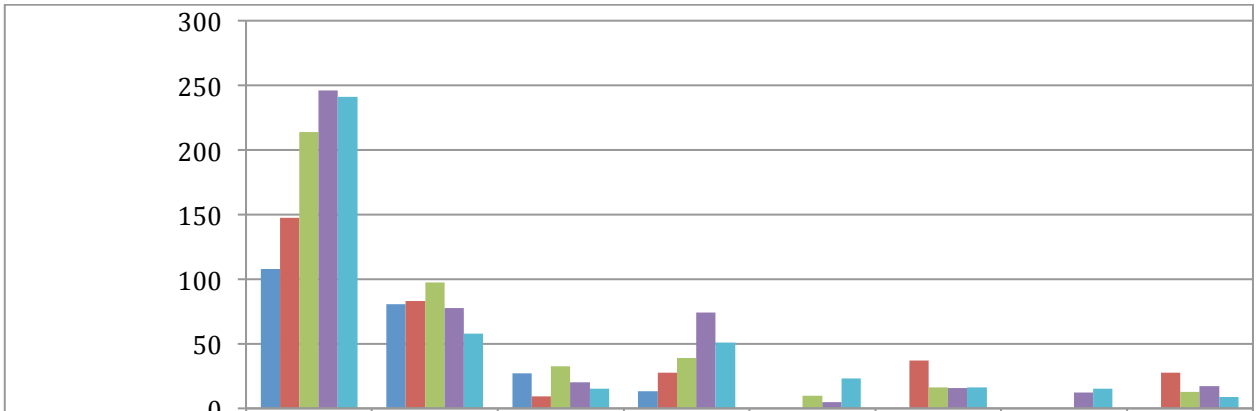
"We are all living on one planet, we need to look after it for us and for future generations, cut the waste and live within the means, not to over-use energy."

People in the Maintenance stage, more so than other stage, indicated Values as a factor in making and maintaining a change:

"Reminders of conscious decision-making informed by personal values (the collective good)."

The relative importance of each broad theme by stage is reflected in Figure 8.1. As there were an unequal number of respondents in each of the stages, these figures have been normalized to give a representative indication.

Figure 8.1: Relative importance of theme by stage.



	Cost	Information	Influence of others	Environment	Values	Ease	No action	Physical contraints or actions
Precontemplation	107.69	80.77	26.92	13.46	0	0	0	0
Contemplation	147.37	82.89	9.21	27.63	0	36.84	0	27.63
Preparation	213.89	97.22	32.41	38.89	9.72	16.2	0	12.96
Action	246.24	77.43	20.13	74.34	4.65	15.49	12.39	17.04
Maintenance	241	58	15	51	23	16	15	9

Stage-matched processes of change

The common themes arising at each stage were analyzed to identify possible stage-matched processes of change as theorized within the TTM. The TTM's processes of change had not been directly assessed as part of the survey, however, the themes within each stage were analyzed to ascertain whether these processes of change could be identified from peoples' voluntary responses.

The TTM claims that people use different processes of change as they move through the stages, and that these processes indicate how people change (DiClemente & Prochaska, 1982; Prochaska & DiClemente, 1986; Prochaska et al., 1997). A total of ten processes of change have been identified, which are differentially important at different stages.

Consciousness Raising, Dramatic Relief and Environmental Re-evaluation

Within the TTM, the processes of Consciousness Raising, Dramatic Relief and Environmental Re-evaluation are believed to be the processes that are most effective in the Precontemplation and Contemplation stages to bring about change (Prochaska, 1999; Prochaska et al., 1997). Consciousness raising refers to increased awareness about the current behavior and the need for change, while Dramatic Relief refers to the emotional arousal that may accompany this awareness. Emotional Re-evaluation is a combination of both the emotional and cognitive awareness of how one's own behavior affects others and their social environment.

Concern about the cost of the electricity bill and seeking information about the benefits of changing and climate change can be interpreted as Consciousness Raising activities. While respondents did not explicitly make statements that refer to an emotional reaction accompanying this awareness (Dramatic Relief), this emotional response can be inferred by the fact that they listed cost, and a desire to reduce cost, as a primary factor. The responses within this survey did not indicate that the process of Emotional Re-evaluation was occurring for respondents. It is possible though that respondents were undergoing this process, but did not identify it in their written response.

Self re-evaluation

This process refers to an individual's evaluation of how their current behavior, as well as how changing, affects their identity and aligns with their personal values. This process is believed to be most effective in the Contemplation and Preparation stages. In this study, there was no indication that respondents were undergoing this form of self-evaluation as part of their change process in these stages.

Self liberation

This process encompasses an individual's belief that they can change, as well as their commitment to act on that belief, and includes making choices and taking responsibility to

change. This process is believed to be differentially important within the Preparation and Action stages.

Review of the dominant themes within these stages provides some indication that this process may have been occurring. Respondents in both these stages indicated that they were looking at various forms information that may have been used to assist in generating a belief in their ability to change. More pronounced in the Action stage, respondents seemed to be using this information to generate further commitment to ongoing changes.

Contingency management, Counter conditioning, Stimulus control, Social liberation and Helping relationships

These five processes are theorized to be most effective in the Action and Maintenance stages of change.

