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The Effects of Behavioral Determinants and Sociodemographic Factors on Homeowners' Intent to Conserve Energy

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Abstract

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MA, New Jersey City University, 2010

BS, Fourah Bay College: University of Sierra Leone, 2003

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Greenhouse gas emissions are caused, in part, by human activities. However, consumers may assume that the burden of environmental problems, such as carbon emissions reduction through sustainable energy practices, should be borne by the entire society. The purpose of this cross-sectional study was to test whether behavioral determinants and demographic factors could influence homeowners' intent to conserve energy. Empirical data were collected from 436 sampled homeowners in the Northeast region of the United States using an online survey questionnaire. The survey instrument was adapted from Ajzen's theory of planned behavior instrument. Variables aligned with the theory of planned behavior, alongside sociodemographic factors, were used to explain any impact the predictors had on the outcome. A multiple ordinary least squares regression model was used to answer the 3 research questions. According to the study findings, the most significant positive relationship was found between homeowners' beliefs about energy conservation and the intent to conserve energy. There was also a significant positive relationship between the other predictors and the outcome at varying levels. Policymakers could generate support for energy efficiency and conservation by educating consumers about alternative energy options as a means of mitigating carbon emissions and air pollution. This study may lead to a positive social change by supporting regional policymakers in designing and promoting cost-effective behavioral solutions and demographic change support systems as an alternative policy tool that could encourage a sustainable energy consumption practice at the household level.

An Empirical Analysis of the Effects of Behavioral Determinants and Sociodemographic Factors on Homeowners' Intent to Conserve Energy

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Dedication

This doctoral study is dedicated to my parents, Mahmoud Juldeh Jalloh and Martha Jalloh. My deepest appreciation goes to my mother for raising me up to what I am, following the passing of my father. Her inspiration and sacrifice have transformed my life into what it is. She gave me the unconditional love and support needed to make my life a success.

I also dedicate this work to my wife, Alice, whose love and support made it possible for me to complete this dissertation. Whenever things went out of track, her forcefulness and encouragement always got me back on the right path. My world is a better place because she is in it.

I specially dedicate this dissertation to my children, Joshua, Ramata, and Maleek for giving me the motivation and inspiration to complete my Doctoral study. They are the light of my life. One thing I know is that everything I do is to make the world a better place for them. Having them as family is a joy that cannot be measured. This dissertation is also dedicated to my sisters, Binta, Christiana, and Safiatu. They are the reason for my success and they have made my academic path and achievement worthwhile.

My sincere appreciation goes to my late uncle, Abu-Bakarr Jalloh. He deserves my deepest appreciation and respect. A special dedication goes to my brother in-law, Osmond Hanciles and wife Mariama. I specially thank Mr. Hanciles for believing in me, by instilling the love of learning through his commitment to academia and positive social changes. I will forever be grateful.

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Chapter 1: Introduction to the Study

Introduction

Residential energy consumption, and the intent to reduce it through behavior changes, is an untapped source of energy reduction. Homeowners or ratepayers who wish to reduce their energy consumption, for environmental or socioeconomic reasons, often face barriers in achieving their goal. One such barrier is the lack of information and knowledge about how energy is efficiently used and how to reduce its consumption through behavioral changes (Frederiks, Stenner, & Hobman, 2015a). One way to understand residential energy consumption is by using a model that predicts the factors that contribute to the reduction of energy use based on various behavioral determinants and homeowner demographic characteristics.

The topic of residential energy use and the behavioral intent to reduce it through energy conservation and the efficient use of energy merits further research to help design more cost-effective and comprehensive behavioral solutions to encourage sustainable energy use at the household level. There is a need for an in-depth analysis of household energy research using a behavioral theory, such as the theory of planned behavior (TPB; Ajzen, 1985). However, other behavioral theories, such as the theory of reasoned action (TRA; Ajzen & Fishbein, 1972) and the value belief norm theory (VBN; Stern, Dietz, Abel, Guagnano, & Kalof, 1999) can also be useful in explaining homeowners' PEBs and their intent to conserve energy. Energy conservation and the efficient use of energy are used to describe the awareness of a potential positive impact of action on greenhouse gas emissions and climate change. Contextually, energy conservation is often mistaken as addressing the financial implications of energy consumption and its corresponding behavioral intentions, social activities, and perceived actions. However, homeowners may use PEB to leverage their household energy end-use and the potential socioeconomic and environmental impacts resulting from their actions (Alibašic, 2013).

Homeowners may attain energy conservation by being more homogenous in their energy consumption practices. Homeowners maybe more likely to conserve energy when compared to the commercial, transportation, and industrial sectors. Energy use in residential buildings is one of the largest contributors to energy consumption and is responsible for about a quarter of total carbon emissions in the United States (Energy Information Administration [EIA], 2015. Consequently, residential buildings have become a target area for emissions reduction in the United States (EIA, 2015).

The U.S. government established its energy efficiency and conservation strategy in setting a goal for reducing emissions in residential buildings by 29% by 2020 (U.S. Environmental Protection Agency [EPA], 2012). Energy conservation improvement in residential buildings is a part of the ongoing decarburization plan in the United States, with millions of retrofits of residential homes planned over the next decade (Huebner, Hamilton, Chalabi, Shipworth, & Oreszczyn, 2015). Achieving this goal requires energy consumers to have a better understanding of those drivers that have the greatest impact on household energy usage and energy conservation. By incorporating PEBs (i.e., energy efficiency improvements, energy saving measures and practices, alternative energy use, and technology appliance usage) into household energy consumption, homeowners may be more fiscally sustainable, socially accountable, and environmentally responsible to their households and communities (Alibašic, 2013). Homeowners may employ efficient energy behaviors and conservation practices to avoid costs, reduce household budgetary constraints, support energy saving awareness, and promote positive social changes. Frederiks, Stenner, and Hobman (2015a) categorized the behavioral intent, related to residential energy conservation, into "curtailment" behaviors (e.g., daily measures adopted to reduce energy use, such as adjusting the thermostats daily and switching off lights at night) and "efficiency" behaviors (e.g., energy saving practices, such as investing in energy-efficient appliances and home improvements such as insulation, solar panels, and other new technologies; p. 574).

The purpose of this study was to provide researchers, policymakers, and other energy stakeholders with information on factors that explain various patterns of energy use and the intent to reduce it through behavioral and demographic changes. This study may also provide insights into when, where, and for whom energy interventions might serve to promote energy conservation and sustained greenhouse gas emissions reduction. In this study, I identified sociodemographic and behavioral correlates of energy end-use through energy conservation. Understanding what drives residential energy demand is important in determining how various energy behaviors are altered through homeowner-focused interventions, energy policy initiatives, energy sustainability, and technological solutions (Frederiks et al., 2015a). By integrating insights from other energy and behavioral literature, I provided a theoretical overview of homeowners' PEBs by describing how the processes of sustainable energy and carbon emissions reduction have been conceptualized to date.

Several studies have been conducted to investigate household profiles and homeowner-specific characteristics by identifying factors associated with energy-saving and energy-wasting behaviors (Fredericks et al., 2015a). Various determinants have also been identified, ranging from person-specific attributes (e.g., sociodemographic, behavioral, and psychological factors) to more situational attributes in the external environment. Nonetheless, in efforts to synthesize and integrate findings across studies on household energy use, scholars have failed to attain information on homeowners' PEBs. In this study, I outlined findings on PEBs and how they relate to homeowners' behavioral intentions to conserve energy. Also, implications of research findings were drawn to identify cost-effective behavioral determinants that may influence energy conservation, resulting in policy implementation of air pollution and carbon emissions reduction programs.

Background of the Study

Solving environmental problems could be complex because the changes induced by PEBs may not be seen or felt immediately and may not directly affect individual consumers. Accordingly, homeowners may think that the socioeconomic and environmental costs of greenhouse gas emissions and air pollution are not seen or felt; homeowners may believe that environmental changes will not affect them personally (Clement, Henning, & Osbaldiston, 2014). Due to consumers’ attitudes, the burden of environmental problems, such as reducing carbon emissions and air pollution through energy efficiency and conservation, must be borne by the entire society. Hence, PEBs and how they relate to background demographic factors in the efficient use of energy is a challenge. PEB to conserve energy and the efficient use of energy is a path to energy sustainability and carbon emissions reduction.

The U. S. EPA was established in 1972 to protect the environment and people's health and to provide an understanding of the current scientific context of greenhouse gas emission and its potential socioeconomic and environmental impact on communities. Although the United States and other industrial economies have yet to fully recognize the effects of human behaviors on greenhouse gas emissions, environmental pollution, and climate change, there is a need to explore emissions reduction through PEBs and demographic changes (Abrahamse & Steg, 2009; Lindfield, 2010). According to the EPA (2012), U.S greenhouse gas emissions have increased by about 7% over the last 3 decades. There was a proportionate increase in total carbon emissions in 2014, compared to the 2013 emissions levels (EPA, 2016). This unparalleled surge was due to factors such as the cold winter conditions, which increases energy use in residential buildings in the Northeastern region of the United States. Residential buildings accounted for approximately 17 % of the total U.S. greenhouse gas emissions, which included direct emissions (from residential furnaces) and the indirect emissions from generating electricity consumed in residential buildings (EPA, 2016).

Current Trends

Although industrialized economies are believed to contribute the most to emissions and pollution, less developed economies and poor communities are affected by their actions. There is no easy solution to the problem of emissions and environmental pollution. Corrective measures should be adopted through public policies and effective organizational structures in addressing these issues, while efforts by homeowners and household occupants should be focused on energy conservation through the efficient use of energy and other proenvironmental measures. Industrial nations, as well as a growing number of emerging economies, continue to contribute to total carbon emissions, a trend that has not shown any signs of improvement since the industrial revolution (Engel & Kammen, 2009). The EPA (2012) has been tracking the current trends in carbon emissions and removals in the United States since 1990. The EPA reported that greenhouse gas emissions in the United States have increased by 10.5% over the last decade.

According to the Organization for Economic Development and Co-operation (OECD, 2011), contributors to carbon emissions and pollution can be natural or human sources. The most prevalent natural sources of emissions are decomposition, ocean release, and respiration, while emissions and pollution from human activities are deforestation, cement production, and the use of fossil fuels (OECD, 2011). According to the U.S. Energy Information Administration (EIA, 2015), human activities, particularly behavior and demographic changes, accounted for most of the increase in greenhouse gases since 1900. The EIA reported that the largest source of greenhouse gas emissions from human activities has been from burning fossil fuels for electricity, heating, and transportation.

According to the Intergovernmental Panel on Climate Change (IPCC, 2014), global carbon emissions from fossil fuels have increased in the last century. The IPCC also reported that carbon emissions have increased by about 90% since 1970, while emissions from fossil fuel combustion and industrial processes have contributed about 78% of the total greenhouse gas emissions increase from 1970 through 2011 (IPCC, 2014). However, deforestation and other land-use changes are reported to be the second-largest contributors to greenhouse gases and changes in the environment (IPCC, 2014).

The U. S. response to carbon emissions and climate change may vary depending on the prevailing political climate, as well as demographic and other socioeconomic characteristics (Lindfield, 2010). As one of the main contributors to carbon emissions, the United States continues to be a part of the ongoing global efforts to mitigate emissions and environmental pollution. Although the United States has played a limited role in the attempt to mitigate carbon emissions on a global scale, individual states such New York and California have exhibited progress in leading local and regional efforts in reducing emissions (Ciocirlan, 2009).

Following the transportation sector, the building sector (commercial and residential) is the second largest source of carbon emissions in the United States (EIA, 2015). Emissions from Vermont's residential sector increased by 23% over the last decade, indicative of a cold climate where petroleum is the primary heating fuel (EIA, 2014). Over the same period (2000 to 2014), carbon emissions fell in 35 states and rose in 15 states across the United States (EIA, 2014). The greatest decrease in emissions occurred in Maine at 26%, or 6 million metric tons (EIA (2015). State policymakers are pursuing both policy and behavioral strategies aimed at reducing energy end-use through energy efficiency and energy conservation. Carbon emissions reduction, through energy conservation, should be looked into from a household and homeowner-specific perspective.

In 2009, residential buildings in Massachusetts consumed about 109 million British thermal units (Btu) of energy per household, 22% more than the U.S. average (EIA, 2009). The higher than average site consumption resulted in households in this region spending 22% more for energy than the U.S. national average (EIA, 2009). Also, electricity spending in the Northeast region was close to the national average due to higher energy prices in New England (EIA, 2009). Because the weather in the Mid-Atlantic and New England is cooler than most areas in the United States, space heating made up a greater portion of energy use in residential buildings (EIA, 2009). This proportion was about 59% as compared to the U.S. average, and air conditioning made up only 1% of energy consumption (EIA, 2009).

Energy-related carbon emissions vary across states, based upon whether they are considered on an absolute or per capita basis. Total state carbon emissions include those from direct fuel use across all sectors, including residential, commercial, industrial, and transportation, as well as primary fuels consumed for electric generation in residential buildings (The World Bank, 2017). The overall size of a state (as well as the available fuels, types of dwellings, climate, and population density) play a role in determining the level of both totals and per capita emissions (The World Bank, 2017). Additionally, each state's energy system reflects circumstances unique to that state. For example, some states have abundant hydroelectric supplies, while others contain abundant coal resources.

In the late 1990s, residential buildings in the Southern region surpassed the Midwest in consuming the most energy in the United States. This shift reflected the economic boom in the region, which stimulated U.S. migration to the South and the construction of more and larger homes (EIA, 2014). In 2009, households in the South consumed about 3.22 quadrillion Btu, which was about 3% of the country's total energy use and about 32% of the energy used in homes. Due to the longer heating seasons, the Northeast and Midwest regions still consume the most energy per household, at 108 and 112 million Btu per household in 2009, respectively (EIA, 2015).

Northeast Energy Efficiency Partnership and Regional Greenhouse Gas Initiative

In 1996, the Northeast Energy Efficiency Partnership (NEEP) was founded with the aim of accelerating residential energy efficiency in the New England and Mid-Atlantic states. The NEEP is one of six regional energy efficiency organizations funded, in part, by the U.S Department of Energy to support state energy efficiency policies and programs (NEEP, 2017). The purpose of NEEP is to implement and accelerate energy efficiency as a part of promoting a sustainable and efficient regional energy system. The NEEP plays a role in the successful launch and implementation of the Northeast region's first functional carbon emissions program, known as Regional Greenhouse Gas Initiative (RGGI), in January 2009. This process allowed the Northeast region to adopt a "declining cap" on emissions of approximately 3% per year (NEEP, 2017). This strategy serves as a primary source of funding for energy efficiency and conservation programs.

The RGGI is the first mandatory, market-based, energy efficiency program in the United States to reduce greenhouse gas emissions. The RGGI is a cooperative effort among the states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, and New York to cap and reduce carbon emissions from electricity and gas (RGGI, 2017). Following a comprehensive 2012 program review, the RGGI states implemented a new 2014 RGGI cap of 91 million short tons (RGGI, 2017). The RGGI carbon cap is expected to decline about 2.5% each year from 2015 to 2020 (RGGI, 2017). The RGGI procures electricity on behalf of residential and commercial ratepayers of the member states. Participating states can sell nearly all carbon emission allowances through the auction and will invest the proceeds back in energy efficiency, renewable energy, and other consumer benefit programs in the communities (RGGI, 2017). These programs are spurring innovation in the clean energy economy and creating green jobs in the RGGI states.

The successful implementation of the RGGI in procuring electricity from alternative sources has influenced homeowners of member states to pursue energy efficiency and emissions reduction programs and practices at the residential level. The RGGI (2017) explored further energy efficiency and conservation programs to serve the Northeastern regional states and neighboring communities in adopting energy efficiency and conservation policies and programs. The state of Pennsylvania also explored the possibility of joining RGGI in promoting various energy efficiency and carbon emissions reduction program (RGGI, 2017). The success of the NEEP has invigorated other states and surrounding communities to consider alternative energy programs. Although energy stakeholders have experimented with energy efficiency and conservation in the region, they are yet to achieve dissemination of distributed renewable energy sources that produce the needed clean energy required for a sustainable energy saving program. To improve the scale of decentralized alternative energy deployment, strategic information and policy support will play a role in the efficient use of energy at the household level.

Problem Statement

The unaddressed threat level of environmental problems such as greenhouse gas emissions and air pollution are rooted in human behaviors and activities, which could be managed and controlled by altering the relevant demographics and consumption behaviors in reducing its social and environmental impacts (Steg & Vlek, 2007). Because most consumers do not use energy efficiently, a change in household energy consumption pattern and behavior is needed. Increased energy consumption may hinder the technical efficiency gains resulting from using energy-efficient appliances, water-saving technologies, and home insulation (Steg & Vlek, 2009). Most importantly, we haven't had the opportunity to gain insight in increasing a sense of the need for household energy conservation, by explaining how occupants' consumption behaviors and actions may influence the way energy is used, and how those activities translate into carbon emissions and air pollution.

The study of household energy consumption and the intent to reduce it through energy conservation merits further empirical investigation to understand the impediments and challenges in the adoption of PEBs in addressing carbon emissions, environmental pollution, and climate change. In this study, I highlighted behavioral and demographic determinants as predictors of energy consumption by outlining the challenges and opportunities of how to plan for sustainable and meaningful energy efficiency and conservation through homeowners' behavior and demographic changes. Accordingly, I described the benefits of PEBs and the effect of waste energy on homeowners' disposable income and environmental change.

Purpose of the Study

The purpose of this study was to determine whether the variables from the TPB, alongside background demographic factors, had a predictive value in explaining and understanding why homeowners may engage in a PEB, thereby using energy efficiently and conserving energy. The goal of this study was to examine how homeowners in the Northeast region of the United States (New England and Mid-Atlantic) perceived energy conservation through behavioral and demographic changes. The behavioral effects were ascertained to quantify the variables under study, while validating the TPB model.

This study may contribute to the energy literature by addressing the impact of PEBs on homeowners' intent to conserve energy. This study may provide information on the sustainable use of energy. Stakeholders may use the findings from this study to shape the policy discourse about energy efficiency and energy conservation through the lens of demographic and behavioral changes. The study may also be beneficial in alleviating the socioeconomic and environmental costs of carbon emissions, environmental pollution, and climate change.

In this study, a quantitative, empirical method was used to identify the significant predictors of homeowners' behavioral intent to conserve energy. A multiple regression analysis was also used to measure the relationship between variables from the TPB and the background demographic factors used in this study.

Research Questions and Hypotheses

To guide this study, the following research questions were developed to identify the most statistically significant behavioral determinants and demographic predictors of homeowners' intent to conserve energy:

Research Question 1: Is there a relationship between behavioral determinants (beliefs, attitude subjective social norm, and perceived behavioral control) and homeowners' intent to conserve energy, while controlling for sociodemographic factors?

H_a1: There is a statistically significant relationship between homeowners' beliefs about carbon emissions and climate change and the intent to conserve energy.

H_01: There is no statistically significant relationship between homeowners' beliefs about carbon emissions and climate change and the intent to conserve energy.

H_a1a: There is a statistically significant relationship between homeowners' attitude toward PEB and the intent to conserve energy.

H_01a: There is no statistically significant relationship between homeowners' attitude toward PEB and the intent to conserve energy.

H_a1b: There is a statistically significant relationship between homeowners' subjective social norm and the intent to conserve energy.

H_01b: There is no statistically significant relationship between homeowners' subjective social norm and the intent to conserve energy.

H_a1c: There is a statistically significant relationship between homeowners' perceived behavioral control and the intent to conserve energy.

H_01c: There is no statistically significant relationship between homeowners' perceived behavioral control and the intent to conserve energy.

Research Question 2: Is there a relationship between sociodemographic factors (personal income, household size, household composition, and education level) and homeowners' intent to conserve energy, while controlling for behavioral determinants?

H_a2: There is a statistically significant relationship between personal income and homeowners' intent to conserve energy.

H_02: There is no statistically significant relationship between personal income and homeowners' intent to conserve energy.

H_a2a: There is a statistically significant relationship between household size and homeowners' intent to conserve energy.

H_02a: There is no statistically significant relationship between household size and homeowners' intent to conserve energy

H_a2b: There is a statistically significant relationship between household composition and homeowners' intent to conserve energy.

H_02b: There is no statistically significant relationship between household composition and homeowners' intent to conserve energy

H_a2c: There is a statistically significant relationship between education level and the intent to conserve energy.

H_02c: There is no statistically significant relationship between education level and the intent to conserve energy

Research Question 3: Is there a relationship among behavioral determinants (attitude, beliefs, subjective social norm, and perceived behavioral control), sociodemographic factors (personal income, household size, household composition, and education level), and homeowners' intent to conserve energy?

H_a3: There is a statistically significant relationship among behavioral determinants, sociodemographic factors, and homeowners' intent to conserve energy.

H_03: There is no statistically significant relationship among behavioral determinants, sociodemographic factors, and homeowners' intent to conserve energy.

Theoretical Framework

Energy conservation and the need to reduce energy use has been a global issue since the industrial revolution (OECD, 2011). Because the use of fossil fuels has been the primary source of energy for many households and business, there is a need for reevaluating energy consumption at the household level. It is important to explore further behavioral sentiments and demographic changes among homeowners for the sustainable use of energy. To achieve this goal, internal factors, such as personal beliefs, and situational factors, such as demographic characteristics, have been identified as elements that generate or prevent behavioral changes among homeowners. By investigating homeowners' behavioral intent in conserving energy, I adopted the TPB model and its traditional determinants in behavior interaction theory.

Although I used this integrative conceptualization as the underlying framework for explaining homeowners' behavioral intent, the theoretical perspective was based on a subset of individual behavior determinants from the TPB framework. As evidenced in the results of the study, each of the TPB determinants in the framework was based on either the behavioral, normative, or control belief about the effect of energy conservation on environmental pollution and climate change. A behavioral belief about the outcome of an energy behavior produces the resultant attitude toward homeowners' conservation behavior. Ajzen (2005) pointed out that belief about the normative expectation of people may create a social norm and that the belief about the controllability of people's behavior may influence their perceived behavioral control. Several factors such as the personal, social, and informational characteristics of homeowners may serve as the basis for their behavioral beliefs. Factors such as age, gender, personality traits, education, and awareness may also influence people's behavioral intent to act in a certain way (Ajzen, 2005, p. 135) or to consume a certain amount of energy at any given time. Figure 1 is an integrative conceptualization of the variables from Ajzen's (2006) TPB, alongside background demographic factors that may influence homeowners' PEBs at varying levels.

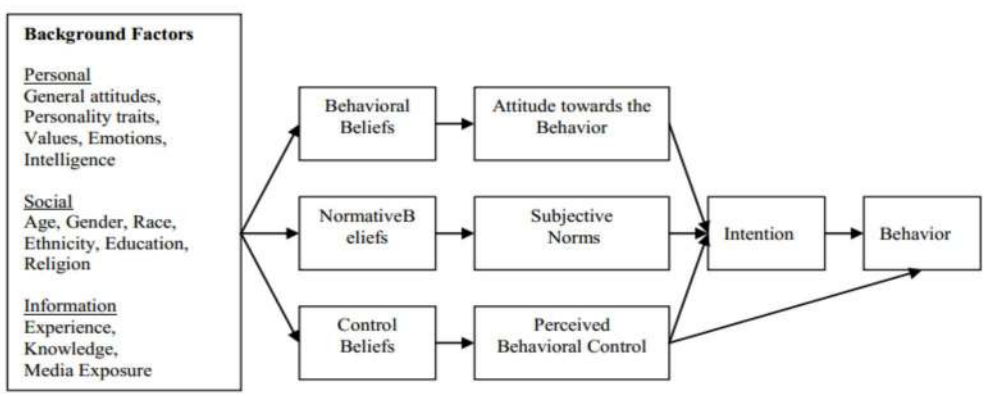

Figure 1. A conceptual framework of the TPB. Adapted from "Constructing a TPB Questionnaire: Conceptual and Methodological Considerations," by I. Ajzen, 2006, from http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf.

The establishment of NEEP (1996) and RGGI (2009) has affected individual homeowners' demographics such as awareness, information, and media exposure, which may trigger behavioral beliefs about PEBs and energy conservation.

Nature of the Study

The nature of this study stemmed from the conceptual framework of the TPB as defined by Ajzen (2006). In this study, homeowners' behavioral intent to conserve energy was measured using variables from the TPB and background demographic factors. The research design for this study consisted of a quantitative method using a web-based survey technique. The primary goal of this study was to understand whether the TPB could theoretically explain residential energy consumption and the intent to reduce energy use through PEBs.

Scholars who employed the TPB model, alongside demographic factors, have provided empirical evidence that the model was an accurate predictor of the intent to reduce household energy use (Abrahamse & Steg, 2011; Clement et al., 2014). Because the study of household energy conservation through homeowners' PEB is a new phenomenon in the energy literature, the TPB model provided a spectrum for explaining the TPB determinants and how they are used with background demographic constructs in explaining the intent to behave in a certain way.

The objective of the research model was to investigate the relationship between the TPB variables, demographic factors, and the intent to conserve energy. Moreover, I used the model to ascertain the effects of the four moderating demographic factors (personal income, household size, household composition, and education level) on the four traditional TPB determinants (beliefs, attitude, subjective norm, and perceived control). In the model, I identified the significant predictors of homeowners' intent to conserve energy at varying levels.

Basic Definitions

Although economic, social, and environmental researchers have different perspectives about energy efficiency, energy conservation, energy intensity, and consumption issues, several general premises were drawn and defined as a basis for this study. The following definitions applied to terminologies as used in the study:

Energy conservation: Energy conservation is where ratepayers reduce energy consumption by using less of an energy service. Energy conservation differs from efficient energy use, which refers to using less energy for a constant service. For example, driving less and walking more to the corner store or turning down a thermostat in the winter is an example of energy conservation. One way of improving energy conservation in U.S households is by using an energy audit, which is a system of audit and analysis of energy consumption patterns that helps reduce the amount of energy input into the system without negatively affecting energy or electricity output (Leslie, Pearce, Harrap, & Daniel, 2012).

Energy efficiency: Energy efficiency is a way of managing and restraining the growth in energy consumption. Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input (Gillingham, Newell, & Palmer, 2009). For example, when a compact florescent light (CFL) bulb uses less energy (one-third to one-fifth) than an incandescent bulb to produce the same amount of light, the CFL is considered to be more energy efficient. The phrase energy efficiency is used to describe various kinds of energy-saving measures. Increasing energy efficiency involves high initial cost, but this capital outlay will be paid back in the form of reduced energy costs within a short time period (Savitz, 2009). This makes efficiency improvements an attractive starting point for reducing carbon emissions.

Energy intensity: Gillingham et al. (2009) referenced that energy intensity is the ratio of energy consumption to a state’s gross domestic product. Energy intensity measures the amount of energy it takes to produce a dollar's worth of economic output, or conversely the amount of economic output that can be generated by one standardized unit of energy. Its value varies between states or countries depending on the level of industrialization, the mix of services and manufacturing in their economies, and the level at which homeowners adopt or engage in energy efficiency and conservation (EIA, 2015). Intensity varies by energy and fuel type. It is not atypical for particularly cold or hot climates to require greater energy consumption in dwellings for heating or cooling. A state or economy with a high standard of living is more likely to have a wider prevalence of consumer goods and, thereby, be impacted in its energy intensity than one with a lower standard of living.

Energy sufficiency: From a social science perspective, energy sufficiency does not mean sacrifice or opportunity cost, but the informed decision by a consumer in favor of or against a possible alternative action and points to the change of preference (Gillingham et al., 2009). For the purposes of this study, I referred to the basic technical definition of energy efficiency, differential household energy conservation and sufficiency, by considering sufficiency as a process of informed judgment leading to behavioral change in ratepayer consumption pattern.

Homeowners: Homeowners are residents who own a dwelling and who use that dwelling as their primary residence (U.S. Census Bureau, 2015).

Household: Household is a group of people who live in a common main dwelling (at the same address) and share joint financial and/or food resources and whose members consider them to be one housing unit. Household can also consist of one member only. According to the U.S. Bureau of Census (2015), there are approximately 124.6 million households in the United States. A household shares a similar economic context. The residents of the household do not have to be related to the head of the household for their income to be considered as part of the household.

Personal income: Personal income is measured as a total weekly income from all sources of the homeowner, excluding dependents. It includes wages and salaries; unemployment insurance; disability payments; child support payments received; rental receipts; and any personal businesses, investments, or other types of income received on a regular basis after tax and other deductions (U.S. Census Bureau, 2012b). Income measures are presented before and after housing cost, which include rent, mortgage, building insurance, and interest payments.

Proenvironmental behavior (PEB): PEB can also be referred to as environmentally friendly behaviors, ecological behaviors, or other variants as applied in this study. PEB is a systematic approach that promotes behaviors relevant to environmental sustainability and the advancement of environmentally-friendly behaviors, such as energy conservation and recycling. According to the EPA (2006), various environmental problems are posing threats to environmental sustainability, among which urban air pollution, global warming, and loss of biodiversity are most prevalent. As referenced by Abrahamse and Steg (2009); Abrahamse and Steg (2011); Clement et al. (2014); and Frederiks, Stenner, and Hobman (2015b), PEB change has become the focus and central phenomenon of not only environmental and social policies but also applied environmental psychology and economics.

Ratepayers: Individuals who own their home and already own all of the electrical appliances they need, or are renting their home, which does include all the electrical appliances needed. These individuals might be in the position of not wanting to buy, for example, a new heating system, air conditioning, refrigerator, or washing machine to reduce their electricity usage, but still wish for possible solutions to optimizing their electricity consumption.

Assumptions of the Study

In this study, I assumed that homeowners' energy behaviors would be affected by the results of this study. I also assumed that the intent to reduce energy use in residential buildings could positively affect homeowners' PEBs. It was also assumed that inherent in residential energy use is the interconnectedness between behavioral factors, demographic factor changes, and various the elements of the social system. Therefore, increasing energy efficiency through the use of renewable energy and technological appliances, as well as conserving energy by means of reduced energy consumption, will inherently reduce emissions and environmental pollution. This may lead to energy sustainability and a positive social change. I assumed that there was a simple, linear, and causal relationship among the TPB variables, the background demographic factors, and a sustainable energy outcome through behavioral changes. These relationships are not always direct, particularly the sociodemographic constructs, which could lead to the overestimation of energy programs or policy effects, thereby ignoring the effects of other demographic elements in the social system.

Scope and Delimitations

The scope of this study was limited to residential energy consumption using a survey study of homeowners in the Northeast region of the United States. However, the results of this study could be universally applicable to other census regions of the United States, as well as other countries and organizations. Less emphasis was placed on the macro determinants of household energy use at the federal and environmental levels, which are often tied to political, social, technological, and institutional constraints. These constraints were considered to limit homeowners from acting, or allowing them to behave, in a certain way regardless of their general demographic and homeowner-specific characteristics (Frederiks et al., 2015a).

Psychological and behavioral factors (such as perceived behavioral control) and other aspects of the broader socioeconomic and cultural environment (ie., government regulations, financial markets, and public infrastructure) may also influence homeowners' PEBs and the intent to reduce energy use through energy efficiency and conservation. These macrolevel factors may also place constraints on energy stakeholders charged with making public policies on carbon emissions reduction initiatives within fixed institutional boundaries. However, many of the sociodemographic predictors discussed were reflective of the interface between homeowners and their socioeconomic and natural environment to the extent that such factors were inherently linked with one another, such as the normative and informational socioeconomic and environmental influence on homeowners' intent to consume a certain amount of energy at any given time (Frederiks et al., 2015a, p. 578).

Limitations

This study had several potential limitations, some of which were consistent with the inherent weaknesses of the research methodology and others with the TPB. One limitation of this study was that the TPB, as applied by Ajzen (1985), did not factor in sociodemographic predictors in its analysis of behavioral intent. According to Ajzen, sociodemographic variables could be accounted for in the TPB only if they influenced the underlying behavioral beliefs that determined the attitude and subjective norm.

Another drawback of this study was its limitation in generalizing the research findings. As referenced by Ajzen (2006), the TPB was designed to measure behavioral actions based on intent. Hence, the TPB only allowed for the generalizability of the research findings to that action and not to related behaviors. Because I focused primarily on the behavioral intent of homeowners who used their dwellings as a primary residence, caution must be taken in applying my results to homeowners who do not use their dwellings as a primary residence, as well as ratepayers who dwell in a residence and pay electricity bills but are not homeowners. The results are valid only for the time and place where the data were collected. As such, results were presented as a survey sample, and the findings were also generalized to only the Northeastern region of the United States. Because of this limitation, the study results, conclusions, and recommendations reached might be difficult to implement in other census regions or countries due to environmental, economic, lifestyle, policy, and social differences. Hence, the generalizability of the results is limited to the sample population that participated in the survey.

It was not the aim of the study to formulate a model that predicts, with precision, residential energy use by reducing its variables to a few key structural, behavioral, or demographic attributes. Energy use, even at the household level, is a result of a complex interplay of personal, psychological, and physical characteristics, including many personal choice opportunities that defy measurement.

Significance of the Study

A practical implication of the survey of residential energy consumption using the TPB is an objective overview of homeowners' intent to reduce energy consumption and the ability to incorporate efficient energy use into long-term sustainability and household energy planning. The intended audience for this study was U.S. homeowners who lived in the New England and Mid-Atlantic census regions. However, the research findings and recommendations could be relevant to the U.S. transportation and industrial sectors and other energy stakeholders who may be interested in sustainable energy development or carbon emission reduction programs.

Communities are faced with environmental challenges due to the scale of greenhouse gas emissions from the use of fossil fuels and other sources of emissions. Addressing this environmental challenge requires economic, moral, and social contributions from every facet of society. The results of this study may assist in shaping the ongoing NEEP and RGGI initiatives and policy discourses about sustainable energy deployment and its strategic benefits in advancing energy efficiency and conservation, while alleviating the social and environmental costs of greenhouse gas emissions and environmental pollution.

Although the Northeast region covers nine states in the United States, the social and environmental policies of the NEEP and RGGI have, over the years, not been effectively disseminated across the region. The successes of these programs and policy initiatives have not been evaluated regarding their level of contribution to reducing carbon emissions by way of promoting PEBs and the efficient use of energy in the region. Hence, I sought to advance the awareness of both regional and household choice energy through the TPB. By examining the factors that contribute to energy conservation through behavioral and demographic changes, I presented an energy reduction model that homeowners and households in other census regions may emulate.

Significance to Theory and Practice

To achieve the research goal, there needed to be an understanding of the application and concept of the TPB and how it relates to the sociodemographic and behavioral attributes that influence homeowners' PEBs and the efficient use of energy. Although income disparity and other demographic factors, such as age and household size, have been the subject of social inquiry, these variables have not been explored theoretically and empirically in the social sciences. In this study, I described how variation in these predictors are used in explaining household energy consumption and electricity usage, as scholars have not addressed them in their entirety.

Some of the most influential and commonly used models and theories in behavioral sciences have included Van Raaij and Verhallen's behavioral model of residential energy use, Costanzo et al.'s sociopsychology model of energy conservation behavior, Stern et al.’s VBN, and Ajzen's TPB. Some researchers have also studied the unconscious habits and technological structures that influence residential energy consumption using Schatzki's practice theory.

This study adds to theory and practice by in providing a broader perspective of the behavioral and demographic factors that trigger the differential effects of PEBs and homeowners' intent to conserve energy. I provided a practical lens of homeowners' socioeconomic and environmental decision making through the TPB regarding alternative energy adoption and the efficient use of energy. Scholars have also used secondary data to discuss and estimate residential energy consumption and energy conservation practices. I used primary data, collected through a web-based survey, to examine the behavioral and demographic effects of the intent to conserve energy.

Researchers have not examined internal variations in economic, social, behavioral, environmental, technical, and other demographic trends that have influenced energy use, as well as the internal dynamics that produce aggregate data on economic and social disparities among homeowners. This study added to the energy literature by providing information on how PEBs, in the form of energy conservation among homeowners, were influenced by public policy tools such as those initiated and adopted by the NEEP and the RGGI.

Implications for Positive Social Change

This study may promote positive social change through PEBs by shaping the discussion about social behaviors and household energy consumption. Society is concerned about how the impact of increased energy use, increased carbon emissions, and environmental pollution could be reduced or eliminated through changes in human behavior. Hence, stakeholders engaged in promoting alternative energy deployment and energy conservation should consider the outcomes of this study as a policy tool for planning and implementing sustainable energy programs geared toward a positive social change. The positive social and environmental impacts resulting from the efficient use of energy and energy conservation includes reduced emissions and air pollution and reduced reliance on foreign oil and other inherent social and environmental benefits.

The efficient use of energy might have a positive social impact on households and communities, as the reduced consumption of end-use energy would free up disposable income and increase savings. The increased savings could be invested in proenvironmental factor support programs and allow for the consumption of other essential social programs such as sustainable health care, sustainable housing, education, and transportation. Once PEBs and practices are reported, measured, and compared to the various energy outcomes, public policy and organizational leaders can assess the positive impact of the overall effectiveness of energy service delivery and the resulting efficiency outcomes to effect positive social changes.

Chapter Summary and Transition to Chapter 2

Residential energy is one of the highest contributors to air pollution greenhouse gas emissions in the United States. Hence, the current trend in the socioeconomic and environmental impact of residential energy use is unsustainable. Although few households and communities are consuming energy at a disproportionate rate and creating environmental damage, the outcome of carbon emissions affects all. Various strategies have been adopted at the federal, state, and local levels to mitigate pollution and increased carbon emissions from residential energy use. One of New England's and Mid-Atlantic's energy efficiency initiatives has been to implement and accelerate energy efficiency and conservation as a part of promoting a sustainable and efficient regional energy system. Homeowners are players in residential energy consumption, and their intent to reduce energy use through PEBs is of importance in minimizing the economic and environmental costs of greenhouse gas emissions and climate change. In Chapter 2, I provide a review of the literature.

Chapter 2: Literature Review

Introduction

In Chapter 2, I present a review of the literature by providing an overview of homeowners' behavioral intent to conserve energy, as it relates to the TPB model. Although comprehensive in context, the review of the literature is not a complete examination of all of the available literature on residential energy use and the intent to conserve energy through PEBs. The purpose of this study was to explain the significant behavioral and demographic factors for evaluating homeowners' intent to consume a certain amount of energy over time. In this chapter, I examine studies on individual behaviors and demographic determinants and the research framework based on the TPB.

Literature Search Strategy

A review of the literature was based on the current knowledge of residential energy use and intention to reduce household energy consumption from the behavioral and demographic perspectives. An extensive collection of published dissertations, books, peer-reviewed journals, and articles provided a supporting background for this study. The literature review was guided by the search of databases using academic search engines for articles and dissertations published in the English language from 2011 to 2017.

The literature search included government databases mainly from peer-reviewed articles and publications through the Department of Energy (DOE), EIA, EPA, NEEP, RGGI, and the Residential Energy Consumption Survey (RECS). I also used state-specific databases and government websites, Academic Search Complete: A Sage Full-Text Collection, Public Policy and Administration Databases, ProQuest Central, Political

Science Complete: A Sage Full-Text Collection, Google Scholar, Science Direct: A Sage Full-Text Collection, and other peer-reviewed Internet sources on residential energy consumption, PEBs, energy efficiency and conservation, the TPB, and theories in the social and behavioral sciences.

Most of the literature used in this research consisted of peer-reviewed studies published within the last 5 years. However, some older sources were used to discuss theoretical developments and for historical referencing only. All referenced materials were in the English language. However, attempts were made to obtain the English version of non-English publications and transcriptions for this dissertation.

Theoretical Foundation

The TPB was used to inform the study and to examine the relationship among the traditional TPB variables, four background demographic factors, and homeowners' intent to conserve energy. Ajzen developed the TPB in 1985 as an extension of the TRA, which was earlier developed by Ajzen and Fishbein in 1967. According to the TPB, the most important determinant of a person's behavior is the intent to perform the behavior (Ajzen, 1985).

There are three considerations that guide human behavior: the belief about the likely consequences of a behavior (behavioral belief), belief about the normative expectation of others (normative belief), and the belief about certain factors that may potentially drive or impede the potential performance of the behavior (control belief; Ajzen, 2006). Ajzen (2006) stated that the behavioral belief construct produces favorable or unfavorable attitudes toward a behavior, while normative belief results in perceived social pressure (subjective social norm); the control belief construct leads to a perceived behavioral control. I expected that homeowners' attitudes toward energy behavior, their subjective social norm, and perception of the behavioral control could lead to the formation of a behavioral intent.

I used the TPB to develop a well-structured and defensible study. Although different theoretical and conceptual perspectives have surfaced in the energy literature and behavioral research, no single framework has provided an all-inclusive explanation of the effects of behavioral changes on energy end-use. Also, there is no single approach that predicts individual homeowner differences in energy behavior. Frederiks et al. (2015b) used various behavioral models to investigate variables that influenced socially and environmentally significant energy behaviors and practices. According to Frederiks et al. (2015a), "the issue of what distinguishes energy users or energy wasting and energy saving consumers is in some way a very complex situation that is hardly captured through the lens of a single framework" (p. 576). Integrating insights from the energy and behavioral literature, I also provided a theoretical outline of residential energy use with a focus on how various sociodemographic and behavioral processes have been conceptualized to date.

I used the TPB to explain the tenets of environmentally conscious behaviors and the intent to reduce energy use through behavioral change. Abrahamse and Steg (2011) examined whether the explanation of energy use in residential buildings, and intent to reduce it, could be informed by variables from the TPB (Ajzen, 1985), variables from the TRA (Ajzen & Fishbein, 1972), and variables from the VBN (Stern et al., 1999) alongside background demographic factors. Clement et al. (2014) also discussed the proenvironmental intent to conserve energy by providing insight on various options in achieving household energy reduction by using the TPB. The study served as a lens into energy reduction and the cost of depleted environmental resources through pollution and climate change. The TPB has been used to establish a theoretical explanation for reduced energy consumption through behavioral and demographic change.

The Theory of Reasoned Action and the Theory of Planned Behavior

Fishbein and Ajzen (1975) developed the TRA as an improvement to the information integration theory (IIT; Anderson, 1971). The basic tenets of the IIT include how attitude toward a behavior is formed and changed through the integration of new information with existing thoughts about the consequence of the behavior (Anderson, 1971). The TRA added the construct of behavioral intent to the process of persuasion (Fishbein & Ajzen, 1975). The TRA was used to understand the effect of attitude on behavior by explaining the relationship among beliefs, attitude, intent, and behavior. According to the TRA, the implications or consequences of a behavior are considered before the act is performed. Hence, Ajzen later added another key construct, perceived behavioral control, as an extension to the TRA.

According to Ajzen and Fishbein (1977), the attitude toward a behavior stems from the underlying belief about the outcome of the behavior. Contextually, the attitude toward a PEB, for example energy conservation, could result from the belief that it may lead to carbon emissions reduction and the evaluation of the characteristics of the action, such as curtailment or efficiency behaviors. Ajzen and Fishbein (1977) also stated that the intent of an action is the greatest predictor of whether or not people will complete a behavior. In their theoretical explanation of the TRA, Ajzen and Fishbein (1980) also argued that the determinants of the intent to act are attitude and the perceived norm guiding the behavior in question. Ajzen and Fishbein (1980) further attested that the forces of attitude and perceived behavioral norm determine the intent to act in a certain way. People tend to perform a behavior when positively evaluated and when the behavior is believed to be approved by their significant others. However, Ajzen and Fishbein (1980) reported that the relative significance of behavioral attitude and subjective social norm varies based on the intent to perform the act.

Ajzen (1985) concluded that the TRA failed to account for perceived behavioral control. Researchers have viewed the lack of accountability for perceived control in the TRA as a weakness in the theory, which gave rise to the development of the TPB (Ajzen, 1985). Hence, the TPB is a theoretical modification and extension of the TRA. The TPB links belief and people's behaviors. Ajzen used the TPB to improve the predictive power of the TRA by including perceived behavioral control as a predictor of behavior. Since its inception, the TPB has been adopted in behaviors studies to explain the causal relationship among people's beliefs, attitudes, and intentions. Figure 2 shows the TRA.

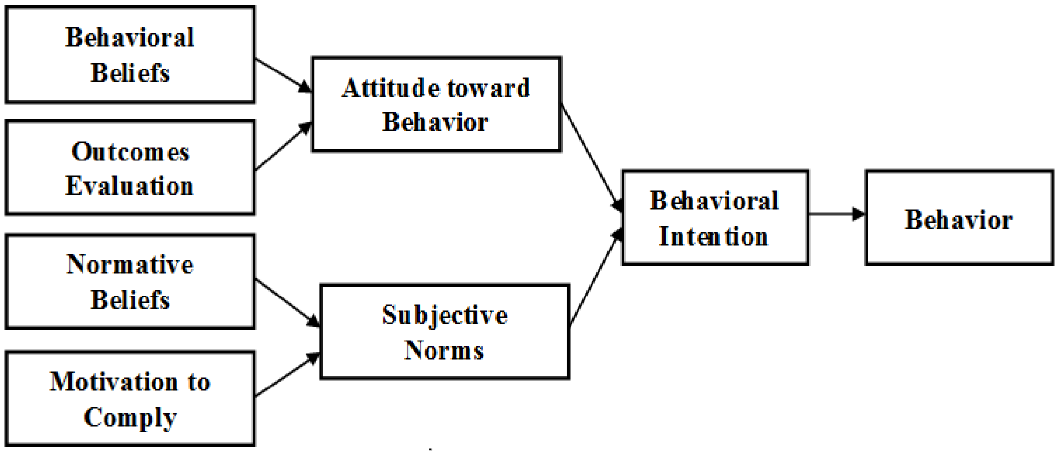

Figure 2. The TRA. Adapted from "Belief, Attitude, Intent, and Behavior: An Introduction to Theory and Research," by M. Fishbein and I. Ajzen, 1975, Reading, MA: Addison-Wesley.