Counter conditioning involves the individual replacing unwanted behaviours with new desired behaviours, while contingency management refers to providing consequences for making behavioral changes. Stimulus Control involves to modifications within the environment that increase the likelihood of the desired behavior occurring and reduce the likelihood of the unwanted behavior. Social Liberation as a process entails noticing and increasing social alternatives and norms that support the changed behavior. Following on from this, Helping Relationships concerns seeking out and using social supports to maintain the desired behavior.

These processes are difficult to identify directly within the themes. The process of Counter Conditioning could be inferred by peoples comments that they are looking for and using information on further energy-savings measures, that is, making further small changes to achieve the overall aim of reducing energy use. Likewise, Contingency Management may be implied when respondents have stated that information on the cost effectiveness of measures taken is an important factor in making further changes. In other words, a reward in the form of cost savings has been provided for changed behavior resulting in lower energy use. Responses indicating that information on available options may be a form of Stimulus Control in which respondents are

making changes to their environment, which enables them to use less energy. The processes of Social Liberation and Helping Relationships can be seen in peoples' comments on the importance of feedback and normative information.

Discussion

The themes discussed above that have been identified from participants' comments concur with what many other researchers have found in relation to pro-environmental behaviour and energy-savings in particular.

Similar to the findings of other researchers (e.g. Brandon & Lewis, 1999; Sütterlin et al., 2011; Sweeney et al., 2013), economic reasons appeared to be the primary reason to reduce household energy use. Even when environmental concerns were expressed, these tended to be in addition, or secondary, to financial concerns. Again similar to other findings (Abrahamse et al., 2005; Fischer, 2008; Spence et al., 2014; Wolak, 2011), financial incentives and discounts did not appear to be highly influential for the majority of people.

This current research suggests that people are looking for information associated with costs. In making a decision to change, respondents indicated they sought information about their current energy use and/or the energy use of certain appliances within the household, as well as information on the cost effectiveness of potential changes. Participants reported that the provision of information on changes in their usage and cost savings, as well as further ways to save energy, would assist in maintaining that change. These findings appear to reflect what other research has found, in that while the provision of knowledge about a behaviour has not been found to significantly increase motivation to engage in that behaviour, a lack of knowledge can be an important barrier (Schultz, 2002). Previous research has shown that people are generally unaware or inaccurate regarding their energy usage (Sweeney et al., 2013). These current findings give further credence to Sweeney and colleagues' (2013) results in that these respondents were identifying that they needed accurate and up-to-date information to assist in their decision-making.

It has been found that targeted or individualized information is effective in changing behaviour, especially for simple behaviours that can be changed with little cost in terms of time or convenience (Gatersleben et al., 2002). Interventions that use tailored information, often also in conjunction with commitment-making, goal-setting and/or the provision of tailored feedback, have been found to be effective in reducing household energy use (Abrahamse et al., 2007; Haq et al., 2013; McKenzie-Mohr, 1994). The results of this study provide further support for the implementation of this form of tailored information and feedback.

Unsurprisingly, concern for the environment was identified by a number of respondents as a factor in their decision to change their energy use behaviour. This is however in contrast to other research, which has concluded that environmental concern does not correlate highly with specific pro-environmental behaviours. These researchers suggest that environmental concern is best viewed as an important, but indirect, determinant of any specific behaviour (Bamberg, 2003; Bamberg & Möser, 2007; Gifford, 2011; Gifford & Nilsson, 2014). It may be that people are already highly aware of the environmental concerns associated with energy use, and thus are primed to state this as a conscious reason.

Given the research on the role of social norms in influencing pro-environmental behavior (e.g. Cialdini, 2003; Göckeritz et al., 2010; Schultz et al., 2007; Thøgersen, 1999a, 2006), it is, at first, surprising that this did not feature more prominently in people's statements. However, as has been suggested by other researchers (e.g. Cialdini, 2005; Nolan et al., 2008), social influence is subtle and unlikely to be a conscious factor in people's decision to change their energy use. Furthermore, it has been suggested that surveys dramatically underestimate the influence of norms (Thøgersen, 2014). As such, it is perhaps not surprising after all that norms did not feature more strongly.

Ease of implementing changes has also been previously identified as a factor in peoples environmentally-responsible behaviour, with the 'cost' in terms of comfort, convenience and finance sometimes being too high (Freestone & McGoldrick, 2008; Newton & Meyer, 2013;

Szmigin et al., 2009). In this present study, cost in terms of time and convenience was coded under Cost, while Ease was focused more on the relative level of difficulty in implementing the behaviour. Nevertheless, neither cost (time and energy) nor ease were identified by many people as factors in their decision to change.

The need for a new behaviour to be easy and uncomplicated was recognized, as was the need to form new habits of behaviour. Many of the behaviours that could be changed to reduce energy use, such as turning off lights, are habitualized behaviours. Habits exert a great influence on behaviour and are generally considered to be barriers to people engaging in pro-environmental behaviour, at least until new, environmentally conscious, habits are formed (Bamberg & Schmidt, 2003; Klöckner & Matthies, 2004, 2012; Klöckner & Verplanken, 2013).

A wealth of research that has found that people's values play a significant role in their environmental behavior, although this may be indirect (e.g. de Groot & Thøgersen, 2013; Schwartz, 2010; Schwartz & Boehnke, 2004; Stern, 2000b). Given these findings, it is somewhat surprising that this factor was not explicitly stated by many respondents. However, values have been referred to as "guiding principles in the life of a person" (Schwartz, 2011, p. 464) and as such, similar to the influence of norms, they most likely not a conscious factor in people's decision-making.

Subtle but distinct differences were noticeable between the themes expressed by respondents in the different stages of change. For example, while Cost was the primary reason given across all stages for wanting to change energy use, this was reflected differently across the five stages. Within the Precontemplation and Contemplation stages, participants stated motivation was to reduce the cost of their electricity bill with little mention of other cost-related factors such as the cost to install alternatives, cost in terms of time and energy and cost reduction measures such as discounts and rebates. In the Preparation stage the cost of installing alternatives and the provision of rebates and discounts became more prevalent in respondents cost considerations. Cost was still a primary factor for people who had moved to the Action and

Maintenance stages, although it was more balanced with other factors, such as Information and the Environment.

Similarly, the role of Information was different across the stages. People in the Precontemplation stage were primarily seeking information about why they should change and what the benefits of changing were. In the Contemplation and Preparation stages, respondents were no longer looking for benefits of changing, but instead looking for information on available options to change and about their current energy usage. Respondents who were in the Action and Maintenance stages appeared to be using information about their energy usage, both historically and normatively, to provide further motivation for additional changes, and also sought information on further options available to broaden their energy savings measures.

Concern about the environmental impact of energy usage, and more specifically climate change, were most pronounced within the Action and Maintenance stages. The role of values as an influential factor in participants' decision to change was also most pronounced within the Action and Maintenance stages.

These results suggest that motivation to save money through lower electricity bills may be the primary reason people begin to notice and think about changing their energy use within the home. However, once people begin to make changes, their motivation to maintain and extend these changes is also influenced by factors such as feedback about the success of earlier measures (cost savings), the availability and knowledge of other energy-saving methods and values associated with thrift and social conscience.

This research provides support for understanding householders' energy use behavior within the framework of the Stages of Change and support for the use of stage-matched interventions to encourage change in energy use behaviours. Conclusions, areas for further research and limitations of this study are discussed in the next chapter.

Chapter 9: Discussion and Conclusion

Only the wisest and stupidest of men never change – Confucius

The Transtheoretical model (TTM), as the theoretical framework for this research, assumes there is a common set of stages and processes people move through over time in the process of changing. Implicit within this model is the assumption that by understanding how people change in general, these principles can then be applied to specific behaviours. The current study developed the Energy Behaviour Stages of Change Questionnaire (EBSOCQ), in both short and long forms, which provides a stage of change measure for energy-use behaviours. The adaptation and development of the questionnaire was informed by the TTM theory, and validated through this study.

This research established that the five theoretical stages of the TTM can be identified in the process of changing household energy-use behaviour. This finding provides additional support for the Transtheoretical model itself, in that the theorized stages have been identified in another sample of participants and with regard to a different behaviour. This research finding also indicates that the stages of change concept is a viable theoretical lens through which to view householders' electrical energy use behaviour change.

To the researcher's knowledge, this is the first study to apply the TTM framework to this form of environmentally responsible behaviour . As such, this research represents a significant extension to psychology's understanding of householder energy-use behaviour.

This research thesis also explored the motivational elements of people's decision to initially make, and then maintain, a change in their energy-use behaviours

It was found that there was a trend for females, and those living in owner-occupied housing, to be in the later stages of change regarding their energy use. The implied assumption is that these people engage in more energy saving or reduction behaviours than those people in the earlier stages of change. It must be kept in mind though that this research only asked about 'change' not about quantities as such or even the type of change (i.e. using less or more electricity).

It is perhaps unsurprising that people living in owner-occupied housing, as compared to rental housing, would be engaging with energy-savings to a greater extent. People living in their own homes may have a greater sense of 'ownership' of their homes, have a longer-term view of investment in their homes, and have greater control over many energy-related behaviours, such as the installation of energy efficiency devices. Additionally, home-owners may also be under more financial pressure due to mortgages, and as such, may be attempting to save money by reducing their energy use.

The finding that females tended to be in the later stages of change, and presumably more engaged with energy-savings behaviours, is consistent with other research, which has found that females are more likely than males to hold stronger pro-environmental attitudes and engage in more pro-environmental behaviours (e.g. Gifford, 2007; Sakellari & Skanavis, 2013; Zelezny et al., 2000). It could be that within the household domain, females feel a greater sense of control and choice, which reflects in a greater consideration of behaviours that benefit the household, such as reducing energy usage, and a greater capacity to act upon their environmental values and attitudes. This finding again supports calls for further research on gender and environmental behaviour.

Additionally, this research identified a number of key themes expressed by respondents as important factors, and according to stage of change, in changing their energy use behavior at home. Primarily, financial cost was the main stated concern. This was expressed as both a motivation to reduce energy use, and also as a barrier to adopting energy-efficient practices, such

as the installation of solar electricity systems. The findings of this thesis are consistent with that of other researchers who have found that people's reasons for conserving energy were more motivated by cost-savings than by environmental concern (e.g. Brandon & Lewis, 1999; Sütterlin et al., 2011; Sweeney et al., 2013; Whitmarsh, 2009).