Assumptions of the Theory of Planned Behavior

The TPB includes the key assumptions of the TRA, with certain modifications of its own. According to the TPB, people's intentions reflect their personal beliefs and attitudes or their perception on the extent of the outcome of the behavior (Ajzen, 1985). The TPB is an effective theory for examining the effects of people's behavioral intent and their attitude toward a behavior.

The TPB has been supported by empirical evidence, particularly with the addition of perceived behavioral control as a predictor that helps to account for variances in the model (Ajzen, 2011; Armitage & Conner, 2001). The TPB has been used in behavioral and psychological contexts, including consumption decisions, proenvironmental choices, reproductive decision making, substance abuse treatment, exercise, transportation choice, energy choice, disability studies, public policy adoption, mental health care, marketing, recycling, and many more contexts. According to de Leeuw, Valois, Ajzen, and Schmidt (2015), the TPB's addition of the perceived behavioral control construct will improve the prediction of intent beyond the level described in the TRA. Also, Kaiser, Hubner, and Bogner (2005) studied PEBs and energy conservation by looking at the relationship and contrasts between the TPB and the VBM.

The TPB's constructs are similar to those of other behavioral theories (e.g., subjective social norms, belief, efficacy, etc.), which indicates general acceptability of its concepts in the social sciences and behavioral studies. Furthermore, the TPB accounts for perceived behavioral control, or people's perceptions of the internal or external constraints on performing a behavior (Ajzen & Driver, 1992). The TPB allows for operationalization of its variables. Ajzen (2006) demonstrated this characteristic in the conceptualization of the linear process of the TPB model, in which one fundamental construct defines and leads to another in the theory's explanation of the intent to act. The TPB can be used to examine homeowners' intent to conserve energy.

Theoretical Background

The TPB was used as the theoretical framework of this study and to understand the drivers and barriers underlining the intent to conserve energy at the household level. Stemming from the TRA (Fishbein & Ajzen, 1975), Ajzen (1985) developed the TPB in a bid to include certain behavioral determinants to better explain why and how people tend to behave in a certain way. Because the TPB includes intent and perceived behavioral control as the determinants of behavior, the theory has been used in identifying the behavioral factors that affect decision making, such as in reproductive and public health

(Ajzen & Klobas, 2013; Klobas & Ajzen, 2015; Liefbroer, Klobas, Philipov, & Ajzen, 2015), health psychology (Ajzen, 2014), substance abuse treatment (Zemore & Ajzen, 2014), PEB (Abrahamse & Steg, 2011), organizational behavior and decision processes (Ajzen, 1991), recycling behavior, adoption of green consumer products, and energy efficiency and conservation behavior (Harland, Staats, & Wilke, 1999; Tonglet, Phillips, & Read., 2004; Wilson & Dowlatabadi, 2007). I used TPB in this study to ascertain the factors that drive or prevent certain energy behaviors and the intent to reduce energy use through energy conservation.

According to Abrahamse and Steg (2011), sociodemographic factors may also influence homeowners' energy intent and behavioral outcomes indirectly. Homeowners make decisions that are typically motivated by self-interest in consuming a certain amount of energy (White & Simpson, 2013). Because of this, the TPB may be relevant in explaining the relationship between homeowners' intentions to act and their demographic characteristics, such as income, gender, age, and education level. According to the TPB, people’s behaviors are a product of the interaction between motivation to act (intent) and the ability to act (behavioral control), and intention may directly predict behavior (Ajzen, 1991).

Theoretical Sufficiency of the Theory of Planned Behavior

Scholars have explored the theoretical sufficiency of TPB against other behavioral theories. Chan and Bishop (2013) completed a study involving the moral basis for recycling using the TPB. In their analysis, Chan and Bishop found a positive relationship between the intent to recycle and actual recycling behavior.

Taylor and Todd (1995) completed a study involving technology adoption and TPB decomposition and compared the technology acceptance model (TAM), the TPB, and the TRA to assess which model best explains the usage of IT in an organizational setting. In comparing the three models, the TRA and TPB models did not perform as well as TAM in predicting IT behavioral intent (Taylor & Todd, 1995). However, the TPB produced a moderately better variance in predicting the intent to adopt IT behavior in the workplace (Taylor & Todd, 1995). Because Taylor and Todd discovered behavioral intent as being the most significant determinant of IT usage behavior among the three models, it has been used to examine the direct and indirect effects of other factors on behavioral intent. Taylor and Todd showed that the TPB explained 57% of the variance in behavioral intent, while TAM explained 52% variation, and decomposed TPB (TRA) 60% of the variance in intent. The addition of perceived control and subjective norm, and the decomposition of beliefs, provided the additional understanding into the conceptualization of the intent act (Taylor & Todd, 1995).

Sheppard, Hartwick, and Warshaw (1988) reported that attitude and subjective norm explained 48% of the variance in the intent to act. These results and conclusions are also similar to those reported by Yousafzai, Foxall, and Pallister (2011); Davis, Bagozzi, and Warshaw (1989); Mathieson (1991); and Hartwick and Barki (1994).

Model Explanation of the Theory of Planned Behavior

Ajzen (1985, 1991) extended the TRA (Fishbein & Ajzen, 1975) in the TBA to account for behavioral conditions where individuals do not have absolute control over their behavior. The TPB can be further divided into three conceptually independent constructs leading to behavioral intent (BI): attitude toward the act (AAct), perceived behavioral control (PBC), and subjective social norms (SN; Ajzen, 1991), which can be expressed in the following equation:

Equation 1

$$AAct_{wi} + SN_{wi} + PBC_{wi} = BI \quad \ldots\ldots \quad (1)$$

(Note: $_{wi}$ *= weights based on multiple regression analyses)*

Each of the determinants of BI is, in turn, determined by underlying belief structures (Taylor & Todd, 1995). In Ajzen's TPB model, behavioral belief leads to attitude, while normative belief leads to subjective social norms, and control belief leads to perceived behavioral control.

Attitude (A) is equated with attitudinal belief (b_i) that performing energy behavior may lead to a particular energy outcome, weighted by an evaluation of the desirability of that energy "conservation" outcome (e_i). This is illustrated as

Equation 2

$$A = \Sigma b_i e_i \quad \ldots\ldots \quad (2)$$

For example, a homeowner may believe that conserving energy could result in greenhouse gas emissions reduction (b_i) and may consider this a highly desirable outcome (e_i). However, subjective social norm is as a result of the homeowner's normative belief (nb_j) concerning a particular referent weighted by the motivation to comply with that referent (mc_j). This is illustrated as

Equation 3

$$SN = \Sigma nb_j mc_j \quad \ldots\ldots \quad (3)$$

For example, a homeowner may believe that his/her peers or significant others think that a person should conserve energy *(*nb_j), but complying with the wishes of peers and significant others is relatively unimportant *(*mc_j; Taylor & Todd, 1995).

According to Ajzen (1985, 1991), perceived behavioral control reflects the belief of being able to access resources and opportunities to perform a behavior. Alternatively, perceived behavioral control is reflective of internal and external factors that may facilitate or impede the performance of a behavior. Perceived behavioral control is a combination of control belief *(*cb_k*)* weighted by the facilitation *(*pf_k*)* of the control belief in either hindering or facilitating the behavior (Taylor & Todd, 1995). This is illustrated as

Equation 4

$$PBC = \Sigma cb_k pf_k \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

For example, a homeowner may feel that he/she does not have the skills to use energy efficient appliances *(*cb_k*)* and that technology skill level is important in determining energy use in a household *(*pf_k*)*.

Although some researchers have categorized these determinants of behavior, Ajzen (1985) kept them separate. The way homeowners evaluate energy conservation (attitude), their socially expected energy behavior (subjective social norm), and self-efficacy that determines how they feel and motivates them regarding energy conservation (perceived behavioral control) are different in behavioral research. According to Knabe (2012), each of the TPB variables is hypothetical or latent in nature and are is measured based on observable responses from the survey.

Summary of Limitations of Existing Models in the Literature

Scholars have offered competing adoption models, such as the TRA, the VBN, and the TAM; however, they have not used all of the TPB variables to analyze residential energy use and PEBs among household occupants, particularly homeowners. Behavioral models such as Ajzen's (1985) TPB; Hines, Hungerford, and Tomera's model of responsible environmental behavior (REB, 1987); Guagnano, Stern, and Dietz's attitude-behavior-external conditions (ABC, 1995); Stern et al.'s (1999) VBN; and Kollmuss and Agyeman's (2002) model of PEB been used to explain behavioral interactions and social movements and how interactions among behavioral phenomenon have affected social change. Most of the existing studies are limited in supporting the research requirements applied in this study due to

- Use of aggregate (low-resolution) energy consumption data. Most scholars who have studied residential energy consumption and energy conservation have used low-resolution secondary data to explain household energy use among occupants. However, household energy consumption has temporary variations, such as income, household size, and weather, which are usually not captured in low-resolution consumption data (Kavousian, Rajagopal, & Fischer, 2013).
- Partial sets of explanatory variables. In most studies on residential energy, researchers have used only partial sets of household energy consumption determinants (e.g., appliance stock, weather condition, or general psychological factors). However, interactions among various

determinants, such as the relationship between behavioral constructs, building types, appliance load, lighting load, and heating load may offer potential for improving energy conservation and environmental change adoption (Kavousian et al., 2013).

- No distinction between wasteful consumption and peak consumption. Researchers have either used peak consumption or the total household electricity load in estimating residential energy use. According to Kavousian at al. (2013), analyzing the lower limits of energy consumption (wasteful/idle load) gives energy stakeholders insight on a building's physical and mechanical characteristics. A building with poorly fitted designed doors, or one with a leaky roof, may have a higher idle energy usage and electricity load because the heater or air conditioner may require constant operating capacity (Kavousian at al., 2013). The distinction between idle and maximum energy consumption allows for disaggregating the effects of demographic and structural factors on household energy conservation.
- Using energy intensity as the only indicator for energy consumption analysis. In most studies on household energy, scholars have used energy intensity (kWh/square foot) to investigate household energy consumption (Kavousian et al., 2013; Sütterlin, Brunner, & Siegrist, 2011). Kavousian et al. (2013) recommended scaling electricity consumption and usage by floor space area. For example, a refrigerator in a 2, 000 square-feet house

is likely to consume twice as much as the same refrigerator in a 1, 000 square feet house. Rather, only those factors whose consumption is dependent upon the floor space areas, such as lighting and heating loads, are scaled, while the un-scaled kWh value is used for other factors such as weather.

- Failure to use additional determinants to the TPB. Although previous scholars have proved that Ajzen's TPB has been successfully applied in various behavioral studies, Tonglet et al. (2004), Abrahamse and Steg (2011), and Frederiks et al. (2015a) posited that the use of additional behavioral determinants, such as self-identity and moral norm, as well as demographic factors, such as personal income and education level, should be used to explain people's behavioral intentions to act in a certain way. In this study, I considered the psychological and behavioral effects of some of the additional variables on homeowners' intent to alter or change their energy behaviors.

Literature Review

In the current literature, there is limited understanding of the relationship between homeowners' energy consumption, the intent to reduce their energy use through behavioral and demographic changes, and the outcomes related to energy conservation and carbon emissions reduction. Although scholars have investigated the impact of energy conservation behavior on household energy use, they have often failed to include the socioeconomic and environmental quantitative impact of PEBs and how they are measured, tracked, and reported.

Clement et al. (2014) and Macovei (2015) used the TPB to test the relationship between residential energy consumption and occupants' intent to reduce their energy use, as well as behavioral and sociodemographic factors. Abrahamse and Steg (2011) found household energy use to be related to demographic factors, while behavioral determinants, such as beliefs, were also significant predictors of occupants' intent to conserve energy. Fredericks et al. (2015a); Fredericks et al. (2015b); Pothitou, Athanasios, Liz, and Sai (2014); Kavousian et al. (2013); and Abrahamse and Steg (2011) used the TPB to examine residential energy consumption from the lens of PEBs and energy efficiency, PEBs and energy conservation, or a combination of both.

Huebner et al. (2015) and Gram-Hanssen (2014) observed the theoretical issues regarding household energy use by explaining the importance of demographic and behavioral change factors in attaining energy conservation through intent. In a similar analysis, Macovei (2015) studied the proenvironmental assessment impact on energy conservation and waste energy in residential buildings; Greaves, Zibarras, and Stride (2013) used the TPB to explore environmental behavior intent in the workplace. Chan and Bishop (2013) also used the TPB to argue for the moral basis of recycling and its antecedent behavioral intentions. However, within this literature, the quantitative impact analysis and measurement of the relationship between homeowners' sociodemographic characteristics and their behavioral intentions toward PEBs and energy conservation were lacking.

Although many researchers have been critical of the technical sufficiency of the

TPB for various reasons, such as the focus on rational decision making rather than emotions (Ajzen & Fishbein, 2005), the theory has been used in peer-reviewed literature in behavioral sciences. More specifically, the TPB framework has been used by Abrahamse and Steg (2011) and Harland et al. (1999) in predicting technology adoption and energy conservation.

Meta-Analyses

Several meta-analyses have been conducted to assess the theoretical sufficiency of the TPB. The framework of the TPB is a useful tool for predicting behaviors in a range of contexts (Armitage & Conner, 2001). In some of the existing meta-analyses, scholars have focused primarily on the TPB (Ajzen, 2014; Armitage & Conner, 2001; Osbaldiston & Schott, 2012; Steinmetz, Knappstein, Ajzen, Schmidt, & Kabst, 2016); however, others have assessed the TRA (Ajzen & Fishbein, 2004; Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997). Armitage and Conner (2001), Lehman and Geller (2004), and Conner (2014) have shown support for the TPB framework.

The results from Sheppard et al. (1998) are consistent with the meta-analysis of the TPB by Armitage and Conner (2001). According to Armitage and Conner (2001), attitude and subjective norm explained 63% of the variance in behavioral Intent. These results are similar to those reported by Davis et al. (1989) and Hartwick and Barki (1994). Armitage and Conner (1999) found that perceived behavioral control accounted for significant amounts of variance in behavioral intent, independent of variables from TRA.

Godin and Kok (1996) also supported the efficacy of the TPB by looking at various kinds of literature that used the TPB framework in studying health-related behaviors. Godin and Kok concluded the theoretical sufficiency of the TPB and by comparing its theoretical basis to that of the TRA, VBN, and the TAM. Godin and Kok also noted that the perceived control and attitude constructs are factors in explaining behavioral intentions. Although the belief factor was found to be the most significant predictor of the intent to conserve energy, the perceived control factor significantly added to behavioral predictions (Godin & Kok, 1996). This result is similar to the meta-analytic comparison of the TPB and the TRA by Hagger et al. (2002), and how they influenced behaviors and physical activities. Haggar et al. used path analysis to examine the relationships among various behavioral determinants in both the TPB and the TRA theories.

The meta-analyses discussed in this chapter served as a lens to a new dimension of residential energy use and the intent to adopt a PEB. I used Ajzen's (2006) recommendations for a useful conceptual and methodological development, decreasing measurement concerns while resulting in a more accurate analysis of the TPB. I aimed to add to the growing body of knowledge on the TPB beyond health-related and communications behavioral studies. Although no previous empirical research has been done on residential energy use and homeowners' behavioral intent to conserve energy, this study represented a new contribution to the field of PEBs and household energy conservation.

Peer-Reviewed Journals

There is a growing interest on empirical studies that examine residential energy use and the intent to reduce it through PEBs (Abrahamse & Steg, 2011; Frederiks et al., 2015a; Kavousian et al., 2013; Valenzuela et al., 2014). In the existing household energy literature, there is limited understanding of the relationship between homeowners' commitment to energy conservation and the behavioral outcomes related to carbon emissions reduction and climate change. Although there are many studies on the socioeconomic and environmental impacts of PEBs on energy end-use, they have often failed to include the quantitative impact of related socioeconomic and environmental outcomes of such energy behaviors.

According to Sütterlin et al. (2011) and Frederiks et al. (2015a), homeowners are more likely to make larger capital investments in energy conservation measures, such as improvements to increase energy efficiency, by purchasing new technology and energy-saving appliances than ratepayers living in rental housing. Although Fredericks et al. (2015a) applied behavioral economics in investigating occupants' intent in energy behaviors, Gram-Hannsen (2014) used the rebound effect to examine residential energy use by focusing on occupants' behaviors, lifestyle, and other energy consumption practices in analyzing energy conservation and how this affects air pollution and the environment. Fredericks et al. (2015b) and Huebner et al. (2015) studied the effects of building characteristics, appliance stock, and occupants' behavior or psychological effects on energy conservation in residential buildings.

Dixon, McGowan, Onysco, and Scheer (2010); Maleki and Karimzadeh (2011); Sütterlin et al. (2011); Schmidt and Weigt (2013); and O'Keefe (2014) focused on energy conservation in residential buildings through occupants' PEBs and their demographic characteristics. Understanding the impact of household energy consumption and the resulting behavioral intentions to reduce energy use through PEBs and energy conservation is a critical phenomenon to scale the level of impact on occupants and the environment. Pothitou et al. (2014) also analyzed household energy saving through behavior changes, which served as the underlying purpose of this study.

An analysis of the economic and environmental impact of having communities and households fueled by alternative energy sources is required to understand the threats and opportunities associated with efficient energy options for households and cities in New England and Mid-Atlantic regions. To evaluate residential energy use, Hargreaves (2011) studied the dynamics of proenvironmental adaptation and behavioral changes in household occupants by emphasizing the need for energy efficiency and conservation at the household level. Guerra, Itard, and Visscher (2009) studied the effects of occupancy and building characteristics on energy consumption and efficiency behaviors. Auffhammer and Mansur (2014) also provided an exploratory analysis of the impact of geographical and climatic factors on residential energy use and further explained the effects these factors may have on efficient energy use. However, the quantitative impact analysis and measurement of the behavioral intent of occupants to conserve energy based on geographical and climate factors were lacking in the literature.

By evaluating the effect of state energy programs on residential energy use, Ofori-Boadu (2012) concluded that state energy programs and contextual factors, such as public policies, enhance energy efficiency, energy conservation, and carbon emissions reduction. Due to the varying levels of commitment in adopting PEBs and other emissions reduction programs (ie., adopting energy efficiency standards, public benefits funds, building energy codes programs, financial and information incentive programs, renewable portfolio standards, and the ENERGY STAR program), stakeholders have pursued ways to reduce aggregate energy consumption through policy options at the local and state levels. Energy programs accounted for an average of 7% variation in electricity consumption over and above the variations associated with sociodemographic factors (Ofori-Boadu, 2012).

Similar to other conceptual explanations of reducing energy use in residential buildings, Shrimali and Kniefel (2011) offered a futuristic vision of energy efficiency and conservation using energy efficient appliances and alternative energy. Shrimali and Kniefel provided examples of the effectiveness of state policies and energy initiatives in achieving energy efficiency by determining which factors (state policies and programs) led to increased deployment of nonhydro alternative energy capacity. Gram-Hannsen (2014) also offered views on economic, environmental, and social metrics by arguing that the impact and applicability of homeowners' demographic status and their behavioral intent to conserve energy are indispensable. Gram-Hannsen illustrated that behavior or lifestyles in analyzing energy use are often not appropriate, as much of energy consumption relates to unconscious habits and technological structures, which are not understood in behavioral or lifestyle approaches.

Mark and McWilliams (2013) offered insight into the determinants of residential heating and cooling consumption and the assessment of the sociodemographic and technical importance of efficient energy technology. According to Mark and

McWilliams, residential energy use is a combination of discrete and continuous choices on the part of the homeowner or occupant. Mark and McWilliams focused on energy consumption, efficiency, and conservation using efficient home appliances, such as cooling, heating, and refrigeration. Mack and McWilliams also argued that homeowners make initial decisions by purchasing an appliance that uses energy to heat and cool their homes. However, Mark and McWilliams pointed out that the frequency at which appliances are used is a continuous decision made by the household, which highlights the importance of information dissemination, awareness of a PEB, and the need to reduce energy use among household occupants. Therefore, a quantitative impact analysis and measurement of residential energy use and the intent to reduce it through the elements of homeowners' PEBs was needed to fill the gap in the energy literature.

Pothitou et al. (2014) claimed that homeowners' demographic and behavioral characteristics, including their socioeconomic status, are viewed as the most significant drivers of residential energy use. Pothitou et al. further argued that although these factors influence energy use, they are rarely researched and analyzed in a manner that empirically relates them to energy conservation based on homeowners’ behavioral intentions. Moreover, Pothitou et al. presented a different perspective of individual sociodemographic and behavioral characteristics by focusing on the variations among homeowners and on the differences between expected and real household electricity consumption behaviors. When it comes to the variation among households, occupants directly and indirectly influence energy demand in the household and the resulting consumption level for space heating and cooling.

Santin, Itard, and Visscher (2009) also contributed to the residential energy literature by focusing on occupancy, building characteristics, and the use of electricity for space and water heating. Santin et al. claimed that energy use in identical buildings may vary depending on the prevailing socioeconomic factors, demographic compositions, and the behavioral characteristics of household occupants. Bhattacharjee and Richard (2011) conducted a systematic review of the various ways in which sociodemographic factors affect household energy use by describing the level of influence this may have on carbon emissions and air pollution in U.S. communities.

Abrahamse, Steg, and Rothengatter (2005) proposed an intervention study on household energy consumption, while Abrahamse and Steg (2009) investigated the effects of sociodemographic and psychological factors on direct and indirect energy use and energy saving in residential buildings. Abrahamse and Steg (2011) further investigated how psychological and demographic factors influence household energy consumption and occupants' intent to reduce energy use through behavioral changes. Abrahamse and Steg (2011) maintained that sociodemographic variables, such as income, education level, and age of occupants might influence the d constraints that households face in their energy choice. However, Abrahamse and Steg (2011) concluded that the intent to reduce energy use is related to behavioral and psychological variables, rather than demographic factors. The intent to reduce energy use is voluntary and may be less constrained by demographic and contextual factors. Behavioral intentions may be dependent on factors such as the perceived costs and benefits of energy efficiency and conservation, as reflected in the behavioral variables applied in this study.

Scholars have not connected behavior factors with the end-use of energy, end-using appliances, or the influence from the lifestyles that produce them. Examining the interconnectedness among sociodemographic and behavioral factors, and the level at which they influence homeowners' PEBs, was at the core of this research. This study was unique, both in nature and context, because researchers have not examined behavioral intentions using both homeowners' behavioral determinants alongside their demographic characteristics. Also, scholars have not addressed the intent to reduce energy consumption through beliefs and behavioral change. In addition, other researchers have used secondary data to investigate residential energy use and energy conservation. This study provided a theoretical presentation and analysis of residential energy use and how energy conservation could be achieved through PEBs among homeowners who use their dwellings as primary residence.

Seminal Literature

Although there have been endeavors to theoretically assess residential energy use and how it can be reduced through PEBs from the perspective of efficiency technology and alternative energy use, a substantive analysis of homeowners' PEBs and their impact on energy conservation is lacking in the reviewed literature. Household occupants adapt their energy behaviors for fiscal, social, and environmental reasons to counterbalance the threats from the impending carbon emissions crisis from increased energy use.

The basic tenet of the TPB was first defined by Ajzen in 1985 as a way of observing people's behaviors at any given time and how those behaviors are guided by intent, beliefs, attitudes, social norms, and perceived control. Ajzen and Fishbein (1980) studied attitudes to predict social behaviors. In the TRA, Ajzen and Fishbein argued that when people evaluate a behavior as positive, and if they think their significant others want them to perform the behavior (subjective social norm), it results into a higher intent (motivations), and they are more likely perform the behavior. However, Miller (2005) proposed a counterargument against the high relationship between behavioral intent and actual behavior. Miller argued that "because of situational limitations actual behavior does not always reflect behavioral intent" (p. 126). Behavioral intent cannot be the exclusive determinant of a behavior, where control over the behavior is incomplete.

Ajzen (1991) advanced the TPB by adding the perceived behavioral control construct and extended the TRA by relating behavioral intent to actual behavior. Ajzen presented a case for behavioral attitude and the relationship between intent and overt behavior. Ajzen believed that the intention to act tends to overestimate the readiness to perform a desirable behavior and underestimate the willingness to perform an undesirable behavior. Therefore, it was appropriate to review people’s behaviors and the intent toward energy use in regions such as New England and Mid-Atlantic and to assess their energy needs and capacity based on beliefs, attitudes, social norms, and perceived control.

Abrahamse and Steg (2011) used the TPB to explain the constructs of residential energy consumption and occupants' intentions to reduce their energy use through sociodemographic and psychological changes. Abrahamse and Steg examined whether the explanation of residential energy use and the intent to reduce it through energy efficiency and conservation could be informed by variables from the TPB, variables from the TRA, variables from the VBN, and background demographic variables.

Researchers have also applied Schatzki's (1987, 1996) practice theory to study the unconscious habits and technological structures that influence residential energy consumption and the intent to reduce energy use through behavioral changes. This study added to the energy literature by adopting Ajzen's TPB to test the relationship between residential energy consumption and homeowners' intent to reduce their energy use. This study provided a theoretical overview of whether energy conservation could be achieved through homeowners' behavioral intentions to conserve energy.

A classic postulate of environmental behavior was defined by the OECD by focusing on household energy use and the intent to reduce energy consumption through efficient environmental actions. Stern (2000) argued that “pro-environmental behavior is one of the most significant behavioral issues facing humanity that has been met with lack of urgency in addressing the issues it presents" (pp. 407-424). Stern also provided a view on environmental behaviors on a global level, by calling on corporations and policymakers to evaluate the economic, environmental, and social costs of their actions. Stern further argued that avoiding these costs requires effective public policies, at the macro and micro levels, in shifting economies and communities toward a low-carbon and climate-resilient growth path.

Abrahamse et al. (2005) discussed both the microlevel determinants (e.g., preferences, attitudes, values, abilities, opportunities) and macrolevel determinants (e.g., availability of new technology, economic and population growth, government regulations and policies, sociocultural change) in the context of energy economics and environmental behaviors and how they relate to people's intent to reduce their energy consumption.

In line with existing literature on environmental behaviors and energy use, Mancha and Yoder (2015) used the TPB to argue the cultural antecedents of green behavioral intent. Mancha and Yoder presented a comprehensive analysis of PEBs and intentions from a subjective norm and cultural perspective. Mancha and Yoder’s application of intent to behavioral framework offers credence to the applicability of the TPB. Ajzen (1991) analyzed behaviors, intentions, and knowledge of the role of perceived behavioral control from Bandura's concept of self-efficacy. Fishbein and Cappella (2006) also posited that self-efficacy is the same as perceived behavioral control in the integrative model of behavior and intentions.

Ajzen (2015) stated that the TPB does not rely on revealed preferences to infer an underlying decision process, but rather on the direct assessment of its theoretical constructs; behavior is a function of the intent to perform an action. The relationship between intention and consumption is determined by the behavioral, normative, and control beliefs of the consumer. Ajzen (1971) attested that "interventions designed to change behavior can be directed at one or more of its determinants, which are attitudes, subjective social norms, or perceptions of behavioral control" (p. 2). However, differences in these factors may produce changes in behavioral intentions. Given control over the behavior, the new intention is carried out under appropriate circumstances.

Literature Review Related to Key Variables and Theories

The variables in the studies have been summarized below within the context of this dissertation.

Dependent Variable: The Intent to Conserve Energy

Ajzen (2006) emphasized that behavioral intention is the willingness to perform a certain behavior or action. A behavioral intent, as in the case of this study, was based on homeowners' attitude toward energy conservation, perceived control, and subjective social norms. Each of these predictors were weighted based on the particular behavior and the individual performing the behavior. The behavioral intent in this research study was the homeowner's intention to engage in a PEB and conserve energy. I assumed that homeowners’ intentions to conserve energy were dependent on several factors, such as beliefs, attitude, subjective norm, perceived control, personal income, household size, household composition, and education level.

As depicted in Figure 3, the most significant residential energy end-users are in the form of heating, ventilation, and air conditioning; equipment and lighting account for a smaller proportion of U.S. residential energy use (EIA, 2009).

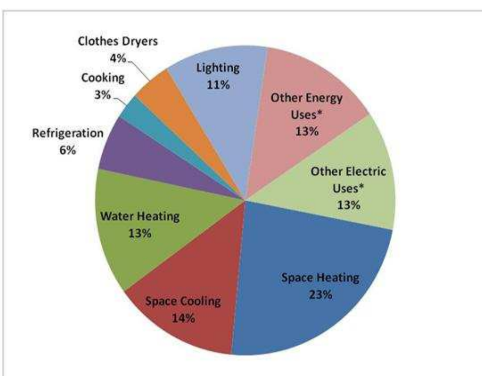

Figure 3. Energy use in U.S residential buildings.

Independent Variables: Behavioral Factors

Although homeowners' sociodemographic characteristics may play a role in the amount of energy consumed in a household, a range of person-specific behavioral factors aimed at reducing overall energy consumption may also have significant effects on end-use energy. Energy behaviors are mostly habitual and discreet, and they stem from practices that are ingrained by the intent to behave in a certain way. According to the TPB, the most significant predictor of people's energy behavior is the intent to perform the behavior (Ajzen, 2015). In the TPB, Ajzen (1991) argued that individuals make rational choices and behave in a way that yields "optimal" outcomes based on environmental concerns and a sense of moral obligation (pp. 179-211). According to Fredericks et al. (2015a), "intent is the driving force or impulse that initiates, guides, and maintains a goal-directed energy behavior" (pp. 588-589). This principle highlights why an energy consumer may act in a certain way at any given time. Steel and König (2006) defined intent as a process that shapes the intensity, direction, and persistence of the effort that a homeowner allocates toward achieving a particular efficiency goal or a desired energy end-use.

Attitude toward energy conservation. A homeowner's attitude toward an energy behavior, such as conserving energy, refers to his/her evaluation of the need for change in the energy behavior in question. Ajzen (2006) associated behavioral intent with the judgment of the behavior in question, which means that before a homeowner decides to conserve energy, he/she evaluates the energy action as favorable or unfavorable. If a PEB and energy conservation is believed to have a desirable impact on the homeowner's income, health, social life, and environmental, this action may yield a favorable attitude from the homeowner. Conversely, energy behaviors that are thought to have undesirable socioeconomic and environmental results often produce negative attitudes by the consumer. In their study on recycling behavior Tonglet et al. (2004) suggested that personal judgment on any behavior, whether favorable or unfavorable, is often reflected in people's attitude toward the behavior. Therefore, it is important to further explore and analyze people’s attitude toward a behavior.

Subjective social norm. Ajzen (1991) argued that behavioral intention is affected by the perceived social pressure to perform the act. A behavior is likely to be exhibited when viewed as socially acceptable, although there may be possibilities of disapproval and negative feedback from significant others. Contextually, if a homeowner perceives a positive evaluation from household occupants by changing consumption behavior from energy-wasting to energy-saving, behavioral change on energy-saving is more likely to occur. Subjective social norm, as a determinant of energy behavior, could play a role in understanding the social pressure of a PEB and conservation in the household. There is a need to understand the causal process of social norms on energy consumption behavior and its resulting behavioral intent to conserve energy.

Perceived behavioral control. The perceived behavioral control determinant of homeowners' intent to conserve energy is a predictor of the TPB that refers to a homeowner's perception of his/her capacity to conserve energy. According to Ajzen (1991), the perception of ability depends on evaluating whether the behavior could be possible or impossible, positive or negative, and favorable or unfavorable. However, Ajzen (1991) and Conner and Armitage (1998) concluded that evaluating behavioral ease or difficulty requires information through knowledge and experience of such a behavior.

The more accurate the information, the more behavioral control is perceived.

Ajzen (2006) also attested that the more control a person has over a perceived behavior, the more likely he or she is to perform the behavior. According to Blake (1999), Kennedy et al. (2009a), and Kennedy et al. (2009b), factors such as time and income are predictors in determining perceived behavioral control. For example, financial incentive is a facilitator of energy conservation. Saving energy through energy efficiency and conservation will increase household disposable income and may improve proenvironmental support in a household or community. Hence, it is also important to look at factors underlying the perception of behavioral control as another determinant of homeowners' intent to conserve energy.

Beliefs (behavioral belief, control belief, and normative belief). According to Ajzen (2006), behavioral belief connects intended behaviors to expected outcomes from performing the behavior. It is the belief about the likely consequences of a behavior. This is the subjective probability that the behavior in question will produce a certain outcome. Knab (2012) based behavioral belief on personal experience, information, and behavioral inferences. A positive belief to perform a behavior means that the person perceives that a favorable outcome is likely to result from engaging in the behavior.

Normative belief. According to Ajzen (2006), a normative belief represents people's belief about the normative expectation of others. A normative belief represents people’s perception of their consumption or peer pressures or significant others' beliefs that they should or should not perform such a behavior.

Control belief. According to Ajzen (2006), control belief is based on perceived behavior control. Ajzen maintained that control belief creates the perceived existence of factors that may give rise to a particular behavior. Theoretically, each control factor or element has a perceived influence associated with it. The influence contributes to a perceived behavioral control in direct proportion to a person's subjective probability that that a control factor is present.

Independent Variables: Sociodemographic Predictors

Personal income. According to Abrahamse and Steg (2011), income is a predictor of residential energy use and energy conservation. Abrahamse and Steg (2009) found a significantly positive relationship between income and household energy consumption. Abrahamse and Steg (2009) concluded that higher-income households tend to consume more energy than lower-income households. However, Abrahamse and Steg (2011) and Frederiks et al. (2015b) also highlighted that a higher-income household could use energy efficiently and conserve energy. Higher-income households can afford the financial costs of energy-saving investments, such as purchasing new, efficient technologies by using alternative energy sources. Higher-income households also tend to have larger floor space with higher appliance ownership and can afford the high-energy cost. In contrast, lower-income households tend to purchase less energy efficient services and appliances that are often old and outdated. Because low-income households cannot afford high-energy costs, they tend to use lesser floor space and own fewer heating, cooling, and refrigeration appliances.

Household size (number of occupants). The size and characteristic of household members affect the pool of energy used within the household. Households with a larger number of residents, as indexed by number floor space and the number of rooms (detached houses), characteristically consume more energy than smaller households, such as apartments and studios (Frederiks et al., 2015b; Huebner et al., 2015). Holloway and Bunker (2006) mentioned that families living in detached houses, townhouses, and semidetached dwellings consumed 74% more energy and electricity than households living in multiunit housings. Frederiks et al. (2015b) attested that households living in detached houses are more willing to engage in energy efficiency and conservation activities than those residing in apartment blocks. Per capita, household energy consumption is an economy of scale. With increasing numbers of occupants in a household, the per-capita amount and cost of energy use decline.

Household composition (age and gender). The household composition variable includes age and gender of occupants at the time of collecting the data. Kemp (2015) highlighted that age exerts an influence on household energy consumption, as older occupants tend to require greater energy use both in the winter and summer. Similarly, health-driven energy use tends to be correlated with age, while nonhealth age group variations show that younger occupants consume more energy than older occupants. When preserving the health of both children and elderly occupants in a household, winter heating and summer cooling must be regulated for longer periods each day and for higher than average indoor temperatures (Abrahamse & Steg, 2011; Abrahamse & Steg, 2009; Kemp, 2015; Nair, Gustavsson, & Mahapatra, 2010). The different energy uses and occupants' intentions to reduce their energy use differ within age groups and gender. To reduce energy consumption, older occupants may alter their energy behaviors through curtailment while younger occupants may prefer technological approaches.

Education level. Scholars have reported the effects of education on PEBs and energy use over time (Fredericks et al., 2015a; Nair et al., 2010). However, Kollmuss and Agyeman (2002) suggested that increased education level does not typically translate into improved PEBs. Rather, Kollmuss and Agyeman claimed that there is often a knowledge-action gap in PEBs with regard to household energy use. Although Fredericks et al. (2015b) found that education level has no significant impact on the number of efficiency and conservation activities in residential buildings, Gram-Hanssen (2014) showed that educated occupants are more likely to display PEBs. However, Gram-Hanssen concluded that these effects are either statistically insignificant or are far weaker than the impact of other demographic, psychological, and motivational factors that are more proximal to energy behaviors.

Gaps in the Literature

Most of the discussion and literature on household energy efficiency and conservation have focused on the mechanical and technical aspects of household energy consumption. This study changes the narrative by focusing on a homeowner-specific behavioral and sociodemographic perspective of energy saving improvements in the household. Also, there are a shortage of primary data and information on certain sociodemographic and behavioral factors in determining household energy use and energy conservation through homeowners' PEBs. Most of the published literature on behavioral determinants and energy consumption is recent, and the energy field on PEB does not cover most behavioral theories, such as the TPB.

Few expost environmental and social impact evaluation studies on PEBs and energy conservation are available. Of the studies that do exist, few include primary data and quantitative analysis on homeowners' behavioral intent to conserve energy. In light of this, researchers should further explore the ancillary or cobenefits of energy conservation and behavioral change among homeowners. By outlining what drives homeowners to consume energy and their intent to reduce their energy use through behavioral changes, this study provided insights into developing socially and environmentally efficient proenvironmental solutions that target individual-level behavioral and demographic predictors used in this study. The findings from this study may advance the design and delivery of environmentally conscious behaviors alongside homeowners' demographics with regard to conserving energy. This study may serve as a lens for creating energy conservation interventions and regional greenhouse gas initiatives in achieving greater energy efficiency and conservation at the household level.

Chapter Summary and Transition to Chapter 3

Chapter 2 provided a comprehensive review of the theoretical sufficiency of the TPB. Some meta-analyses and synopsis of comparative studies were discussed to provide further insight and information on measurement of the TPB variables. Based on the reviewed literature, this study offered information on the TPB's behavioral determinants, alongside sociodemographic factors, and how they influence homeowners' intent to conserve energy. The framework and theoretical approach used may serve as a tool in the context of residential energy use and the intent to conserve energy through PEBs.

Although there have been various applications of the TPB, few scholars have reported empirically-based comparisons of variables with homeowners' demographic characteristics to study behavior change. Although the literature covered in this study is by no means conclusive and definite, researchers offered a framework on the importance of energy conservation through behavior and demographic changes.

Discussed in the next chapter are the research methodology, research design and approach, research setting, sample size, data collection procedure, data analysis plan, instrumentation, dissemination of findings, issues of trust worthiness, credibility, transferability, dependability, confirmability, ethical procedures including validity and reliability, addressing bias, and the chapter summary and conclusion.

Chapter 3: Research Method

Introduction

In this quantitative study, I examined the relationships between household energy consumption and homeowners' intent to reduce their energy in behavioral determinants and sociodemographic variables. I determined whether the explanation of household energy consumption and homeowners' intent to reduce their energy use could be informed by variables from the TPB (Ajzen, 1985), alongside background demographic factors. I reviewed the impact of behavioral changes on household energy use through the lens of energy conservation, such as efficiency and curtailment behaviors. I provided information on when, where, and for whom energy-conservation intervention might serve to promote and sustain carbon emissions reduction and climate change.

Building upon the available body of knowledge and literature on energy conservation, coupled with the existing paradigms on PEBs, this study could expand on the interaction between homeowners' behavioral intent to adopt a PEB and energy conservation. This study may provide an overview of the resulting economic, social, and environmental implications of a behavioral change action on energy conservation in residential buildings.

Research Design and Rationale

I adopted a survey research design to conduct a quantitative analysis of eight independent variables. These independent variables included homeowners' beliefs to conserve energy; homeowners' attitude toward energy conservation and greenhouse gas emissions; homeowners' perceived control to conserve energy; homeowners' subjective social norms that influenced the outcome behavior to conserve energy; homeowners' personal income, household size, and household composition; and homeowners' education level. The dependent variable for this study was homeowners' intent to conserve energy. I used the research design to provide information on sample size selection, instrumentation, and data collection procedures of the study. The research design is the general plan of the study used to determine how to answer the research questions.

According to Frankfort-Nachmias and Nachmias (2008), a survey research design provides generalizability of the research findings. A survey research design was deemed appropriate in quantifying psychometric data and providing a numeric account of the phenomena from the sample data. Fowler (2002) argued that the sample survey method entails three different methodologies: sampling, designing questions, and data collection. Survey research has been aligned with practical worldviews as it relates to the realistic application and implication of the central phenomena under investigation (Creswell, 2009, 2012). Also, surveys include probability sampling to ensure that the sample is unbiased. Yin (2008) mentioned that surveys include standardized measurement tools that are consistent across respondents in obtaining comparable information.

Using a survey research method presented two potential areas of error in this study. First, it was assumed that the survey mirrors the population. As such, the potential error could be the degree to which survey respondents represented the target population under study (Fowler, 2002). The second error could arise from the assumption that "the answers from respondents were used to describe only the characteristics of the respondents" (Groves, 1989, p. 13). However, the degree to which these answers fail to represent the behavioral intent of the population might result in an error of estimation.

The survey design includes a larger population by investigating a sample of that population. Ultimately, by using the survey research method, existing views and ideas on PEBs and energy conservation were tested and discussed. A detailed review of PEBs allowed for various methodical processes and new ideas in behavioral theory to emerge. This may add a new dimension to test views and the theoretical understanding of the role of individuals' behavioral changes in the energy conservation framework.

Methodology

The methodology used in this study included the ways in which the research was carried out. I used the methodology to define the research structure and process, as well as the way in which the data were analyzed. I used a multiple, ordinary, least squares regression model. This type of regression model is the standard statistical analysis technique commonly used in the social sciences (Allison, 1987, 1999). According to Nathans, Oswald, and Nimon (2012), scholars use a multiple regression to determine the overall fit of the research model and the relative contribution of each of the predictors to the total variance explained.

Prior to analysis, all variables were converted into their natural logarithms to ensure that their coefficients were interpreted as elasticities. All coefficients were homogenous across time, with only the data and fixed effects changing across homeowners. A standard multiple linear regression equation model is illustrated as follows:

Equation 5

$$Y_{it} = \beta_0 + \sum_{j=1}^{n-1} \beta_j X_{jit} + \alpha_i + \varepsilon_{it}$$

Given that *i* and *t* represented homeowners and states respectively, such that Y_{it} was the predicted value of *Y* (which was the dependent variable) of homeowner *i* in state *t*. β_0 was the constant *y* intercept of homeowners across all states represented in the study, while *X* was an *n* by 1 vector of explanatory variables; $\beta_j X_{jit}$ was the product of the observation for each of the independent variables *j* through *n* for homeowners *i* in state *t* and the coefficient of *X*; *n* was the total number of included independent variables, α_i was the time-invariant fixed effect for homeowner *i,* and ε_{it} were the residuals, where $\varepsilon_{it} \sim N(0, \sigma 2)$, or are approximately normally distributed with a mean of zero (Dilaver & Hunt, 2011).

Population and Research Participants

The population for this study was a defined group of all homeowners in the United States. A sample of 436 homeowners, who used their dwellings as primary residence in the Northeast region of the United States (New England and Mid-Atlantic regions), were generalized to the population in making the statistical inference. Research participants were drawn from the portion of the population to whom there was reasonable access in collecting the data.

By owning a home and paying utility bills, homeowners exert influence over household energy through psychological and behavioral changes. Hence, I determined that homeowners could be an ideal unit of analysis for this study. Unlike other energy consumers who do not own a dwelling, homeowners' commitment to energy conservation and the various ongoing carbon emissions reduction and proenvironmental programs could be a source of useful information for this study. Homeowners' role in alternative energy adoption, energy conservation, and proenvironmental activities qualified the population as a source for this study.

Sampling Frame

I examined homeowners' behavioral intentions to conserve energy. Hence, all homeowners in the Northeast census region of the United States made up the sampling frame that reflected the phenomenon under investigation. The sampling frame was an enumeration of homeowners located in the New England and Mid-Atlantic census regions between January 1 and October 14, 2017. The SurveyMonkey Audience provided a complete listing of registered homeowners by state, who had volunteered to take part in household energy surveys. These sample units were assembled to create the sampling frame. In the sampling frame, I ensured that each participant in the sample was a homeowner in the designated census region and had used his or her dwelling for at least 6 months leading to the survey. The SurveyMonkey Audience, and all necessary information regarding homeownership, were acquired in September 2017, augmented by unit locations, ownership indicators, and living arrangements obtained through SurveyMonkey.

Dwelling locations included in the sampling frame covered the states in the New England and Mid-Atlantic regions, all of which are geographically designated as part of the Northeastern census region of the United States. This census region was chosen because of its variations in weather and socioeconomic activities among states, with the Mid-Atlantic region a slightly warmer temperature than the New England region. According to the U.S. Census Bureau (2015), the Mid-Atlantic region had a higher population density with more economic activities than the New England region, which means that homeowners in the Mid-Atlantic region were likely to consume more energy than homeowners in the New England region.