It is arguable that participants' claims of cost as a primary factor more accurately reflects a socially acceptable and salient response. This view would be supported by previous research, discussed in Chapter 4, that identified a rebound effect of energy-efficient appliances and homes. In these instances, costs saved through efficient appliances are then 'taken back' by consumers purchasing more, or larger, appliances; or using these appliances more often (e.g. Brännlund et al., 2007; Greening et al., 2000; Herring & Roy, 2007). There is also a contrary body of research that has found little effect for cost factors as a motivation to reduce energy use (Abrahamse et al., 2005; Fischer, 2008; Spence et al., 2014; Wolak, 2011) and that cost savings tend to be quite small in actual dollar amounts (Gatersleben, 2001).

An article in *The Australian* newspaper (Pearson, 2014) reports that household electricity prices have increased by more than 110 per cent in the period 2009-2014, with another 7 per cent increase expected in 2014-2015. Reducing the electricity bill is an area of the household budget that is controllable for many people, in contrast to fixed expenses such as mortgages or rent payments. Perhaps given this recent electricity price rise, the ability to save money through reducing energy use is both salient and, moreover, may now represent a significant dollar value for householders in Australia.

If, as participants clearly indicated, cost factors are the main stated motivation and barrier to reducing energy use, this is the logical starting point to connect with consumers regarding energy use reduction strategies.

Gifford (2011; Gifford & Nilsson, 2014) coined the term 'honeybees' to refer to people such as this who engage in pro-environmental behaviours for non-environmental reasons. It is this researcher's belief that one of the key advantages of the TTM as a framework for

understanding people's ERB is that environmental motivation is not a necessary precursor for change to occur. That is, it does not matter in this model whether people are changing due to a concern for the environment or for economic reasons; the change process and its applications remains the same.

The Transtheoretical Model has been proposed as a method of audience segmentation, grouping people together based on stage of change, with interventions tailored to each stage or a selected number of stages (Armitage, 2009; Siegel & Lotenberg, 2007) . This is consistent with the model developers' call for stage-matched processes of change interventions. An application of this, was, for example, Maibach's and Cotton's (1995) utilization of concepts from social cognitive theory to develop HIV prevention messages for people in each of the TTM's stages of change.

Limitations and Implications for Future Research

There were a number of fundamental assumptions in this research project. Firstly, it was assumed that the participants would understand the intent of the open-ended questions, that they would see them as being distinct from one another and that they would each understand them in the same way. It became apparent in reading the response excerpts that in some cases people were referring to energy in very broad terms, such as the energy requirements to run motor vehicles. In other cases, people spoke of behaviours at work rather than solely at home. Secondly, it was assumed that participants would be accurate reporters of their own behavior and motivations. This may involve both a high level of self-awareness and resistance to providing socially desirable responses. In future research, self-reported behaviours could be supported by an unobtrusive measure of energy use, such as in some previous studies that have used meter readings (e.g. Katzev & Johnson, 1984; Schultz et al., 2007). However, it is difficult to determine in these studies what behavioural changes had brought about energy savings and which specific individual within a household has made the savings (Gatersleben et al., 2002).

Perhaps the greatest limitation in the qualitative component of this research is its reliance on the EBSOCQ to identify participants as fitting a particular stage of change. Although the EBSOCQ was developed and validated as part of this research project, it has not been the subject of additional studies and represents an opportunity for future research. Further studies are needed to provide additional validation of the EBSOCQ in larger and different populations.

While the TTM is inherently concerned with behaviour change over time, this research project was not longitudinal and only captured householders' responses at a single point in time. As such, no claims can be made regarding progression through the stages of change as part of this research. It can only be assumed that respondents moved through the stages of change in the sequential manner described by the TTM. Additionally, this study does not account for any 'spontaneous' stage transitions, as has been found in some previous research, discussed in a previous chapter (e.g. De Nooijer et al., 2005; De Vet et al., 2005; Hughes et al., 2005). Spontaneous stage transitions are said to occur when a person moves between stages without an intervention and without spending the theorized time in each stage. An avenue for future research would be to evaluate behaviour change over time to identify stage progression and any instances of spontaneous stage progression.

Potential sources of sampling error within this research design include coverage error and nonresponse error. Coverage error occurs when the sample or respondents do not completely represent the population of interest (Sue & Ritter, 2012). While legitimate concerns exist regarding the use of convenience sampling, attempts were made in this study to increase validity by approximating random selection as much as possible, following the suggestions of Babbie (2008). Conducting web-based surveys introduces coverage error, as household internet access differs across the target population (De Vaus, 2014). However, as many universities and workplaces now provide constant internet access, coverage error in these situations is reduced.

Another form of potential sampling error is due to non response bias, which affects the representativeness of the final sample of respondents. However, the demographics of the sample

gathered for this study were comparable to those from the 2011 ABS census data, as discussed in Chapter 6, and as such, the sample can be considered to be reasonably representative. Concerns about the declining response rates for social science surveys have been documented elsewhere (e.g. Tourangeau & Plewes, 2013). One consequence of general increased nonresponse rate is reduced validity of the results and implications that may be drawn from information gathered from participants through surveys. That is, as the participants in this study were those who self-selected for participation, rather than a probability sample, they may be different to those who did not respond. In this study, the respondents were not evenly spread between the five stages, with the Action and Maintenance stages being over-represented, and with proportionately few respondents in the Precontemplation and Contemplation stages.