Sampling Design

A probability, stratified, random sampling technique was used in collecting the data from sampled research participants. A stratified sampling technique was believed to be most appropriate for the desired data, because the process of stratification reduces sampling error and ensures greater level of representation of the population under study (Koyuncu & Kadilar, 2010a, 2010b). Although the research process may take longer and be expensive due to the extra stage in the sampling procedure, a stratified sampling technique helped divide the Northeast census region into various strata by defining the population, choosing the relevant stratification, listing the population according to the preferred stratification, choosing the sample size, and calculating proportionate stratifications from the sample frame.

Sample Size

The sample size was determined based on the results of the G*Power 3.1.5 analysis. Using eight predictors, a medium effect size ($f^2 = 0.15$), an α error probability level of 0.05, and a power of 0.8, the minimum required number of sampled survey participants was 109. As a result, it was expected that at least 109 participants, from 436 pooled-participants, would complete the survey to achieve empirical validity. Figure 4 shows the G*power distribution plot. Figure 5 shows the population sample.

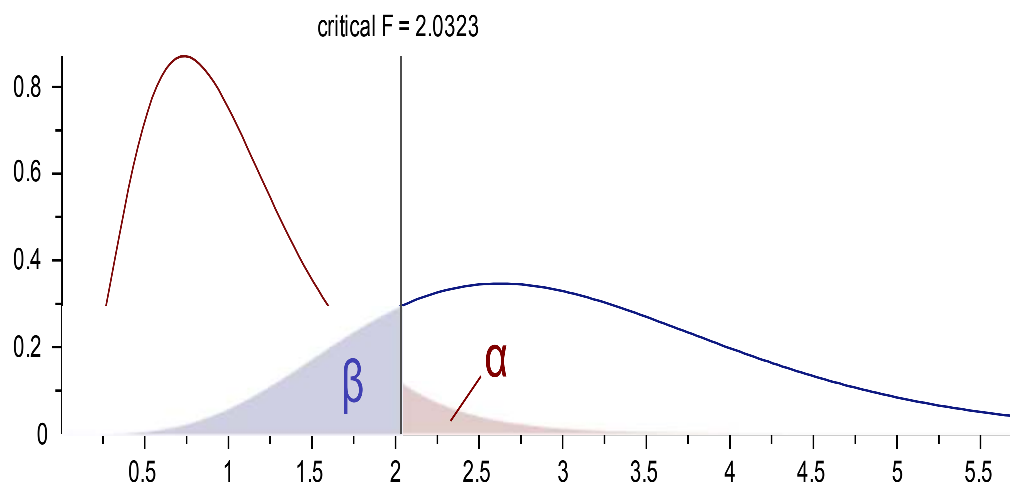

Figure 4. Graph showing G*Power distribution plot.

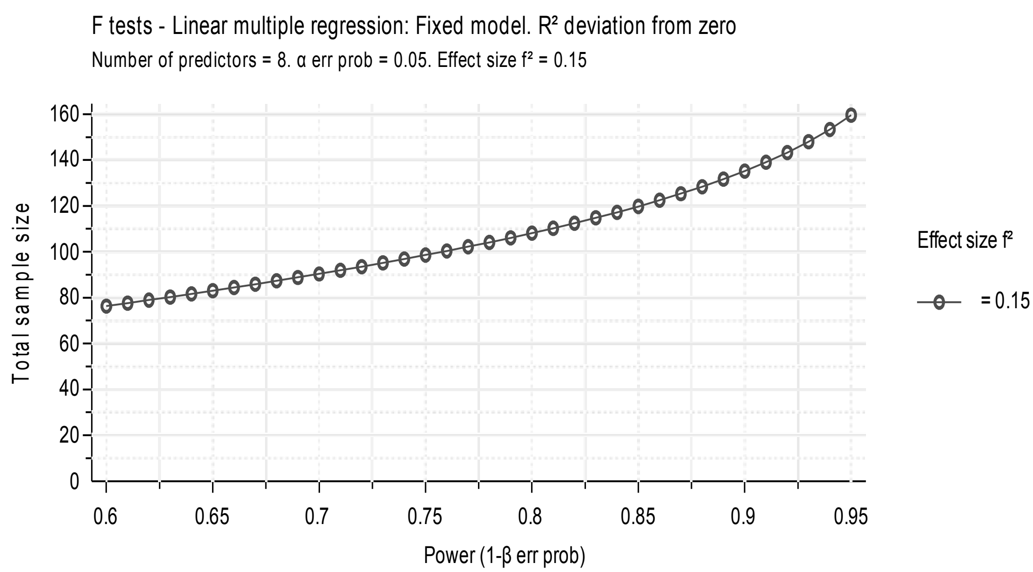

Figure 5. Graph showing the population sample.

According to Cook, Heath, and Thompson (2000), the required minimum response rate needed for a valid sample test group was 25% of the sample size. Although the G*power minimum expected value was 109, a sample size of 436 was selected. Hence, 25% of 436 produced a value of 109 minimum expected survey participants. Also, between 3-4% of the sample size was required to participate in the pilot test. Hence, a total of 15 participants, out of 436 pooled participants, were selected to complete the pilot study.

The survey included a single-stage, area probability sampling for the sample test group at the 95% confidence level. A sample of homeowners was drawn from the SurveyMonkey master list, referred to as the SurveyMonkey Audience. The SurveyMonkey Audience is a large sample designed to meet all household survey needs based on the 2015 U.S. census. It was also divided into census regions with various strata that reflect homeowner-specific demographic characteristics.

I adopted a single round of sampling that involved the following phases: (a) targeting options; (b) selection of census zones to be surveyed; (c) familiarization with the SurveyMonkey Audience; (d) selection of sampling procedure and estimation of sample size, reliability, and precision; (e) selection of the method for estimating population parameters and incidence rates from the sample variables; and (f) launching the questionnaire in time and space.

All housing units occupied by homeowners who used their buildings as a primary residence in the Northeast region of the United States (excluding secondary homes, vacant units, military barracks, and common areas in apartment buildings) were eligible for inclusion in the targeting option for sample selection. To minimize the possibility of bias, all items in the population had an equal chance of being included in the sample frame. The duration of the survey was approximately 2 weeks**.** This study had a possible total of 436 units of observation with a minimum requirement of 109 to be sufficiently powered. The survey also had an incidence rate of 75-100%. The incidence rate indicated how many respondents were expected to be disqualified during the survey. A 75-100% incidence rate ensured that the survey was sent to at least 520 participants, because it was estimated that, at most, 25% of the survey participants would be disqualified from participating, while at least 75% of the participants were expected to qualify for completing the survey.

Data Collection

Collecting the data was the most significant challenge in this study. A single-stage data collection technique was adopted for this study. Data were collected only one time, using an online survey research method over a 2-week period. Sampled participants were contacted approximately 1 week after the questionnaire was launched on the SurveyMonkey Audience website as a follow-up on their participation. This follow-up also served as a reminder that the survey would be closed on the date and time as stated on the cover page of the questionnaire. The process included discussions about questionnaire implementation, sampling and sampling procedures, the online procedure, nonresponse bias analysis, and sample representativeness.

The survey instrument contained 36 items adapted from previous studies. In the survey, I measured participants' PEBs and their intent to conserve energy based on their beliefs about greenhouse gas emissions and climate change, their attitude toward adopting a PEB and to conserve energy, the external factors or subjective norms that influence their ability to conserve energy, the perceived control that each homeowner may hold over the desire to adopt a PEB, their personal income, household size, and composition, as well as their education level. These behavioral determinants and demographic factors were measured on a 7-points Likert scale, which was marked 1-7.

Higher scores on this scale indicated a positive intent to adopt a PEB and to conserve energy in a particular household. All data were collected using an online survey through SurveyMonkey. To ensure an appropriate level of integrity and ethics, I followed the standards and guidelines of the research and data collection process as established by Walden University's Institutional Review Board (IRB). Permission to collect data was granted by the IRB on September 5, 2017. In compliance with the National Institute of Health (NIH), Office of Extramural Research, and the Walden University IRB, the data collection process started after acquiring Walden University's IRB approval #09-05-17-0411956. The pilot study was conducted between September 21 through September 27, 2017. After making all corrections and adjustments to the final survey questionnaire based on the feedback and recommendations from the pilot test, the final survey was launched on September 30 through October 14, 2017.

The pilot study was conducted to assess the scale reliability and to validate the survey instrument. I used the pilot test to measure the type of responses received for each of the variables based on the type of questions. I also used the pilot test as a means of quality assurance to maximize the effectiveness and sufficiency of the survey. Reliability was evaluated based on George and Mallery's (2003) guidelines, where an $\alpha > 0.90$ was considered an excellent level of reliability, $\alpha > 0.80$ was considered good reliability, and an $\alpha > 0.70$ was considered acceptable reliability. An $\alpha < 0.70$ was considered an unacceptable level of reliability.

The final questionnaire was adapted based on the response level from the pilot study. The survey instrument was administered to respondents with a cover letter explaining the academic intent and purpose of the study. To begin the survey, reliability and construct validity of the questionnaire was enhanced using the input and responses from the pilot data analysis. The full-scale survey was launched through the SurveyMonkey Audience website with the survey link to participants. A reminder and follow-up e-mail were sent to the participants at least once during the course of the survey.

SurveyMonkey maintains a database of homeowners, also referred to as the SurveyMonkey Audience, with a given homeowner's census region, building or dwelling location, household type, gender, age, race, employment, lifestyle, and move-in dates. The database on individual homeowners contained no information on physical address, e-mail address, or date of birth. Also, SurveyMonkey provided no information on the exact apartment within a multifamily house in which an individual dwelled. Therefore, the online survey, administered through SurveyMonkey, did not deliver complete data on households that lived together in the same apartment. This led me to only use the data from individual households. Only demographic data with average values were available for multifamily households.

Survey participants were provided with an informed consent via SurveyMonkey. No incentive was offered for participation; survey participation was completely voluntary. The survey questionnaire administered to respondents, with a cover letter attached, was comprised of the following sections and information: (a) the purpose and academic intent of the study; (b) an explanation of the survey procedure, survey questions, the type of information requested from the participants, and the reason why information was required; (c) a description of the benefits of the study, (d) a disclosure of risk to the participants; (e) a statement of confidentiality that responses will be kept confidential; (f) an explanation of the decision to quit participation from the research at any time without notification or penalty; (g) how the research findings will be used; and (h) contact information provided to forward concerns or questions about the data collection and research process.

To maximize the quality of survey responses, a course of action guideline, as described in Huber and Power (1985), was adopted. This guideline requires the researcher to guarantee response confidentiality, distribute personalized feedback documents, and promise to share the final results with research participants and respondents as required. Because I used a web-based questionnaire, privacy and anonymity was required for participants' information. I safeguarded all documents and information with sensitive personal and public data by storing pertinent information on a pass-code protected flash drive, which was deemed a safe and secure storage method as required by Walden University's IRB.

Dependent Variable

The dependent variable for this study was the intent to conserve energy. In residential buildings, energy is wasted. These inefficiencies, though individually small, may add up to a large amount of economic, social, and environmental resources. Understanding the potential for reduced energy use and the improvement in residential energy conservation requires a detailed energy literature and information beyond those currently available. Thus, this quantitative survey study was designed to evaluate the access to energy conservation information, particularly among homeowners, based on person-specific behavioral intentions to conserve energy. To evaluate the effects and outcome of energy conservation and the intent to reduce energy use through behavioral and demographic changes, I used electric energy, natural gas, solar energy, biomass, wind energy, geothermal, and hydro power generation as a measure of end-use residential energy.

Independent Variables

The independent variables used in this study included sociodemographic factors (personal income, household size, household composition, and education level) and behavioral determinants (beliefs, attitude, subjective social norm, and perceived behavioral control). Because the variables were quantitative in nature, they were measured on a continuous numeric scale, such as the subjective rating of homeowners' PEB based on belief or personal income. However, the scale of measurement was ordinal, using a 7-point Likert-scale to measure the predictability of these independent variables.

Instrumentation and Operationalization of Constructs

Effort was made in determining the type of instrumentation used in collecting the data. The TPB instrument, developed by Ajzen (1985), was adapted to align with the sample population and research questions, and it was administered via the SurveyMonkey website. The instrument was used to determine a valid measurement of the research variables based on a 7-point, continuous Likert scale. The Likert scale served as an appropriate measurement tool for the type of parametric data that were collected.

The survey consisted of 36 mostly forced-choice questions; there were no binary type yes or no or true or false questions. By using forced-choice survey questions, respondents were not given the option of reflecting a nonresponse type choice, such as no opinion, don't know, not sure, or not applicable (Lavrakas, 2008). Hence, respondents were required to select a response choice that indicated, definitively, their opinion about PEBs and the intention to conserve energy. The elimination of nonresponse choice items in the forced-choice survey increased the number of complete surveys with responses that were valid for analysis purposes.

Permission to use the TPB instrument was obtained from Ajzen, who authored the TPB instrument. A request to use the information adapted from the TPB instrument was also granted by Ajzen via e-mail (see Appendix B). The request and authorization to use the TPB instrument was forwarded to the Walden University IRB for approval.

The wording of survey items was based on recommendations from Ajzen (2006) and Francis et al. (2004). Each survey question was measured using a 7-point Likert rating scale (1–7) with the middle point (4) as neutral. Although some of the survey questions in the final questionnaire took a slightly different format, they were mostly measured as the following: 1=*extremely likely*, 2=*quite likely*, 3=*somewhat likely*, 4=*neither*, 5=*somewhat unlikely*, 6=*quite unlikely*, and 7=*extremely unlikely*. Other questions were also measured on the 7-point scale as *beneficial or harmful*, *desirable or undesirable*, *wise or foolish*, *I should or I should not*, *approve or disapprove*, *completely true or completely false*, *definitely true or definitely false*, *possible or impossible*, *complete control or no control*, *strongly agree or strongly disagree*, and *very much or not at all*.

Additional Items in the Questionnaire: Use of Energy Efficiency Technology

Additional questionnaire items in the pilot study and final survey were used to measure participants' experience using renewable energy sources and energy efficiency technology. Questions were also asked about homeowners' prior sociodemographic characterizations, which reflected participants' income; gender; age; household size; level of education; and information and knowledge about energy efficiency, energy conservation, greenhouse gas emission, and climate change. Although these remaining survey items about sociodemographic characteristics and technology adoption are not required in Ajzen's TPB model, Abrahamse and Steg (2011) and Conner and Armitage (1998) stated that they are useful in examining how some of these variables relate to homeowners' intent to conserve energy.

Rationale for Using the Theory of Planned Behavior Instrument

The TPB instrument has been used in various disciplines, such as educational studies, public health interventions, technology use, management decision making, and product consumption studies. Researchers have used the TPB determinants, as well as background demographic factors, in testing the validity and reliability of the TPB instrument. Clement et al. (2014) and Macovei (2015) also used the TPB instrument in testing the relationship between residential energy consumption and occupants' intent to reduce their energy with behavioral and demographic variables.

Scholars have found household energy use to be related to demographic factors; behavioral determinants were also predictors of occupants' intent to consume energy (Abrahamse & Steg, 2011). However, the additions of homeowners as a unit of analysis with the personal income and education level variables as a predictor in the domain of household energy use and energy conservation have established the need for this study. The validity and sufficiency of the TPB instrument has been tested and has been found to capture a comprehensive energy behavior construct.

Knab (2012) used the TPB instrument in testing the effectiveness of online course adoption in public relations education. Chan and Bishop (2013) also used the TPB instrument to test the moral basis for recycling and found a relationship between the intent to recycle and recycling behavior. Taylor and Todd (1995) used the TPB instrument in testing technology adoption in organizational behavior, Fraser, Ajzen, Johnson, Hebert, and Chan (2011) also used the TPB instrument in testing employers' intent to hire qualified workers with disabilities in the workplace. Ajzen (2015) used the TPB instrument to investigate consumers' attitude and behavior in food consumption, while de Leeuw et al. (2015) used the TPB instrument to test and identify the beliefs underlying PEBS among high school students. Klobas and Ajzen (2015) used the TPB instrument to test reproductive decision making and the intent to bear children. Zemore and Ajzen (2014) predicted substance abuse treatment completion using the TPB instrument. Reinecke, Schmidt, and Ajzen (1997) also used the TPB instrument in predicting the behavioral intent toward birth control and AIDS prevention among young adults. Hence, the sufficiency and validity of the TPB instrument was established as evidenced in the literature outlined in this study.

Pilot Study

Prior to formal data collection, a pilot study of 15 sampled participants was conducted to examine the reliability, validity, and conformability of the survey instrument and research questionnaire. The comments and suggestions from the pilot study were used to improve on the final questionnaire in terms of simplicity and understandability. To establish sufficiency and validity of the instrument in answering the research questions and to maintain the highest level of reliability, a panel of experts from the SurveyMonkey organization, as well as my research committee, was used to review the layout and content of the adapted survey instrument and research questionnaire**.**

An online survey was used as the standard data collection method for this study because online surveys provide rapid deployment and return times controlled within the survey environment. This could not be achieved through the traditional methods of data collection. As recommended by Nunnally and Bernstein (1994), a sample size of at least 400 was used to achieve a sufficiently precise estimate of the Cronbach’s α coefficient.

The survey questions were grouped into four main sections to measure the 7-point Likert scales on the instrument. The first section of the survey was the screening section.

This section contained the first four questions of the survey, which was designed to enforce the inclusion criteria for participation. Using the “page skip logic,” survey participants were automatically locked out of the survey if they did not meet the inclusion criteria as set in any of the four screening questions. Section 2 was designed to assess the direct measure of behavioral intentions and homeowners’ beliefs (behavioral belief, normative belief, and control belief). Respondents were asked to indicate their behavioral ignitions based on the belief that energy conservation will induce carbon emissions reduction. Section 3 was designed to assess and measure the other behavioral determinants to conserve energy. The first part of Section 3 was used to assess respondents’ attitude toward PEBs and energy conservation based on knowledge. In this section, I examined how homeowners’ intent to conserve energy was influenced by their attitude toward energy conservation. The second part of Section 3 was adapted to assess the level at which respondents’ subjective social norm would influence their energy behavior and their intent to conserve energy. The third part of Section 3 was used to assess the level at which respondents’ perceived behavioral control influenced their energy behavior and their intent to conserve energy.

Section 4 of the survey was designed to assess and measure the four demographic characteristics and their effects on homeowners’ intent to conserve energy. Part 1 of Section 4 was adapted to assess the effect of respondents’ personal income on their ability to adopt a PEB and their intent to conserve energy. In Part 2 of Section 4, I measured the effect of household size (number of occupants) on homeowners’ PEBs and their intent to conserve energy. Part 3 of Section 4 was adapted to assess and measure the effect of household composition (age and gender) on homeowners' PEBs and their intent to conserve energy. Part 4 of Section 4 was designed to assess and measure the effect of respondents' education level (high school, vocational or college) on homeowners' PEBs and their intention to conserve energy. Section 5 was designed to investigate how additional homeowner attributes (i.e., age; gender; and their knowledge about energy efficiency, alternative energy sources, technology appliance usage, environmental pollution, and climate change) would influence their behavioral intent to conserve energy.

Implementing the Questionnaire

In questionnaire development, three techniques are used to design the questions: The first technique is to adopt questions from other questionnaires. Another technique is to adapt questions from other questionnaires. The third technique is to develop an original set of questions (Saunders, Lewis, & Thornhill, 2003). The questionnaire used in this study was adapted from a previously validated and published questionnaire from Ajzen's TPB. Adapting an already validated and published questionnaire saved time and resources in this process.

All efforts were made to ensure clarity and attractiveness of the questionnaire. To ensure validity and reliability, the findings from this study were compared to other results from historical studies that have used the TPB questionnaire. However, the validity and reliability of this approach was dependent on whether the type and range of closed responses mirrored the full range of homeowners' behavioral intentions, including their sociodemographic characteristics. The response level was based on the behavioral belief that participants in the sampling frame held about greenhouse gas emissions and the intent to conserve energy.

Energy consumption, and the intent to reduce it through energy conservation, when related to sociodemographic and behavioral determinants, tended to lose their validity when used beyond the context in which the TPB instrument was developed. Therefore, I took greater care in modifying the TPB questionnaire, while adapting relevant questions related to the study. It was also necessary to modify those questions that did not adequately address or suit the research questions and the hypotheses. For ethical considerations, permission to use the TPB questionnaire was granted by the Ajzen, whose academic materials were used in this study. Borrowed academic materials from other studies were also recognized and acknowledged where necessary.

Although financial incentives in web-based surveys tend to increase response rate and improve the problem of bias in scientific research, no financial incentives were made to respondents in this study. Also, a single stage data collection technique was used to save time; data were collected only one time over a 2-week period. In the questionnaire used in this study, I focused on three types of variables. In one set of variables, I measured homeowners' behavioral intentions to conserve energy. In another set of variables, I measured homeowners' beliefs to conserve energy. In the third set of variables, I measured homeowners' demographic characteristics and how they influenced their PEBs and their intent to conserve energy.

General and demographic data were collected using a combination of dichotomous (i.e., homeowners) and multichotomous (i.e., ratepayers and household occupants) characteristics. The questionnaire also contained attitudinal questions concerning the energy information and consciousness of homeowners, and whether they believed their energy behavior, practice, or situation to conserve energy may affect the life style of household occupants. This was included to recognize the possibility that information and the attitude of homeowners might affect the way energy was used in their households.

Dealing with Missing Data

Missing data could occur as a result of respondents' uneasiness and unwillingness to answer certain survey questions concerning their lack of knowledge about PEBs, lack of information and awareness about carbon emissions and environmental pollution, or the lack of motivation to engage in energy efficiency and conservation. According to Allison (2002), "it is important that the researcher identifies whether the missing data is a function of a random or systematic process" (p. 142). According to Allison (2001), nonrandom missing data may cause a reduction in sample size, which might diminish the external validity of the research.

As recommended by Tabachnick and Fidell (2001), an imputation procedure was implemented to estimate the values from variables that contained missing data that exceeded 5%. Thus, the expectation maximization (EM) imputation approach was ideal in dealing with and estimating any missing data. This approach, as applied in the SPSS missing value analysis module, uses a maximum likelihood approach for estimating missing values. Because this study had fewer than 2% of incomplete responses, it was determined that this level did not affect the sample size required to attain a sufficient statistical power (Little & Rubin, 2002).

Data Entry

Data were systematically entered into an Excel worksheet and sorted into the appropriate SPSS format for analysis purposes using the SurveyMonkey software. Data from SurveyMonkey were also verified for accuracy using random checks. The choice of computer processing depended on the length of the questionnaire, number of variables, and the number of respondents. Computer processing, using SPSS, facilitates and speeds up data entry and analysis. Therefore, the SPSS software was used to calculate the statistical significance and for establishing relationships among the variables. This mode of computer processing was also used to tabulate answers by absolute and relative and cumulative frequencies and to automatically calculate values such as the mean, median, mode, standard deviation, variance, minimum, maximum, range, number of valid cases, and bias (Bryman & Cramer, 2008, 2009, 2011). SPSS was also used to analyze the statistical limits of the data, by dividing response error frequencies by those attributable to the enumerator and respondent errors due to bias, ignorance, or memory lapse. Finally, an optical scanner provided by SurveyMonkey was used with a computer and designed questionnaire form to speed up data entry and tabulation.

Data Analysis

The results of the survey were analyzed to determine the changes in homeowners' energy behaviors and their intent to conserve energy through behavioral determinants and background demographic factors. Descriptive statistics were generated on each of the 36 individual questions, which were separated under five main headings. Descriptive statistical analysis included graphs and tables showing correlation coefficients, frequencies, standard deviations, means, and other significant relationships associated with household energy behavioral intentions to conserve energy.

The SPSS software was used to manage and analyze the data that were collected. A multiple regression was also used to model the relationship among the variables by fitting a linear equation to the observed data. In a multiple linear regression, every value of the independent variable *x* is associated with a value of the dependent variable *y* (Field, 2013). The population regression line for *p* explanatory variables $x_1, x_2, ..., xn$ was defined to be $\mu_y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_n x_n$. This line described how the mean response μ_y changed with the explanatory variables. The observed values for *y* varied about their means μ_y and were assumed to have the same standard deviation σ. The fitted values b_0, b_1..., *bn* estimated the parameters β_0, βx_1, ..., β_p of the population regression line.

Statistical Assumption

Prior to data analysis, the assumptions of the multiple regression were assessed. As recommended by Meyers, Gamst, and Guarino (2006), the use of multivariate scatter-plots was the most typical way of assessing linearity among the variables. Therefore, the assumptions of normality, homoscedasticity, and linearity were assessed by viewing the multivariate P-P scatter-plots of the residuals. Also, the absence of multicollinearity was assessed using the variance inflation factor (VIFs).

Research Questions

Research Question 1: Is there a relationship between behavioral determinants (beliefs, attitude subjective social norm, and perceived behavioral control) and homeowners' intent to conserve energy, while controlling for sociodemographic factors?

Research Question 2: Is there a relationship between sociodemographic factors (personal income, household size, household composition, and education level) and homeowners' intent to conserve energy, while controlling for behavioral determinants?

Research Question 3: Is there a relationship among behavioral determinants (attitude, beliefs, subjective social norm, and perceived behavioral control), sociodemographic factors (personal income, household size, household composition, and education level), and homeowners' intent to conserve energy?

Reporting the Results

Effective reporting requires appropriate data analysis. The results of the study were reported in terms of a multiple regression to measure homeowners' intent to conserve energy. The structural model was estimated using SPSS with the maximum likelihood method. Model fit determined the degree to which the sample variance-covariance data fitted the structural equation model (Cheon, Lee, Crooks, & Song, 2012). Schumacker and Lomax (2010) also recommended a variety of model fit criteria for determining the model fit of a structural model, which are discussed in the next chapter.

Tables and diagrams were used to reflect the various demographic and behavioral constructs that were important in studying general behaviors and the intent to conserve energy, and not just a description of the facts uncovered in the survey. I summarized the research methodology, including the target population and sample stratification, conversion factors, and the socioeconomic and environmental aspects of the data and research findings. I used tables, graphs, diagrams, and charts to clarify the data based on conclusions and recommendations of the research findings. The results also provided information on the time spent gathering the data, period of the survey, and a listing of unusual events that potentially affected the validity of the results. In scientific research, findings are prone to inconsistencies or are difficult to explain. These findings were mentioned and their significance to the study was also discussed.

Validity and Reliability of Model Construct

According to Burns and Burns (2008), validity is concerned with objectivity, generalizability, replicability, predictability, controllability, neutrality, and nomothetic statements. Four validation measures were applied to the various phases of this study. They included construct validity, content validity, criterion-related validity, and face validity.

Content Validity

Content validity was conducted during the various stages of this study. The content validity was used to verify the adequacy with which the variables measured the data that they were intended to measure. Also, the content validity was used to verify that the instrument used to collect the data was a comprehensive measure of the phenomenon under study. However, its determination was subjective and judgmental. Because I used a web-based survey questionnaire, care was taken in selecting and verifying that the variables in the model were sufficiently appropriate for measuring a homeowner's behavioral intent to conserve energy.

Content validation is used to eliminate predictors that are of little or no significance to the study. Using content validation, any insignificant predictor was replaced by variables that have had social, economic, environmental, and technical implications on U.S. residential energy deployment, intensity, consumption, efficiency, conservation, carbon emissions, climate change, and positive social changes. The statistical model applied in this study was tested using data collected through a web-based survey. Further validation of the research model was tested with various sources of data throughout the model development process. This demonstrated and confirmed the level of content validity needed for the study.

Construct Validity

The construct validation was used to test the degree to which the structural model measured what I purported to measure. I measured the effects of four behavioral determinants with four background demographic constructs on homeowners' intent to conserve energy. Construct validity is an assessment tool that indicates the degree to which the model is correct in achieving the aim and objective of the study.

Construct validation was first applied in identifying the variables used in the model while conducting the literature review. The model was validated through feedback from my dissertation committee, based on their experience and expertise in model construct and the use of structural models in multiple regression analysis. The purpose of this type of construct validation was to ensure that the predictor variables were independent of one another and that there was an existential relationship among the different behavioral and sociodemographic constructs and the intent to conserve energy in U.S. households.

Criterion-Related Validity

Criterion validity was the degree to which variables from TPB, alongside background sociodemographic factors, could explain homeowners' behavioral intent to conserve energy in real-life scenarios. I wished to obtain reliable and detailed information about the need to reduce residential energy use through PEBs and energy conservation. This objective had recently been the subject of research by Abrahamse and Steg (2009), Abrahamse and Steg (2011), Fredericks et al. (2015a), and Fredericks et al. (2015b).

The results and recommendations derived from applying the TPB should be applicable in government and public policy objectives on energy efficiency, energy conservation, carbon emissions reduction and climate change, and other PEBs for a sustainable community. The results were accurate and valid enough for further testing and research findings. Conclusions from the research finding provided the basis for reliability, validity, and acceptability of the research result. The generalizability of the research model was also essential for validation of the research findings.

Face Validity

Face validity is the extent to which the survey instrument is measuring what it purports to measure. Although face validity was not the primary evidence for the quality of the instrument used in this study, it was determined by an expert methodologist in behavioral research studies and the literature that it served the purpose of the research.

Reliability

Reliability is the level of consistency of the research findings. To ensure reliability, I took into consideration the large population size of homeowners in the

Northeast census region of the United States. According to Burns and Burns (2008), a small sample size tends to limit the reliability and power of the statistical tests. Households in the Northeast region of the United States, with homeowners who used their dwellings/buildings as primary residence, were used as the appropriate units of analysis. I also assumed that a sample of 436 homeowners from nine states was adequate to detect any variation in the relationship among variables. This technique was used to reduce the possibility of a Type II error. Assumptions were made and tested, while a data transformation was carried out to ensure that various statistical assumptions were met. The internal reliability of the study was also verified by computing the Cronbach's alpha.

Addressing Bias

Bias is a form of systematic error that could affect a scientific investigation by distorting the measurement process. A biased study loses validity. Although some study designs are more prone to bias, its presence is universal in the social sciences. According to Krishna, Maithreyi, and Surapaneni (2010), bias in scientific research may be addressed by focusing on random bias, which occurs due to sampling variability and measurement precision. Because the data for this research study were collected using web-based survey questionnaires, it was difficult to ensure that participants' views, opinions, and responses to sensitive questions were not biased in nature. However, I assumed that participants might not be biased while responding to questions in the survey. Hence, this was one of the shortcomings of this study.

However, my own personal views on residential energy use, energy efficiency, PEBs, and public policies on carbon emission and climate change were noted and addressed. Support for energy conservation and carbon emissions reduction did not influence or prevent me from reporting on the contrary, or findings that showed homeowners' intent to consume energy in a negative light. Being a scholar practitioner who is directly involved with local government management, energy sustainability, sustainable communities, greenhouse gas emissions reduction, climate change, and positive social changes, I added substance and value to the outcomes of this study.

Ethical Procedures

To ensure an appropriate level of integrity and ethics, I followed the standards and guidelines as established by the provisions of the Walden University IRB. The Walden University IRB granted me permission to collect data after meeting the research standards as set by the NIH and the Office of Extramural Research. Because I used an online survey to collect primary data from research participants, the privacy and anonymity of survey participants was required. I presented summary information on the collected data and participants' information. The research data and pertinent information regarding research participants were collected and stored in an electronic format on a pass-code-protected portable external drive. This strategy was considered to be safest and most secured means of storing sensitive data, and it ensured the privacy and anonymity of participants' information and responses.

Protection of Human Participants

Ethical consideration was applied to this study. Several of the NIH concepts were adopted in the use of human research participants. The NIH provisions ensured that voluntary participation by participants, no harm to the participants, anonymity and confidentiality, free of deception in the analysis and reporting of data, as well as fulfilling the Walden University IRB criteria. Adopting this strategy ensured that the basic levels of institutional review provisions were met. Because I used primary data collected through a web-based survey, there was an extensive use of human subjects whose rights, privacy, and privileges were given the highest level of institutional review standards. The methodology and data collection, research method and design, and the type of data collected necessitated and validated this study.

The level of privacy adopted in this study ensured that any form of deception or breach of privacy and confidentially was avoided in the research and data collection process. Because the survey questions were based on personal views and opinions of the research participants, ethical considerations were taken in to account to protect participants from personal embarrassments or other inconveniences that may have occurred due to sharing their personal information, views, and opinions in the questionnaire. Survey participants were required to read and sign the informed consent, which was on the first page of the questionnaire. In the informed consent, I emphasized confidentiality and allowed the research participants to voluntarily participate in the survey. A letter of cooperation was also sent out to potential participants via the SurveyMonkey Audience link. This was electronically signed and returned before the survey was officially launched. This letter of cooperation served as increased assurance of privacy and accountability guiding the research process.

Chapter Summary and Transition to Chapter 4

In Chapter 3, I presented and discussed the research design and methods used in the study. I provided information on the research methodology, research approach, validity, reliability, research setting, population and sample, data collection and analysis, instrumentation, protection of human participation, addressing bias, and dissemination of the findings in this study. Various research approaches in the social sciences were also discussed, alongside the sequential quantitative approach used in this study. Factor analysis was also discussed. Using an effective and well-developed research design and methodology was key in ensuring the validity and reliability of this research study.

In Chapter 4, I discuss the results and findings of this study.

Chapter 4: Results

Introduction

The purpose of this empirical, quantitative study was to examine the relationship between household energy consumption and homeowners' intent to reduce their energy consumption through behavioral and sociodemographic factors. This study was designed to answer the three research questions on whether the explanation of household energy consumption and homeowners' intent to reduce their energy use could be informed by variables from the TPB, alongside background demographic factors.

I used Pearson's correlation coefficient (*r*), which is a statistical tool that measures the strength of a linear relationship between the independent variables (predictors) and the dependent variable (outcome). The main predictors from the TPB model, and the background demographic predictors, were found to have a positive linear relationship with the intent to conserve energy at varying levels ($p < .001$, $p < .05$). Theoretically, a correlation coefficient is an effect size, and the strength of the Pearson's correlation *(r)* for this study was based on Evans' (1996) guidelines, which suggested the following *r*- values: very weak relationship (.20 - .39), moderate relationship (.40 - .59), strong relationship (.60 - .79), and very strong relationship (.80 - 1.0). Based on these effect sizes, the null and research hypotheses that corresponded with each of the research questions were tested and validated.

In this chapter, the results of the pilot study are discussed. The results of the statistical tests and analyses of the main study are also presented and discussed. The sample characteristics of the population are identified, and the descriptive statistics are also discussed using graphs and tables. Chapter 4 concludes with the summary of the research results and findings.

Pilot Study

To ensure that the measurement procedure and the survey instrument used in this study had an acceptable level of reliability and validity to implement the study, the questionnaire was pretested through a pilot study, which was hosted through the SurveyMonkey website. SurveyMonkey offers features such as sample selection, skip logic, page logic, randomization, bias elimination, data representation tools, data analysis, and a highly scalable architecture that supports the visual display of survey questions on a 7-point scale as specified in Ajzen's (2006) TPB.

Fifteen pilot participants were used to examine and test the validity and reliability of the survey instrument through a pilot test. The comments and suggestions from the pilot participants were used to make the necessary adjustments to the final questionnaire in terms of simplicity and ease of understanding. The layout of the survey questions for use in the final survey was adapted from Ajzen's TPB questionnaire, which was an intent-based measure of the same predictors as well as the outcome variable.

Criteria for Testing Scale Reliability

Reliability of the 7-point scale survey instrument was evaluated and established based on George and Mallery's (2003) parameters and guidelines as illustrated in Table 1. An Alpha level of $\alpha = .9$ represented excellent reliability, while an Alpha level of $\alpha = .8$ was considered a good or reasonable level of internal consistency for this study. An Alpha level of $\alpha = .7$ was also considered an acceptable level of reliability, while an

Alpha level of $\alpha = .6$ denoted a questionable level of reliability for this study.

Table 1

Internal Consistency Using Cronbach's Alpha

Cronbach's Alpha	Internal Consistency
$\alpha \geq .9$	Excellent Reliability
$\alpha \geq .8$	Good Reliability
$\alpha \geq .7$	Acceptable Reliability
$\alpha > .6$ but $\alpha < .7$	Questionable Reliability
$\alpha \leq .6$	Poor/Unacceptable Reliability

Pilot Result-Test of the Instrument and Scale Reliability

Prior to launching the final survey, a pilot study of 15 participants was conducted to assess the reliability of the survey instrument used in the study. The Cronbach's alpha reliability test that was conducted in the pilot study produced an alpha level of $\alpha = .809$, which was considered a good or reasonable level of reliability of the instrument.

Although a high value for Cronbach's alpha indicated good internal consistency of the items in the scale, it did not mean that the scale was unidimensional. To show that the items in the scale were unidimensional, an item analysis was conducted to further estimate the reliability of the instrument. This analysis allowed me to measure the internal consistency of the items in the scale and the extent to which they correlated with one another. To adequately measure the internal consistency on how closely related the variables were as a group, a Cronbach's alpha reliability test was carried out to measure the scale reliability and internal consistency. Table 2 shows the pilot study reliability on a scale.

Table 2

Pilot Study Reliability on Scale

	Scale Mean	Scale Variance	Corrected Item-Total Correlation	Squared Multiple Correlation	α
Intent	20.0667	47.495	.576	.895	.783
Beliefs	20.0667	52.067	.373	.887	.805
Attitude toward the Act	19.8000	46.600	.592	.787	.780
Subjective Norm	19.8000	44.886	.666	.925	.770
Perceived Control	19.8000	46.743	.658	.936	.774
Personal Income	19.9333	61.781	-.283	.796	.852
Household Size	19.4000	47.400	.444	.970	.799
Household Composition	18.8667	37.552	.817	.983	.739
Education Level	19.3333	42.810	.585	.801	.780

The reliability of the items in the scale ranged from acceptable reliability (α=.739) to good reliability (α=.852). A good reliability was found for personal income (α=.852) and beliefs (α=.805), while an acceptable reliability was found for the remaining items. As referenced in George and Mallery (2003), a questionable or poor reliability may suggest that the survey participants did not answer the questions as consistently as possible, and caution should be taken in interpreting results from scales with questionable ($\alpha > .6$ but $\alpha < .7$) or poor reliability ($\alpha \leq .6$).

There was one item, personal income, that had rather low or negative item-total correlation. The alpha value could go up, by a large margin, if this variable was deleted. However, this item was retained in the final survey. It was confusing that the personal income variable did not perform better, because the personal income of most U.S. homeowners are within the median income bracket of the U.S income index. Hence, falling within the median income range was a necessary condition for owning a home, but not a sufficient condition for adopting a PEB. I may not have made it clear that I was talking about homeownership and energy conservation, rather than other income analysis. For example, a participant might think it was acceptable to own a home to decide whether to adopt a PEB, but immoral to weigh morally good consequences against morally bad consequences when deciding whether it was proper to spend more money for conserving energy by purchasing energy efficient appliances.

According Tavakol and Dennick (2011), reliability of an instrument is underestimated by the absence of an interitem correlation in the scale. Therefore, survey items were reviewed to improve the interitem correlation, which improved the reliability of the scales that showed lower than acceptable Cronbach's alpha coefficients. Some of the items in the scales were replaced, and others were further refined to help attain acceptable Cronbach's alpha reliability coefficients for most of the items in the final survey. Table 3 shows the pilot study interitem correlation matrix.

Table 3

Pilot Study Interitem Correlation Matrix

	Intent	Belief	Attitude	Subjective Norm:	Perceived Control	Personal Income	Household Size	Household Composition	Education Level
Intent	1.000	.562	.528	.680	.729	-.081	-.107	.415	.248
Belief	.562	1.000	.304	.446	.569	.144	-.034	.144	.008
Attitude	.528	.304	1.000	.836	.439	-.257	.161	.453	.358
Subjective Norm	.680	.446	.836	1.000	.422	-.308	.191	.494	.406
Perceived Control	.729	.569	.439	.422	1.000	-.141	.177	.599	.394
Personal Income	-.081	.144	-.257	-.308	-.141	1.000	-.178	-.130	-.507
Household Size	-.107	-.034	.161	.191	.177	-.178	1.000	.806	.741
Household Composition	.415	.144	.453	.494	.599	-.130	.806	1.000	.770
Education Level	.248	.008	.358	.406	.394	-.507	.741	.770	1.000

The pilot study produced a 100% response rate. Six pilot participants (40%) were male, while nine participants (60%) were female. Eight of the 15 participants were over 45-years-old and had used their dwellings as a primary residence for at least 48 months prior to the survey. Also, three of the pilot participants were between the ages of 35 and

65 and had used their dwellings as primary residence for at least 24 months. Table 4 shows the case processing summary for the pilot test.

Table 4

Case Processing Summary for the Pilot Test

		N	%
	Valid	15	100.0
Cases	Excluded[a]	0	.0
	Total	15	100.0

Note. Listwise deletion based on all variables in the procedure.

The pilot study was conducted using the software and layout of the final survey. This technique allowed for identifying and addressing any potential issues with the final survey, based on respondents' feedback and recommendations on the nature, scope, and clarity of the questionnaire items. The initial pilot questionnaire was sent via SurveyMonkey, with instructions and completion date indicated on the survey cover letter. Accordingly, revisions were made on the questionnaire based on the recommendations and feedback from participants. This process ensured that the survey questions and variables generated data that were useful and accurate for the study.

Recommendations from the pilot participants included the number of questions, clarifications of questionnaire wording, revising redundant questions, and other necessary suggestions that made the questionnaire shorter and time saving. Two participants responded in the comment box explaining that they felt like U.S residents were doing too much to reduce emissions while other nations continue to produce emissions at an alarming rate. Also, two of the 15 pilot participants indicated that they thought some of the questions were repetitive and redundant in context.

Four pilot participants commented that the cover letter did not state whether or not the survey was approved by Walden University's IRB. However, the survey and research methodology were approved, in both the pilot study and the final survey. Hence, this wording was added to the final questionnaire. One participant found a formatting error on the screen of Page 2 that stated, "begin survey" but would generally state "next" or "previous." This error was also corrected in the final survey. A subset of scales that demonstrated high internal consistency was selected for the final intent measure, reducing the item numbers from 48 to 36 items. Item-total correlations and Cronbach's alpha analysis of reliability were used to ensure reliability and internal consistency.

The Pilot Study Result Determined the Final Survey

The wording of the items in the scale was based on the recommendations of Ajzen (2006) for a TPB questionnaire. The questionnaire items used in the pilot study reflected the TPB key constructs based on Ajzen's approach. After the pilot study, questions were revised until the questionnaire items were no longer ambiguous or required further clarifications. Based on the recommendations from the pilot participants, the scope of the questionnaire was reduced to an optimal size, while allowing Ajzen's (2006) TPB model to be tested and validated. Ajzen's main constructs (intent, attitude toward the act, perceived behavioral control, subjective social norm, and beliefs) were all analyzed in SPSS using the Cronbach's alpha test of reliability. The survey was reduced in scope and size to include only items with the strongest alpha value, while retaining the required number of items as recommended by Ajzen (1988).

Although some participants in the pilot study found the behavioral intent statements redundant, they were mostly used in the final instrument as required by Ajzen (2006). Using the TPB required adequate internal consistency and using a minimum of three items (Ajzen, 1985). The fourth item, "I plan to adopt energy efficiency behavior in my household," was eliminated after the pilot study, increasing internal consistency and shortening the survey, while still meeting Ajzen's (2006) questionnaire criteria of at least three measures to represent intent.

Sample Population

The target population for this study was homeowners in the Northeast region of the United States. I identified this population as having a direct influence on energy conservation and the way energy is used in residential buildings. Based on the size and diversity of the population, a stratified random sampling technique was used to select survey participants from the population. This approach offered equal chance to all homeowners in the sampling frame who met the inclusion criteria to participate in the survey. Potential participants were voluntary homeowners who were registered with the SurveyMonkey Audience to take part in household surveys in the United States.

The sample size was determined based on the results of the G*Power 3.1.5 analysis. Using eight predictors, a medium effect size ($f^2 = 0.15$), an α error probability level of 0.05, and a power of 0.8, the minimum required number of sampled survey participants was 109. Accordingly, the survey was administrated to 436 sampled participants living in electrified housing units, using a single-stage, area probability sample design for the sampled test group. The sample size was approximately 76% of the total population at the time of the survey, with an incidence rate of 75-100%. The aim of selecting this sample size was to obtain sufficient survey responses in order to achieve adequate empirical validity for the multiple ordinary least square regression analysis that I wished to conduct.

Data Collection

I used primary data collected from pooled participants in the Northeast region of the United States. Identifying the appropriate sample size and the survey instrument was a challenge to this study. The survey instrument was adapted from Ajzen's TPB instrument, which consisted of seven scales that measured 36 items in the survey (Appendix A). The data used in this study were collected through the SurveyMonkey Audience. The survey developed a psychometric measurement based on a 7-point Likert scale to elicit information about homeowners' behavioral intent to conserve energy through a multiple regression analysis.

The questionnaire used in this study had five sections. Section 1 consisted of four screening questions, which were set on a page-skip logic pattern to ensure the inclusion criteria for participation. This skip logic automatically logged participants out who did not meet all of the qualifying questions. For example, any participant who did not live in either New England or Mid-Atlantic regions, in Question 1 on Page 2, was not allowed to proceed to Question 2. Also, any participant who did not own a home in Question 2 on Page 3 was automatically logged out of the survey and was not allowed to proceed to

Question 3 on Page 4. The same logic pattern applied to those who had not used their dwelling or building as a primary residence for at least 6 months prior to the survey.