Both social desirability and acquiescence in responding are threats to the validity of any form of self-report survey. Acquiescence is the tendency of respondents to agree with, or answer in the affirmative, the question being answered without full consideration of the question. Socially desirable responding is the tendency of respondents to provide the respectable or socially acceptable response, rather than what actually may be true for them. The implication then is that these responses lose their meaning and the validity of the survey is reduced (Knowles & Nathan, 1997; Winkler, Kanouse, & Ware, 1982). Suggested methods for reducing the issue of acquiescence in responding is the use of negatively worded questions and the use of impersonal (non face-to-face) techniques to gather the data (De Vaus, 2014). This research project attempted to reduce the likelihood of an acquiescent response set by using a web-based format, open-ended questions and negatively worded questions.

Social desirability in responding is likely to have been a greater issue in this current research. Previous research has found that social desirability bias is more pronounced for sensitive topics, although the use of computer surveys reduces bias even for sensitive topics (De Vaus, 2014; Lind, Schober, Conrad, & Reichert, 2013; Tourangeau & Yan, 2007). The current research on energy-use is not likely to be a highly sensitive topic, although there are likely to be

fairly clear socially acceptable responses (i.e. a desire and willingness to reduce energy use). The use of a web-based survey is anticipated to have reduced the degree of socially desirable responding.

Whilst it is acknowledged that limitations such as these may effect the validity and reliability of the results, all reasonable efforts were made to ensure the comparability of the sample to the general population, and the results of this research can be generalised with confidence.

Conclusion

The specific aims of this research project were to:

- Provide an integrative review of the literature regarding pro-environmental behaviour generally, and household energy use specifically;
- Modify and validate the original Stages of Change Questionnaire to assess individual's stage of change regarding their household electrical energy use;
- Identify stage-matched process of change for household energy use;

It was concluded from a comprehensive review of the previous research that there is no gold-standard model or intervention program that will be effective in producing the desired behaviour change across any behaviour and within any situation. To date though, no research on changing residential energy-use using the TTM framework had been conducted. This thesis addresses this gap and represents an initial step in the application of the TTM framework to understanding householder's electrical energy use behaviour.

This research thesis has provided original research support to demonstrate that the TTM framework can be applied to environmentally responsible behaviour in the form of household energy use. It also developed a short, user-friendly tool that can be used to classify householders' stage of change with respect to their energy use.

The results of this research could be used by social marketing campaigners to tailor messages to people in the Precontemplation and Contemplation stages highlighting the current

cost of their energy use, and providing information on the benefits of changing and the available options. Additionally, the provision of information on the science of climate change and link between global warming and the use of coal for electricity could be beneficial at the Precontemplation stage to promote change. For householders who have already made changes to their energy use (i.e. those in the Action or Maintenance stages), social marketers could provide tailored feedback on the effectiveness of the measures already undertaken, and information on how to save even more, perhaps through the use of incentives or subsidies. To date however, social marketing using the TTM as a means of audience segmentation has not been applied to ERB and remains an area for future research.

The results of the current research provide further support for psychology's important role in contributing to climate change mitigation efforts. There is exciting and wide ranging scope for the results of this research to be used within social marketing campaigns to reach and engage with householders. Such outcomes could significantly enhance current measures to address electrical energy use, carbon emissions and subsequent global warming impacts.

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Appendices

Appendix A: Full web-based survey

Explanatory Statement

EXPLANATORY STATEMENT

Project: Applying the Transtheoretical Model of Change to Environmentally Responsible Behaviour

Chief Investigator's names: Dr John Roodenburg & Dr Janette Simmonds
Faculty of Education
[redacted]

Student Name: Donna Simpkins
(M Psych/PhD Educational & Developmental Psychology candidate)
[redacted]

My name is Donna Simpkins and I am conducting a research project with Drs John Roodenburg and Janette Simmonds, who are Senior Lecturers in the School of Psychology (Faculty of Education) towards a combined Master/PhD in Educational and Developmental Psychology at Monash University. This means that I will be writing a thesis which is the equivalent of a 300 page book.

The aim of this research is to determine whether stages can be identified in the change process people use regarding their household energy use. Additionally, I will be looking at whether personality plays a role in these stages.

What does the research involve?
This survey is looking at how you think and feel about reducing your household electrical energy use. At the end of this survey, you will be invited to leave your details for further involvement. Additionally, you will be invited to take part in another survey that looks at your personality profile. Each survey will take approximately 15-20 minutes to complete.

It is not anticipated that your participation in these surveys will cause you any harm.

Consent to participate and withdrawal
Your involvement in this survey is voluntary. By undertaking this questionnaire, you have provided your consent to participate. You have the right to withdraw from further participation at any stage by quitting the survey, however, it will not be possible to withdraw data once you have submitted your responses.

Confidentiality and Storage of Data
Your responses to these surveys will remain confidential and anonymous. Any information used from this research (such as journal article publications) will use aggregated information, with no personal or identifying information provided. Your information will be used solely by Monash University and not passed on to any other organizations. All data collected will be stored in accordance with Monash University regulations (further details available from http://monash.edu/library/researchdata/about/index.html).

Publication and Feedback of results
It is anticipated that the results of this research will be published in peer-reviewed journals (such as the Journal of Environment and Behaviour). Feedback on individual results of this survey is not available. You may contact the Student Researcher for feedback on the research project and to obtain copies of any published articles arising from this study.

Complaints
Should you have any concerns or complaints about the conduct of the project, you are welcome to contact the Executive Officer, Monash University Human Research Ethics (MUHREC):

Executive Officer
Monash University Human Research Ethics Committee (MUHREC)
Room 111, Building 3e
Research Office
Monash University VIC 3800

[redacted] Fax: +61 3 9905 3831

I have read the Explanatory Statement above and voluntarily consent to participate in this research

- ◯ Yes, take me to the survey
- ◯ No, I don't want to participate

Demographics

The following questions ask for some basic demographic information about yourself. These questions help us to answer research questions based on populations of people and will not be used to identify individual respondents.

What is your gender

Male ◯ Female ◯

In what year were you born?

Do you speak English as your first or fluent language?

- ◯ Yes
- ◯ No

What is your highest completed level of formal education?

- ◯ Secondary school
- ◯ Certificate or Apprenticeship
- ◯ Diploma
- ◯ Bachelor degree
- ◯ Postgraduate Diploma
- ◯ Masters degree
- ◯ PhD
- ◯ Other

Which occupation type describes you best?

- ◯ Professional (e.g. lawyer, doctor, lecturer)
- ◯ Manager/Executive (e.g. senior/executive management)
- ◯ Clerical/Administration (e.g. bank teller, secretary)
- ◯ Craft or Trades-person (e.g. plumber, electrician)
- ◯ Service or sales (e.g. hairdresser, shop assistant)

- Agricultural worker (e.g. farmer, fisherman)
- Student
- Unemployed
- Technician/Assoc Professional (e.g.veterinary assistant)
- Plant or machine worker (e.g. plant operator, bus driver)
- Elementary occupation (e.g. cleaner, labourer)
- Armed forces
- Retired
- Prefer not to answer

Would you describe where you are currently living as urban or rural?

- Urban
- Rural
- Unsure

What is the postcode of your current residential address?

What is your current living situation?

- Renting
- Owner-occupied
- Living with parents/family

Introduction - energy behaviours

This study is interested in looking at people's household energy use behaviour. So, what is meant by 'household electrical energy use' (hereafter simply called 'energy use')? Generally, energy use behaviours within the household fall into two categories:

1. ***Efficiency behaviours*** – these are the things you do that require the purchase of a product. Examples include:
   - installing solar hot water or electricity panels,
   - buying energy efficient light bulbs, or
   - buying energy efficient household appliances.

Normally, these behaviours are once-off purchases. They don't require you to change your regular behaviour, but mean that you can still reduce your power use.

2. ***Consumption behaviours*** – these are the everyday, habitual things that you do with the intention to use less electricity. Examples include:
   - turning off lights when you leave a room,
   - using less heating or cooling,
   - using the washing machine, dryer, dishwasher etc less often or only with a full load.

These behaviours may have initially required you to change the way you previously acted and need you to continually keep that change going on a day-to-day basis.

Please consider your behaviour in *both* these categories when answering the questions in this survey. You will notice that many questions appear similar with small differences. This is because we are trying to measure the same things in different ways. It is important that you answer all questions, even though they may seem the same.

Env Behav SOCQ

I've never thought about changing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I don't see why I should change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

There is no reason for me to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Other people may think about changing their energy use, but I don't see any need

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I guess I could change my energy use, but I don't see the point

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Other people say I should change my energy use, but I don't agree

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I don't understand what the benefits would be of changing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I'd rather deal with my energy use as it is than change it

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I may be using too much energy, but I'm not really concerned about it

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I don't really know whether I need to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I'm happy with my energy use as it is, rather than change it

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I'm not worried about my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I don't think my energy use is an issue

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I think it might be time to start doing something about my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I've thought about changing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I think it could be worthwhile to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I would like some ideas on how to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I've given some thought to changing my energy use, but I'm not really sure

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I probably could change my energy use, but I'm not sure how

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I guess I could change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I've thought about changing my energy use, but it's all too hard

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I know I probably should change my energy use, but it seems too difficult to do

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I've been thinking about changing my energy use, but I haven't made any decisions yet

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I'm still deciding if I want to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I'm undecided about changing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I'm undecided about what to do to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I don't really know whether or not it's worth changing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I don't want to change my energy use, just because I feel I have to

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

It seems like my energy use is important to consider, but I'm not sure

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am considering whether or not to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am making plans to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am finding out ways I can change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am doing things now so that I can change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am putting in place measures so that I can change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am getting ready to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am nearly ready to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am gathering the information and resources that I need to change my energy use

Neither Agree nor

Strongly Disagree	Disagree	Somewhat Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am exploring new ways to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am looking for ways to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am investigating my options to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I plan to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I want to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am looking at finding out more about my current energy use so that I know how I can change it