In Section 2, I measured homeowners' behavioral intentions and beliefs to conserve energy. This section covered Questions 5 to 9 and measured the intent to conserve energy against behavioral factors as well as demographic factors. Questions 7 through 9 measured the intent to conserve energy against homeowners' beliefs (behavioral, normative, and control) to engage in a PEB. In Section 3, I measured the other behavioral factors (attitude, subjective social norm, and perceived behavioral control), taken independently. These included Questions 10 through 22. In Section 4, I measured the sociodemographic predictors (personal income, household size, household composition, and education level) taken independently. These included Questions 23 through 28 of the survey questionnaire. In Section 5, I collected information and measured other questions, which included both demographic and behavioral factors that were not a part of the traditional TPB construct.

Survey Administration

The first part of the data collection process was to design and develop the survey using SurveyMonkey. To administer the survey, I was granted access to the target audience through the SurveyMonkey Audience. The SurveyMonkey Audience used in this study was an enumeration of registered volunteer homeowners in the Northeast region of the United States, who had opted in to participate in general household surveys. A sample of 436 participants was extracted from the target audience section of the SurveyMonkey Audience database development section. Although homeowners (who did not use their buildings as primary residence at the time of the survey) and ratepayers (who do not own the dwelling they used as primary residence) have direct involvement and influence on residential energy use as identified in the reviewed literature, they were outside the bounds of this study and were, therefore, not included in the target audience section of the database.

The survey was administered through the SurveyMonkey website, where participants were reached by selecting the appropriate targeting options. First, the total response was set at 436 participants, which was the sample size for the study with an incidence rate of 75-100%. Selecting an incidence rate of 75-100% for a sample size of 436 ensured that the survey was sent out to 574 participants, estimating that at most 25% of those respondents will either be disqualified, or will not complete the survey. This also meant that at least 75% of the total respondents would complete the survey. The location was set to the United States. Also, the Northeast Census Region was selected for the study. Other targeting options included gender, personal income, household size, age of occupants, education level, and home ownership.

The final survey was launched on September 26, 2017 and was administered through October 14, 2017 via the SurveyMonkey website. The questionnaire was administered to participants in nine states in the New England and Mid-Atlantic census regions. The population size and mix of these states and jurisdictions varied significantly, from a few hundred thousand to close to millions of homeowners. To maximize the response rate, the survey questionnaire was sent to 574 participants, based on the 75-100% incidence rate that was selected. However, the survey was designed to automatically close when the total respondents to the survey reached the 436 sample thresholds. Data were collected using the SurveyMonkey software and were exported into the SPSS statistical software version 22.0 for Windows. Descriptive statistical tests were conducted to evaluate the sampled test groups and the research variables used in the analysis. The means and standard deviations were calculated for the continuous data, such as homeowners' intent to adopt a PEB, which translates into beliefs, attitudes, subjective social norms, and perceived control.

Results

To examine the three research questions, a multiple linear regression was conducted to assess how homeowners' beliefs, attitudes, subjective norms, perceived control, personal income, household size and household composition, and education level influenced their intent to conserve energy in their households. Using a multiple regression analysis was appropriate for this study, because I wished to assess the relationship between multiple interval/continuous level independent variables and a single interval/continuous level dependent variable (Pallant, 2007). The continuous dependent variable was homeowners' intent to conserve energy. The continuous independent variables were belief, attitudes, subjective social norms, perceived behavioral control, personal income, household size, household composition, and education level. These scales were determined by the average of the responses to each of the survey questions.

The research model was analyzed using SPSS. Descriptive statistics, a multiple ordinary least squares regression, bivariate analysis, and a correlation matrix were conducted to assess the research questions and make conclusions based on the hypotheses. According to the results of the multiple regression, all of the predictors had a significantly positive relationship with the outcome variable at $p < .001$ and $p < .05$ at varying levels. For example, the belief predictor and the intent to conserve energy had a significantly positive relationship. As homeowners' beliefs about carbon emissions and climate change increased, the intent to adopt a PEB by conserving energy also increased significantly. Also, homeowners' attitudes, subjective norms, perceived control, personal income, household size, household composition, and education level all had a positive relationship with the intent to conserve energy. Although these relationships were significant at $p < .001$, they ranged from a very weak to moderate relationship. Among the predictors, beliefs and attitude had the most significant positive relationship with the intent to conserve energy, at $r = .647$, $p < .001$ and $r = .498$, $p < .001$ respectively. Although the personal income predictor was significant at $p < .001$, this variable had the weakest relationship with the outcome variable at $r = .647$.

Data Analysis

The first step of the data analysis was to examine the various descriptive statistics of the continuous variables. According to the standardized coefficients, the belief predictor had the strongest Beta ($\beta = .520$), while perceived control had $\beta = .094$). Household composition showed the weakest Beta-value ($\beta = -.005$). The homeowners were more likely to perceive behavioral control to conserve energy if they had the belief that energy conservation could reduce environmental pollution and climate change. I found a poor model-fit when the TPB variables were applied with the background demographic factors.

Table 5

Coefficients of the Multiple Regression with Behavioral and Demographic Factors Predicting Intent

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.591	.118		5.005	.000		
	Beliefs	.493	.048	.531	10.266	.000	.514	1.946
	Attitude	.103	.069	.081	1.494	.136	.468	2.138
	Subjective Norm	.033	.048	.031	.685	.494	.662	1.511
	Perceived Control	.123	.051	.104	2.418	.016	.740	1.352
2	(Constant)	.399	.145		2.743	.006		
	Beliefs	.483	.048	.520	10.050	.000	.509	1.963
	Attitude	.066	.072	.052	.919	.359	.428	2.336
	Subjective Norm	.023	.050	.022	.467	.641	.615	1.626
	Perceived Control	.112	.051	.094	2.166	.031	.721	1.388
	Personal Income	.016	.032	.020	.491	.623	.830	1.205
	Household Size	.069	.042	.087	1.620	.106	.475	2.106
	Household Composition	-.004	.042	-.005	-.097	.923	.463	2.158
	Education Level	.028	.038	.034	.745	.457	.667	1.500

Note. Dependent variable: intent to conserve energy

The variance inflation factor (VIF) was used to assess the assumption of the absence of multicollinearity. I found that multicollinearity was not a concern because the VIFs were below 3.0. The assumption of the absence of multicollinearity was met. Homeowners' attitude toward energy conservation showed the highest VIF of 2.336, while personal income showed the lowest VIF of 1.205.

Nunnally and Bernstein (1994) recommended a sample size of 109 or more, while Charter (1999) suggested that a minimum sample size of 400 was needed for a sufficiently precise estimate of Cronbach's alpha coefficient. A total of 436 attempted the survey. Seventeen participants were excluded due to providing an incomplete survey response, while three participants were excluded due to other disqualifying criteria as set out in Section 1 of the questionnaire. In total, 416 responses were considered valid for assessing the research questions and the hypotheses as shown in Table 6.

Table 6

Case Processing Summary of the Final Survey

		N	%
	Valid	416	95.4
Cases	Excluded[a]	20	4.6
	Total	436	100.0

Note. Listwise deletion based on all variables in the procedure.

A total of 416 valid respondents, which characterized approximately 95.4% of the total sample size of 436 participants, were coded in the database and further analyzed using the SPSS software.

Descriptive Statistics

Measures of distribution and normality are the types of descriptive statistics that were estimated and observed in this study. Table 7 shows the descriptive statistics showing skewness and kurtosis.

Table 7

Descriptive Statistic Showing Skewness and Kurtosis

	N	Minimum	Maximum	Mean	Std. Deviati	Skewness		Kurtosis	
	Statisti	Statistic	Statistic	Statisti	Statistic	Statisti	Std.	Statisti	Std.
Intent	425	1.00	7.00	2.0776	1.32327	1.808	.118	3.552	.236
Beliefs	425	1.00	7.00	1.9835	1.39987	1.812	.118	3.218	.236
Attitude	421	1.00	7.00	1.7815	1.01641	1.433	.119	2.605	.237
Subjective Norm	420	1.00	7.00	2.2071	1.22910	.746	.119	-.161	.238
Perceived Control	417	1.00	7.00	1.9640	1.10120	1.417	.120	3.011	.238
Personal Income	416	1.00	7.00	2.8510	1.63159	.977	.120	.413	.239
Household Size	416	1.00	7.00	3.1851	1.65212	.617	.120	-.245	.239
Household Composition	416	1.00	7.00	3.3077	1.70373	.599	.120	-.317	.239
Education Level	416	1.00	7.00	2.6082	1.55473	1.197	.120	1.154	.239
Valid *N* (Listwise)	416								

The closer the skewness statistic to zero, the more symmetrical the distribution. The skewness statistic had positive values of ≥1, which indicated a positively skewed distribution. Also, the closer the kurtosis value to zero, the more normal the distribution of scores. Hence, the Kurtosis statistic showed a normal distribution. Table 8 shows a measure of the Cook's distance in the multiple regression model.

Table 8

Residual Statistics Showing the Cook's Distance

	Minimum	Maximum	Mean	Std. Deviation	*N*
Predicted Value	1.2194	5.5863	2.0697	.86997	416
Std. Predicted Value	-.977	4.042	.000	1.000	416
Standard Error of Predicted Value	.053	.369	.110	.043	416
Adjusted Predicted Value	1.2049	5.4718	2.0685	.86480	416
Residual	-3.69324	5.44311	.00000	.97300	416
Std. Residual	-3.773	5.560	.000	.994	416
Stud. Residual	-3.861	5.590	.001	1.006	416
Deleted Residual	-3.86769	5.50127	.00117	.99722	416
Stud. Deleted Residual	-3.928	5.809	.002	1.015	416
Mahal. Distance	.206	58.083	4.988	5.940	416
Cook's Distance	**.000**	**.129**	**.004**	**.015**	**416**
Centered Leverage Value	.000	.140	.012	.014	416

Note. Dependent variable: the intent to conserve energy

According to Cook and Weisberg (1982), a value greater than 1 could be a cause for concern. Cook (1977) further referenced that the Cook's distance value should not be greater than 4/*N* (in this case, 4/416 = .009). It was examined, though not necessarily classified, that the Cook's measure for this study had a mean distance of .004, which was less than the threshold of .009; while the minimum, maximum and standard deviation values were < 1. Therefore, the aggregate effect of each observation on the regression model as a whole, as well as the group of fitted values in the dataset, was noninfluential. Hence, it was concluded that the regression model was stable across the sample (Field, 2013). Table 9 shows the descriptive statistics showing the mean and standard deviation of the model.

Table 9

Descriptive Statistics Showing the Mean and Standard Deviation of the Model

	Mean	Std. Deviation	*N*
Intent	2.0697	1.30521	416
Beliefs	1.9856	1.40559	416
Attitude toward the Act	1.7837	1.02090	416
Subjective Norm	2.2091	1.22897	416
Perceived Control	1.9639	1.10253	416
Personal Income	2.8510	1.63159	416
Household Size	3.1851	1.65212	416
Household Composition	3.3077	1.70373	416
Education Level	2.6082	1.55473	416

Prior to data analysis, the assumption of normality was assessed with a p-p scatterplot. The scatterplot shows little digression from the normality line, which means that the assumption of normality was met. Figure 6 shows the P-P scatterplot of residuals testing for normality. Figure 7 shows the scatterplot of residuals testing for homoscedasticity.

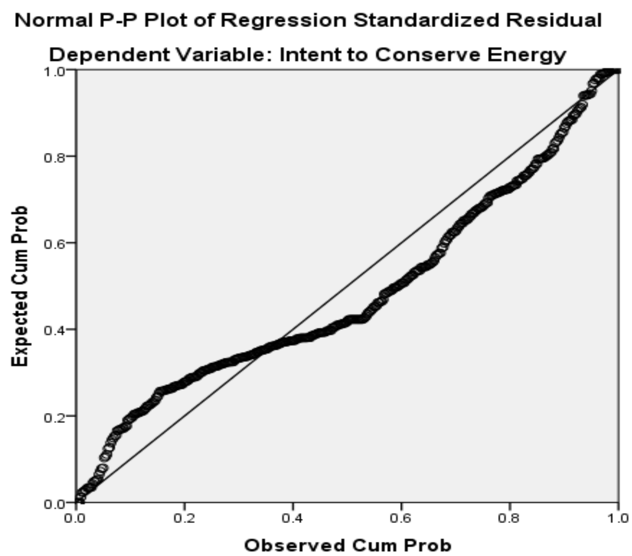

Figure 6. P-P scatterplot of residuals testing for normality.

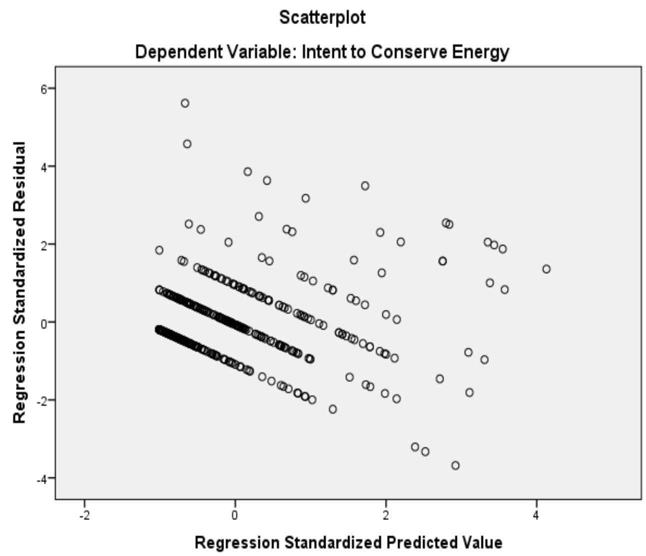

Figure 7. Scatterplot of residuals testing for homoscedasticity.

A residuals scatterplot was also used to assess the assumption of homoscedasticity in Figure 7. The scatterplot showed no indication of a definite pattern; hence, the assumption of homoscedasticity was also met. Although the scatterplot of the residuals suggested that the linearity assumption may be violated using this model, the personal income construct was kept in the model because its correlation with behavioral intent was significant at $p < .001$ or $p < .05$. Figure 8 shows the histogram of the outcome variable, the intent to conserve energy.

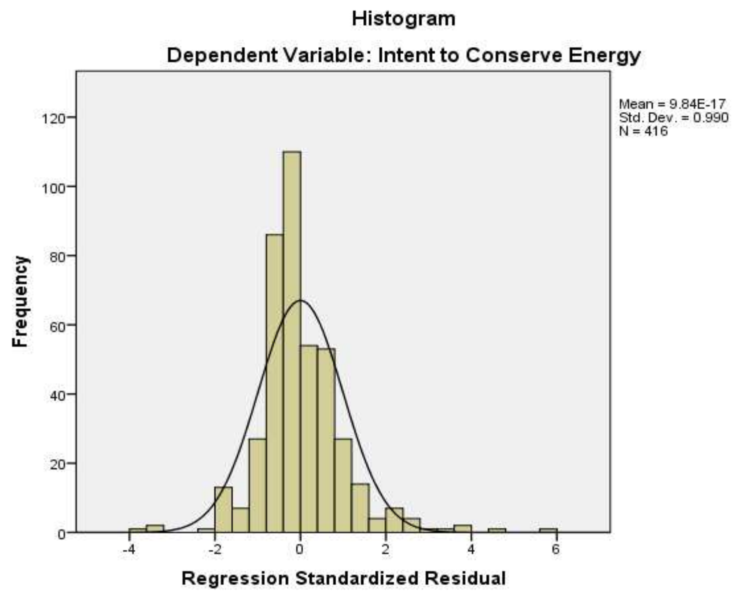

Figure 8. Histogram of the outcome variable, the intent to conserve energy.

The histogram of the residuals showed a normal distribution. Hence, based on the results, the normality of residuals assumption was satisfied and met. Because the values of the VIF in were below 3.0, this indicated that the assumption of the absence of multicollinearity was also met.

The standardized Beta (β) coefficients compared the strength of effect of the independent variables to the dependent variable and had the standard deviations as their units. This means the variables can be easily compared to each other. Here, the higher the absolute value of the beta coefficient, the stronger the effect of the predictor on the outcome. For example, the belief predictor with $\beta = .520$ had the strongest effect on intent. The standardized Beta (β) coefficients for subjective norm and personal income were virtually identical (.022 and .020 respectively), which indicated that both predictors had a comparable degree of significance in the model.

To interpret these values, the standard deviations from the descriptive statistics were used: beliefs (behavioral, control, and normative): standardized β = .520. This value indicated that as homeowners' beliefs about carbon emissions and climate change increased by one standard deviation (1.40559), the intent to conserve energy also increased by 0.520. The same analysis was true for the other predictors: attitude (β = .052, *SD* = 1.02090), subjective norm (β = .022, *SD* =1.22897), perceived control (β = .094, *SD* = 1.10253), personal income (β = .020, *SD* = 1.63159), household size (β = .087, *SD* =1.65212), and education level (β = .034, *SD* = 1.55473). However, the household composition predictor (standardized β = -0.005, *SD* = 1.55473) indicated that as household composition (age and gender) increased by one standard deviation unit, the intent to conserve energy decreased by 0.005 units.

Bivariate Analyses

A bivariate Pearson's correlation was conducted on the scales. All of the variables were continuous scale variables. The correlation matrix provided the relationship between each predictor and the outcome variables. The variables were normally distributed and had a linear relationship, which is why the Pearson's (*r*) correlation was used. There was a 1.0 value across each diagonal, which implied that when a variable is correlated with itself (e.g., beliefs with beliefs, attitude with attitude), it will be perfectly positively correlated.

I found that the belief predictor had a large positive correlation with the intent to conserve energy (*r* = .647). Homeowners' attitude and the intent to conserve energy (*r* = .498) had a moderate correlation, while perceived control (*r* = .395), subjective social norm (*r* = .357), education level (*r* = .319), household size (*r* = .291), household composition (*r* = .224), and personal income (*r* = .185) showed a very weak correlation with the intent to conserve energy. Second, the one-tailed significance of each predictor is displayed with all of the predictors showing a significant correlation (*p*< .001) with the outcome variable.

Looking only at the predictors while ignoring the outcome (intent), the highest correlation was between household size and household composition (*r* = .690, *p*< .001), followed by beliefs and attitude (*r* = .668, *p*< .001) and subjective norm and attitude (*r* = .555, *p*< .001). The relationship between subjective norm and personal income (*r* = .142, *p* = .002) and perceived control and personal income (*r* = .057, *p* = .122) was nonsignificant or no relationship existed (*p* > .001).

Despite the significance of these correlations, the coefficients that determined the degree of significance between these variables were small. It looked as though these predictors were measuring different things (no collinearity). Among the predictors, homeowners' beliefs had the strongest relationship with the outcome variable (*r* = .647, *p*< .001). Hence, it is likely that homeowners' beliefs about carbon emissions, environmental pollution, and climate change will best predict their intent to adopt a PEB and conserve energy. Table 10 shows the values of bivariate correlation between each pair of variables.

Table 10

Bivariate Correlation Among Variables

	Intent	Belief	Attitude	Subjective norm	Perceived control	Personal income	House hold size	House hold composition	Education level
Pearson Correlation	1.000	.647	.498	.357	.395	.185	.291	.224	.319
	.647	1.000	.668	.455	.460	.206	.275	.214	.365
	.498	.668	1.000	.555	.434	.251	.312	.210	.440
	.357	.455	.555	1.000	.383	.142	.235	.310	.373
	.395	.460	.434	.383	1.000	.057	.252	.216	.274
	.185	.206	.251	.142	.057	1.000	.322	.308	.295
	.291	.275	.312	.235	.252	.322	1.000	.690	.404
	.224	.214	.210	.310	.216	.308	.690	1.000	.423
	.319	.365	.440	.373	.274	.295	.404	.423	1.000
Sig. (1-tailed)	.	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.	.000	.002	.000	.000	.000
	.000	.000	.000	.000	.	.122	.000	.000	.000

	.000	.000	.000	.002	.122	.	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.
N	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416
	416	416	416	416	416	416	416	416	416

Note. Correlation is significant at the 0.01 level (1-tailed)

According to the analysis, homeowners were more likely to perceive their behavioral control in conserving energy when they had the belief that energy conservation could reduce environmental pollution and climate change. I found poor model-fit when the TPB was applied to the other sociodemographic predictors.

Research Questions and Hypothesis Testing

To examine the research questions, a multiple linear regression was conducted to determine whether the explanation of household energy consumption and homeowners' intent to reduce their energy use could be informed by the variables from the TPB, alongside background sociodemographic factors. The continuous dependent variable was homeowners' intent to conserve energy.

Research Question 1

In Research Question 1, I examined the model fit and the role of behavioral determinants (beliefs, subjective social norms, attitude, and perceived control) in determining the main constructs of the model when applied to behavioral intentions.

Research Question 2

In Research Question 2, I examined the role of sociodemographic factors (personal income, household size, household composition, and education level) and whether these predictors improved the model when applied to behavioral intention. These demographic variables are not included in Ajzen's TPB.

Research Question 3

In Research Question 3, I examined the model fit and the individual relationships among the behavioral determinants, sociodemographic factors, and the intent to conserve energy.

From the model, the belief construct t (407) = (10.05, $p < .001$), perceived control t (407) = (2.166, $p < .001$), household size t (407) = (1.62, $p < .001$), homeowners' attitude toward the act of conserving energy t (407) = (.919, $p < .001$), education level t (407) = (.745, $p < .001$), personal income t (407) = (.491, $p < .001$), and subject norm t (407) = (.467, $p < .001$) were all significant predictors of the intent to conserve energy. Although household composition t (407) = (-.097, $p < .001$) showed a negative t value, this relationship, based on the significance level of ($p < .001$), was true because all of the statistical assumptions listed above were met. Table 11 shows the ANOVA.

Table 11

ANOVA

Model		Sum of Squares	*df*	Mean Square	*F*	Sig.
1	Regression	308.095	4	77.024	79.363	.000[b]
	Residual	398.884	411	.971		
	Total	706.978	415			
2	Regression	314.972	8	39.371	40.877	.000[c]
	Residual	392.007	407	.963		
	Total	706.978	415			

The p value for the F statistic was < .05, which means that at least one of the independent variables was a significant predictor of the intent to conserve energy.

Results of the Multiple Linear Regression

The results of the multiple regression indicated a significant model among the constructs. A hierarchical method was chosen to for the model, showing the R (values of the multiple correlation coefficients between the predictors and the outcome), R^2 (measures how much of the variability in the outcome is accounted for by the predictors), and the adjusted R^2. Model 1 depicts the first stage in the hierarchy when only the behavioral determinants were predictors of intent. Model 2 shows when both the behavioral and sociodemographic determinants were used as predictors of the intent to conserve energy.