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I want to change my energy use and I'm looking at ways to change it

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I'd like to change my energy use and I'd like to know the best way to change

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am considering different ways of changing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am doing something to change my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am making changes to the way I use energy

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

At times it is difficult, but I am making changes to my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am working hard at making changes to my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Even though I sometimes slip up, I am making positive changes to reduce my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Even though there is more I can do, I have made a start at reducing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

While other people may think or talk about changing, I am actually doing something about reducing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I am actively working on reducing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

After thinking and planning it for some time, I am now finally actively working on reducing my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Every now and then, I am tempted to do something that I know isn't helping me to reduce my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Most of the time, I am doing really well with my attempts to reduce my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I hardly even think about reducing my energy use now - it just comes naturally

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

The changes that I have made to reduce my energy use are now just a part of everyday life

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I couldn't imagine not doing the things I do now to minimize my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I know what I need to do to reduce my energy use and I usually do it

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

While there may be more that I could do to minimize my energy use, I am happy with the changes I've made so far

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I've made some really permanent changes to reduce my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I want to keep my energy use low

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Sometimes it is not convenient, but I still stick with the changes I've made to reduce my energy use

Neither Agree nor

Every now and then, I am tempted to do something that I know isn't helping me to reduce my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Most of the time, I am doing really well with my attempts to reduce my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I hardly even think about reducing my energy use now - it just comes naturally

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

The changes that I have made to reduce my energy use are now just a part of everyday life

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I couldn't imagine not doing the things I do now to minimize my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I know what I need to do to reduce my energy use and I usually do it

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

While there may be more that I could do to minimize my energy use, I am happy with the changes I've made so far

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I've made some really permanent changes to reduce my energy use

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

I want to keep my energy use low

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Sometimes it is not convenient, but I still stick with the changes I've made to reduce my energy use

Neither Agree nor

Strongly Disagree	Disagree	Somewhat Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Sometimes I find it difficult to maintain the energy use reduction measures that I've put in place

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Sometimes I am tempted to go back to my old energy use behaviours, even though I am trying to change.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
○	○	○	○	○	○	○

Block 8

Thinking about the energy-use behaviour change you rated in the questionnaire, please type in your responses to the following questions. You may skip these if you prefer.

What sorts of things helped you make, or would help you to make, that decision to change?

What was, or would be, the biggest or most influential factor in making this decision to change?

What sorts of things would you find helpful to make, or maintain, that change?

Thank you & further contact

Thank you for completing this survey. Your participation in this research is greatly appreciated.

Would you be willing to be contacted by the researcher to answer some more questions about your energy use behaviour?

- ◯ Yes
- ◯ No

How would you like to be contacted?

- ◯ Phone (please provide the best number to contact you on)
- ◯ Email (please provide your email address)

When is the best time to contact you?

- ◯ Best day/s
- ◯ Best time/s

Would you be interested in continuing with this research by answering another survey which asks some questions about personality types? As an added bonus, at the end of this part of the survey, you will be provided with brief feedback about your particular personality type.

- ◯ Yes
- ◯ No

BFI

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who ***likes to spend time with others?*** *Please place a mark in the circle for each statement to indicate the extent to which you agree or disagree with that statement.*

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

I see myself as someone who ....

Is talkative

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

Tends to find fault with others

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

Does a thorough job; does things carefully and completely

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

Is depressed, blue

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is original, comes up with new ideas

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is reserved, keeps thoughts and feelings to self

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is helpful and unselfish with others

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Can be somewhat careless

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is relaxed, handles stress well

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is curious about many different things

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is full of energy

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Starts quarrels with others

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is a reliable worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Can be tense

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is clever, thinks a lot

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Generates a lot of enthusiasm

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Has a forgiving nature

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Tends to be disorganized

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Worries a lot

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Has an active imagination

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Tends to be quiet

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is generally trusting

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Tends to be lazy

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Doesn't get easily upset, emotionally stable

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Is creative and inventive

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Takes charge, has an assertive personality

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Can be cold and distant with others

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Keeps working until things are done

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Can be moody

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Likes artistic and creative experiences

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is sometimes shy, inhibited

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is considerate and kind to almost everyone

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Does things efficiently (quickly and correctly)

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Stays calm in tense situations

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Likes work that is the same every time (routine)

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is outgoing, sociable

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is sometimes rude to others

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Makes plans and sticks to them

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Gets nervous easily

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Likes to think and play with ideas

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Doesn't like artistic things (plays, music)

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Likes to cooperate; goes along with others

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is easily distracted; has trouble paying attention

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Knows a lot about art, music, or books

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Is the kind of person almost everyone likes

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

People really enjoy spending time with

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
○	○	○	○	○

BFI thank you

Thank you for completing this survey.

Would you like to gain some feedback on your personality profile?

○ Yes

○ No

Decades of research on personality has uncovered five broad dimensions of personality. These so-called Big Five dimensions are called:

- Extroversion
- Agreeableness
- Conscientiousness
- Neuroticism
- Openness

These are not "types" of personalities, but *dimensions* of personality. Everybody displays different levels of each of these five dimensions. Your personality is your unique combination of each of these Big 5 dimensions. ***Your score*** on each of these dimensions is given below as a number out of 5. A high score indicates a high level of this dimension – remember though, your personality is a combination of all five dimensions.

Extroversion - is characterized by positive emotions and the tendency to seek out stimulation and the company of others. People high on Extroversion enjoy interacting with people and are often perceived as full of energy. They tend to be enthusiastic, action-oriented individuals who possess high group visibility, like to talk, and assert themselves. In contrast, people who are lower on Extroversion seem quiet, low-key, deliberate, and less involved in the social world. However, their lack of social involvement is not due to shyness or depression. These people appear to need less stimulation and more time alone.

Your score was ${gr://SC2/WeightedMean} out of a possible 5

Agreeableness - is a tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others. This dimension reflects individual differences in general concern for social harmony. People who score high on Agreeableness value getting along with others. They are generally considerate, friendly, generous, helpful, and willing to compromise their interests with others. These people also tend to have an optimistic view of human nature.

People who score lower on Agreeableness tend to place self-interest above getting along with others. They are generally less concerned with others' well-being, and are less likely to extend themselves for other people. Sometimes their skepticism about others' motives causes them to be suspicious, unfriendly, and uncooperative.

Your score was ${gr://SC3/WeightedMean} out of a possible 5

Conscientiousness - is a tendency to show self-discipline, act dutifully, and aim for achievement against measures or outside expectations. People who are high on this dimension show a preference for planned rather than spontaneous behavior. Those high in Conscientiousness tend to be organized and mindful of details, with good impulse control and goal-directed behaviors. People who score lower on Conscientiousness tend to be more easy-going and can show less organization and care with undertaking tasks.

Your score was ${gr://SC4/WeightedMean} out of a possible 5

Neuroticism - is the tendency to experience negative emotions, such as anger, anxiety, or depression. Those who score high in neuroticism are emotionally reactive and vulnerable to stress. They are more likely to interpret ordinary situations as threatening, and minor frustrations as hopelessly difficult. Their negative emotional reactions tend to persist for unusually long periods of time, which means they are often in a bad mood. These difficulties with emotional regulation can diminish the ability of a person scoring high on neuroticism to think clearly, make decisions, and cope effectively with stress. On the other hand, people who score low in Neuroticism are less easily upset and are less emotionally reactive. They tend to be calm, emotionally stable, and free from persistent negative feelings.

Your score was ${gr://SC5/WeightedMean} out of a possible 5

Openness - is a general appreciation for art, emotion, adventure, unusual ideas, imagination, curiosity, and variety of experience. People who are high on Openness to experience are intellectually curious, appreciative of art, and sensitive to beauty. They tend to be creative, aware of their feelings and are more likely to hold unconventional beliefs. People with low scores on Openness tend to have more conventional, traditional interests. They prefer the plain, straightforward, and obvious over the complex, ambiguous, and subtle. They may regard the arts and sciences with suspicion or view these endeavors as uninteresting. These people prefer familiarity over novelty and tend to be conservative and resistant to change.

Your score was ${gr://SC6/WeightedMean} out of a possible 5

Once again, thank you for participating in this research

Appendix B: EBSOCQ

* items in italics are only included in the long form

Precontemplation

- There is no reason for me to change my energy use
- I guess I could change my energy use, but I don't see the point
- I may be using too much energy, but I'm not really concerned about it
- I don't really know whether I need to change my energy use
- *I've never thought about changing my energy use*
- *I don't see why I should change my energy use*
- *Other people say I should change my energy use, but I don't agree*
- *I don't understand what the benefits would be of changing my energy use*

Contemplation

- I've thought about changing my energy use, but it's all too hard
- I know I probably should change my energy use, but it seems too difficult to do
- I've been thinking about changing my energy use, but I haven't made any decisions yet
- I'm undecided about changing my energy use
- *I've given some thought to changing my energy use, but I'm not really sure*
- *I probably could change my energy use, but I'm not sure how*
- *I'm still deciding if I want to change my energy use*
- *I don't really know whether or not it's worth changing my energy use*

Preparation

- I am finding out ways I can change my energy use
- I am exploring new ways to change my energy use
- I am looking for ways to change my energy use
- I am considering different ways of changing my energy use

- *I am making plans to change my energy use*
- *I am investigating my options to change my energy use*
- *I plan to change my energy use*
- *I want to change my energy use and I'm looking at ways to change it*

Action

- I am doing something to change my energy use
- I am working hard at making changes to my energy use
- Even though I sometimes slip up, I am making positive changes to reduce my energy use
- After thinking and planning it for some time, I am now finally actively working on reducing my energy use
- *I am making changes to the way I use energy*
- *Even though there is more I can do, I have made a start at reducing my energy use*
- *While other people may think or talk about changing, I am actually doing something about reducing my energy use*
- *I am actively working on reducing my energy use*

Maintenance

- Most of the time, I am doing really well with my attempts to reduce my energy use
- The changes that I have made to reduce my energy use are now just a part of everyday life
- I know what I need to do to reduce my energy use and I usually do it
- I've made some really permanent changes to reduce my energy use
- *Every day, I am doing something to help me reduce my energy use*
- *I hardly even think about reducing my energy use now - it just comes naturally*
- *I want to keep my energy use low*
- *Sometimes it is not convenient, but I still stick with the changes I've made to reduce my energy use*