When only the behavioral determinants were used as predictors in Model 1, I found a simple correlation of R = .660 between behavioral factors and the intent to conserve energy. When both the behavioral and sociodemographic predictors were used in Model 2, I found a simple correlation of R = .667 between the behavioral determinants and the sociodemographic factors and the intent to conserve energy. For Model 1, R^2 = .436, which means that behavioral factors accounted for 43.6% of the variation in the intent to conserve energy. However, when the sociodemographic predictors were included in the model specification with behavioral factors, this value increased to R^2 = .446 or 44.6% of the variation in the intent to conserve energy. Hence, if behavioral factors alone accounted for 43.6% of intent, it was concluded that homeowners' demographic factors alone accounted for 0.01 or 1% of variation in the intent to conserve energy. Therefore, the inclusion of demographic factors explained a small amount of variability in the intent to conserve energy. In Model 2, the adjusted R^2 = .435, was smaller than R^2 = .446. This decline (.446 – .435 = .011) meant that if the model was derived from the population rather than a sample, it would account for approximately .011% less variation in the outcome. This is close to the observed value of 0.01 or 1%, which indicated that the cross-validity of this model is very good (Field, 2013).

Model 1 also caused R^2 to change from 0 to .436, which produced an F-statistic of 79.36, and it was significant at $p < .001$. In Model 2, in which demographic factors had been added as predictors, R^2 increased by .01, making R^2 of the new model .446. This increase produced an F-statistic of 1.79, which was insignificant at $p = .13$. This change was insignificant to the model fit. The final column of the model summary describes the Durbin-Watson statistics. According to Field (2013), the closer the Durbin-Watson value is to 2, the better the model. Hence, according to the data and analysis, the value was 1.96, which was so close to 2 that the assumption had been met. Table 12 shows the regression model summary.

Table 12

Regression Model Summary

Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the Estimate	*R* Square Change	*F* Change	df2	*Sig. F* Change	Durbin-Watson
1	.660[a]	.436	.430	.98515	.436	79.363	411	.000	
2	.667[b]	.446	.435	.98141	.010	1.785	407	.131	1.965

Hypothesis Testing

For the hypothesis testing, it was assumed that $p < .01$ and $p < .05$ are significant.

H_a1: There is a statistically significant relationship between homeowners' beliefs about carbon emissions and climate change and the intent to conserve energy.

H_01**:** There is no statistically significant relationship between homeowners' beliefs about carbon emissions and climate change and the intent to conserve energy.

To test Hypothesis 1, the homeowners' beliefs predictor was examined. The homeowners' beliefs construct was significant ($\beta = .531$, $p < .01$). The homeowners' belief about carbon emissions and climate change was a significant predictor of the intent to adopt a PEB, and thus conserve energy. Because this predictor was significant, null Hypothesis 1 can be rejected.

H_a1a**:** There is a statistically significant relationship between homeowners' attitude toward PEB and the intent to conserve energy.

$H_0$1a**:** There is no statistically significant relationship between homeowners' attitude toward PEB and the intent to conserve energy.

To test the hypothesis, the homeowners' attitude predictor was examined. The attitude construct was not significant (β = .052, p = .359). The homeowners' attitude toward carbon emissions and climate change was not a significant predictor of the intent to conserve energy. Because this predictor was not significant, this null hypothesis cannot be rejected

H_a1b: There is a statistically significant relationship between homeowners' subjective social norm and the intent to conserve energy.

$H_0$1b: There is no statistically significant relationship between homeowners' subjective social norm and the intent to conserve energy.

To test the hypothesis, the subjective social norm predictor was examined. The subjective social norm construct was not significant (β = .022, p = .641). The homeowners' social norm (significant others) was not a significant predictor of the intent to conserve energy. Because this predictor was not significant, the null hypothesis cannot be rejected.

H_a1c: There is a statistically significant relationship between homeowners' perceived behavioral control and the intent to conserve energy.

*H₀*1c: There is no statistically significant relationship between homeowners' perceived behavioral control and the intent to conserve energy

To test the hypothesis, the perceived behavioral control predictor was examined. The perceived control construct was significant (β = .094, $p < .05$). The perceived behavioral control was also a significant predictor of homeowners' intent to conserve energy. Because this predictor was significant, the null hypothesis can be rejected.

H_a2: There is a statistically significant relationship between personal income and homeowners' intent to conserve energy.

H_02: There is no statistically significant relationship between personal income and homeowners' intent to conserve energy.

To test the hypothesis, the personal income predictor was examined. The personal income construct was not significant (β = .020, p = .623). The personal income was not a significant predictor of homeowners' intent to conserve energy. Because this predictor was not significant, the null hypothesis cannot be rejected

H_a2a: There is a statistically significant relationship between household size and homeowners' intent to conserve energy.

H_02a: There is no statistically significant relationship between household size and homeowners' intent to conserve energy

To test the hypothesis, the household size predictor was examined. The household size construct was not significant (β = .087, p = .106). The household size was not a significant predictor of homeowners' intent to conserve energy. Because this predictor was not significant, the null hypothesis cannot be rejected.

H_a2b: There is a statistically significant relationship between household composition and homeowners’ intent to conserve energy.

H_02b: There is no statistically significant relationship between household composition and homeowners’ intent to conserve energy.

To test the hypothesis, the household composition predictor was examined. The household composition construct was not significant (β = -0.005, p = .923). The household composition (age and gender) was not a significant predictor of homeowners’ intent to conserve energy. Because this predictor was not significant, the null hypothesis cannot be rejected.

H_a2c: There is a statistically significant relationship between education level and the intent to conserve energy.

H_02c: There is no statistically significant relationship between education level and the intent to conserve energy

To test the hypothesis, the education level predictor was examined. The education level construct was not significant (β = .034, p = .459). The homeowners’ education level was not a significant predictor of homeowners’ intent to conserve energy. Because this predictor was not significant, the null hypothesis cannot be rejected.

H_a3: There is a statistically significant relationship among behavioral determinants, sociodemographic factors, and homeowners’ intent to conserve energy.

H_03: There is no statistically significant relationship among behavioral determinants, sociodemographic factors, and homeowners’ intent to conserve energy.

To test the hypothesis, the eight predictors were taken together to examine their total effect on the outcome variable. Based on conclusion from the hypotheses testing, only the belief predictor and the perceived control predictor had significant relationships with the intent to conserve energy (β = .531, $p < .001$; β = .094, $p < .05$ respectively); hence, the null hypotheses were rejected. The other six predictors were nonsignificant in predicting the outcome, all of which had a value of $p > .01$ and $p > .05$. Because only two predictors, out of eight (2/8 = .25) were significant in predicting the outcome, it was concluded that .25 was far from 1 and was not considered sufficient enough to imply meaningful level of significance. Therefore, the behavioral determinants and demographic predictors, taken together, were not significant in predicting intent; hence, the null hypothesis 9 cannot be rejected.

The diagnostic analysis model-fit showed a poor fit of the model to the data. This is a statistical indication that Ajzen's approach to the TPB did not work well when applied with sociodemographic factors in determining homeowners' behavioral intent to conserve energy. Table 13 shows a model of the correlation between beliefs and intent.

Table 13

Model Summary Showing the Correlation Between Beliefs and Intent

		Intent	Behavioral Belief	Control Belief	Normative Belief
Intent	Pearson Correlation	1	.490**	.694**	.479**
	Sig. (2-tailed)		.000	.000	.000
	N	425	425	425	425
Behavioral Belief	Pearson Correlation	.490**	1	.436**	.483**
	Sig. (2-tailed)	.000		.000	.000
	N	425	425	425	425
Control Belief	Pearson Correlation	.694**	.436**	1	.522**
	Sig. (2-tailed)	.000	.000		.000
	N	425	425	425	425
Normative Belief	Pearson Correlation	.479**	.483**	.522**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	425	425	425	425

Note. Correlation is significant at the 0.01 level (2-tailed).

The TPB's indirect variables (behavioral beliefs, normative beliefs, and control belief) showed that the indirect constructs had positively significant relationships with the intent to conserve energy. The control belief factor had the strongest influence on the intent to act ($r = .694$, $p < .001$), while the behavioral belief and normative belief factors reported $r = .490$, $p < .001$, and $r = .479$, $p < .001$ respectively.

Chapter Summary and Transition to Chapter 5

In Chapter 4, I presented the results of the pilot study and the descriptive statistical tests for the survey that I conducted. Prior to analyses, statistical assumptions (assumptions of normality, linearity, homoscedasticity, and multicollinearity) were assesses and validated, ensuring that these assumptions were met. A multiple linear regression was conducted, using SPSS, to examine the research questions about homeowners' intentions to conserve energy. The main constructs from Ajzen's traditional TPB model were found to be statistically significant at varying levels. The TPB variables collectively explained 43.6% of variability in intent to conserve energy, while the sociodemographic predictors collectively accounted for 1% of variability in the intent to conserve energy. The belief construct showed the strongest standardized beta of the eight independent variables. I also found that homeowners were more likely to perceive behavioral control to conserve energy if they used alternative energy or efficient appliances in the past and believed that they had the financial resources to do so. A significant relationship between attitude and beliefs was also found. I also found a significant relationship between subjective social norms and the attitude toward energy conservation. These two relationships were also found by Knab (2012), but are not part of Ajzen's traditional TPB. I found a significant relationship between household size and household composition, while personal income showed no relationship with subjective norm and perceived control. Also, personal income showed a very weak relationship with the intent to conserve energy. Overall, I found a very weak or no relationships among the sociodemographic variables and the dependent variable.

In Chapter 5, I present an analysis of the study's findings and its limitations, recommendations for practical action and future research, and implications the current study may have on energy reform efforts. In addition, the relationship between the quantitative results and the literature is discussed.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

This dissertation was a survey of homeowners who used their dwellings as a primary residence in the Northeast census region of the United States and the factors that influenced their intent to conserve energy. The study was based on the perception of homeowners on the adoption of PEBs and energy conservation. For the web-based survey, a questionnaire was adopted, reviewed, and pilot tested for the validity and reliability of the survey instrument. In the survey, I measured the constructs of Ajzen's (1985) TPB, followed by a model fit and the findings associated with the independent sociodemographic variables not normally associated with the theory.

Hypotheses were tested through a regression analysis in SPSS. The analysis was based on Ajzen's (2006) TPB model using the endogenous variable, the intent to conserve energy, regressed on the behavioral variables (beliefs, attitude, subjective social norm, perceived behavioral control) and the sociodemographic variables (personal income, household size, household composition, and education level). The use of demographic predictors was similar to the use of Ajzen's classic TPB model, alongside sociodemographic factors in Abrahamse and Steg (2011). Using SPSS, several common model-fit measures were used in assessing the model's overall goodness-of-fit. These tests included Pearson's correlation coefficient, change statistic estimation, analysis of variance, scale reliability test, the Durbin-Watson estimation, and the comparative fit index.

In the classic TPB, Ajzen used beliefs, attitude, subjective social norm, and perceived behavioral control in predicting behavioral intentions with high accuracy. According to the TPB, behavioral intentions, when combined with the belief that the behavior or action may produce a certain outcome, and the person's attitude toward the act, as well as his or her perceived control, will help predict the behavioral outcome with more precision than other behavioral models (Ajzen, 1991). This theory was proven when I found that the belief predictor had a significant relationship with attitude (r = .668, p < .001) and for belief and perceived control (r = .460, p < .001). The TPB was broken down into four conceptually independent constructs leading to behavioral intentions: beliefs, attitude, perceived control, and subjective norm.

Interpretation of the Research Findings

I found that the intent to conserve energy was associated with several behavioral and demographic factors as described in the reviewed literature. However, these associations were not substantial and consistent, which made it difficult to draw conclusions concerning the effects of PEBs on energy conservation, air pollution, and greenhouse gas emission across studies. Theoretically, the predictor variables examined in this study interacted with other variables, and their impact was contingent upon several moderating factors. These inconsistencies may pose challenges in drawing conclusions about the effects of the predictors on the outcome and to generalize the research findings.

Summary of Findings on Key Behavioral Factors

In terms of the effect of behavioral determinants on the intent to conserve energy, several factors were identified as playing a role in drawing the research conclusion, with beliefs and attitude being influential on the outcomes of the study. As in many studies, the effects of the other behavioral factors in this study were not consistent or conclusive. For example, scholars have investigated the impact of variables such as beliefs, attitude, subjective norm, perceived control, knowledge and awareness, values, and motives on behavioral intent. Yet, I found that environmentally-friendly knowledge and values do not consistently predict PEBs. Consequently, there was a discrepancy between intentions and behavior.

Furthermore, the effects of many behavioral factors, such as perceived control and subjective norm, on PEBs were small and weak and often failed to attain statistical significance when compared to the effects of certain demographic factors such as income and age of occupants. Although the behavioral factors in this study explained a mere 1% of variation in residential energy use and the intent to conserve energy, the variance explained increased to 15% after considering several sociodemographic variables. Future energy-saving initiatives should direct efforts in helping energy consumers to act in accordance with their beliefs about environmental pollution and climate change, their attitude toward the use of energy efficient technology and energy conservation, their subjective social norms, and the perceived control to adopt a PEB. These behavioral factors may translate the intentions into changes in energy efficiency and conservation practices.

The direct variables from Ajzen's classic TPB model were found to be positive predictors of the intent to conserve energy, and they were statistically significant at varying levels. The TPB's indirect variables (behavioral beliefs, normative beliefs, and control belief) were also found to have positively significant relationships with the outcomes. This result supports the meta-analysis of the TPB as discussed in the literature review (Abrahamse & Steg, 2011; Ajzen, 2014; Ajzen & Fishbein, 2004; Armitage & Conner, 2001, 2014; Hagger et al., 2002; Harland et al., 1999; Hausenblas et al., 19977; Osbaldiston & Schott, 2012; Sheppard et al., 1998; Steinmetz et al., 2016).

In this study, beliefs, attitudes, subjective norms, and perceived control collectively accounted for about 44% of the variance in homeowners' intent to conserve energy. Among the four TPB variables, only the belief predictor (β = .531, p< .001) with a standardized path coefficient (r = .647, p< .001) and the perceived control predictor (β = .094, p < .05) with a standardized path coefficient (r = .395, p< .001) had true significant relationships with the outcome variable. The other two traditional TPB variables, attitude (β = .052, p = .359) and subjective norm (β = .022, p = .3641), were nonsignificant.

Summary of Findings on Key Sociodemographic Factors

I found that sociodemographic factors (ie., personal income, household size, household composition, and education level) were positively associated with homeowners' intent to conserve energy; however, the effects were mixed. For example, although some scholars have suggested a curvilinear effect on energy consumption for demographic factors, this nonlinear pattern did not hold up in other studies. Some researchers have recommended that middle- and higher-income homeowners are most likely to save energy while low-income homeowners and are unable to save energy due to social and economic constraints. Fredericks (2015a) also concluded that high-income homeowners are reluctant or unwilling reduce their energy usage.

Moreover, the relationship between personal income and energy consumption is expected to be influenced by the ability of higher income homeowners to invest in energy efficiency technologies and measures, which compliments their PEBs. This pattern of results for personal income was just one example of the many complexities identified in the results of this study. The extent to which sociodemographic factors influenced household energy use depended on the complex and dynamic interaction between predictors, sometimes simultaneous, and other times unfolding over time. Also, the relationship between education level and energy behavior was inconclusive within the literature. Although Poortinga, Steg, and Vlek (2004) argued that a higher level of education may be associated with lower household energy use, Gatersleben, Steg, and Vlek (2002) suggested that education is not related to energy consumption (β = .034, p = 457), which is consistent with the results of this study.

The sociodemographic variables used in this study (ie., personal income [β = .020, p = *623*], household size [β = .087, p = .106], and education level [β = .034, p = .457]) had no significant influence on the intent to conserve energy. Household composition showed a negative relationship (β = -0.005, p = .923).

Limitations of the Study

This study had several potential limitations, some of which are consistent with the inherent weaknesses of the research methodology and others with the TPB. One limitation was that the TPB, when applied as conceptualized by Ajzen, did not factor in sociodemographic variables. According to Ajzen (1988), sociodemographic variables could be accounted for in the TPB only if they influenced the underlying behavioral beliefs that determined the attitude and subjective social norms.

Inherently, correlation is an effect size and the strength of the Pearson's correlation (r*)* for this study was based on Evans' (1996) guidelines, which suggested the following *r* values: .20-.39 = very weak relationship, .40-.59 = moderate relationship, .60-.79 = strong relationship, and .80-1.0 = very strong relationship. Due to the very weak effect sizes of the relationship between the behavioral determinants and demographic variables (r = .20-.39), except for education level and attitude that had a moderate relationship (r = .440), it was determined that Ajzen's (2006) TPB could not effectively account for sociodemographic factors in its model. Also, the use of the TPB to measure behavioral determinants was a limitation to the study, because observations of behavioral determinists were indirect, which was a part of a broader model in this study.

Another limitation to this study was the limit to the generalizability of the research findings. According to Ajzen (2006), the TPB was designed to measure actions based on intentions. Hence, the theory only allowed for the generalizability of findings to those actions and not to related behaviors. In this study, the TPB was used to study the behavioral intentions of only homeowners who used their buildings as primary residence. Therefore, caution must be taken in applying the results of this study to homeowners who do not use their buildings as a primary residence, as well as ratepayers who dwell in residences and pay electricity bills, but are not homeowners.

Although survey research saves time, and it is relatively inexpensive to execute in a web-based setting that allows the researcher to reach large number of participants at a given time and offers strength in measurement, this type of research can be easily simulated based on participants' response. Also, surveys may increase bias, which increases the probability that the characteristics of the participants who respond to the survey may be different from those who do not, particularly when the questionnaire was administered online and involved statements about people's behavioral determinants. However, participants' anonymity may have reduced the chances of bias, unlike the face-to-face and focus group techniques, which may be subject to both social and political correctness.

A common attribute with studies of this nature is that the results are valid only for the time and place where the data were collected. As such, the results were presented as a survey sample, and the findings were generalized to all homeowners in the Northeastern census region (New England and Mid-Atlantic) of the United States. Because the study was limited to this region, results, conclusions, and recommendations reached may be difficult to implement in other census regions and countries due to environmental, economic, lifestyle, policy, and social differences. Hence, the population that participated in the survey could limit the generalizability of the result.

Also, assumptions, errors, and inaccuracies in the data collection process, such as questionnaire structure, could impact the results obtained from this study. It is difficult to isolate individual behavior and sociodemographic impacts, because of changing socioeconomic and environmental conditions in various census regions and households across the United States. Hence, I did not formulate a model that predicts, with precision, residential energy use by reducing its variables to a few key structural, behavioral, or demographic attributes. Energy use, even at the household level, is as a result of a complex interplay of personal, psychological, and physical characteristics, including many personal choice opportunities that defy measurement.

Recommendations and Direction for Future Research

This study was the first to examine, using primary data, the relationship between household energy consumption and homeowners' intent to reduce their energy use using behavioral determinants and sociodemographic factors. I adopted the TPB to explain the impact of behavioral determinants and background demographic factors on the intent to adopt a PEB and conserve energy. To explain whether this relationship was informed by variables from the TPB, alongside background demographic factors, further research study is needed to validate the findings of this study. This study was limited to one group of the stakeholders, homeowners who used their buildings as primary residence in the Northeast census region of the United States. Future research could broaden the scope of this study, by incorporating other stakeholders, such as homeowners who do not use their buildings as primary residence, as well as ratepayers who consume energy and pay utility bills, but do not own their dwellings.

When analyzing the underlying causes of homeowners' behavioral intent and a change in attitude toward energy conservation, a survey of other demographic factors such as employment, building type, geographical location, and dwelling ownership are also constructs that are needed for further analysis of the intent to conserve energy. As in the case of this study, the information collected was based on homeowners' general demographics, such as personal income, household size (number of occupants), household composition (age and gender), and education level as recommended by Lovelock (2010). If the purpose of a research is to understand the factors affecting PEBs, other determinants, such as environmental awareness, structural incentives, and locus of control are also recommended for future research.

To evaluate any potential bias among the variables and to further improve the validity of the result of this study, the average energy consumption of the 436 surveyed homeowners and the nonsurveyed homeowners in New England and Mid-Atlantic regions can also be further analyzed. To find out whether there is any significant difference between their average energy consumption, a mixed-method study is recommended for further analysis. To determine the most significant predictors that may influence homeowners' energy conservation and PEBs in Northeastern United States, the results of this study should be compared to future studies using structured interviews. These scholars could highlight, and perhaps address, any weaknesses in the research design and method used in this study. Because of limited access to personal information, I collected information by means of a web-based questionnaire. Other survey methodologies, such as mail-in questionnaires and telephone interviews, may increase the survey response rate and allow the sample size to have greater representation of the pilot site.

Implications of the Study

Ajzen's TPB is a rational choice theory from social psychology, which is often used in the study of PEBs (Macovei, 2015). The TPB variables were successfully applied in the case of homeowners' intent to behave in a proenvironmental manner and to conserve energy. To this effect, the model was validated with very good model fit and quality indices. However, the newly introduced sociodemographic variables were proven to be somehow significant determinants. These levels of significance were believed to be very weak at varying levels (*r* ranging from 0.185 to 0.319 = very weak relationship). These demographic factors may serve as predictors for future research in the field of energy efficiency, energy conservation, and other proenvironmental studies.

Practical Implications

Although energy consumption and PEBs at the household level has received little attention from researchers and lawmakers, this study contributed to the knowledge gap, which has implications for the study and implementation of energy conservation programs, environmental pollution guidelines, and carbon emissions reduction goals for sustainable communities. This knowledge may be obtained within the framework of PEB change, such as highlighted in the study.

The variables that influence homeowners' PEBs and energy conservation within one household are also likely to act upon the occupants of another household. Consequently, any positive results arising from this study may provide ideas, which may help to address the energy reduction and proenvironmental problems in other census regions of the United States and beyond. An evaluation of homeowners' PEBs within the residential sector will only serve to develop the energy literature and its diffusion for a positive social change. Although it would be convenient to suggest that homeowners' intent to conserve energy may be adequately characterized by demographic determinants and behavioral analysis and, therefore, can be easily impacted by strategies aimed at addressing the areas outlined in this study, it does not present the actuality of energy saving and other PEBs at the household level.

Achieving a reduction in household energy use, through homeowners' behavioral changes, offers a multifaceted challenge. Not only is residential energy use based on behavioral and sociodemographic determinants, but also its reduction is dependent upon the strategies employed to encourage the behavioral understandings that are provided by its psychological modeling. It is important to consider the dynamics of persuading homeowners to engage in PEBs, especially when the adoption decision involves certain socioeconomic and environmental contexts, such as the cost and benefit of conserving energy and the reaction of household occupants.

Policymakers should be concerned about the use of energy by other household occupants, based on their beliefs about the effect of PEBs on environmental pollution and climate change. This includes findings about occupants' behavioral and normative influences on the homeowner's intent, and the relationship between subjective social norm and the attitude toward the act of conserving energy. If homeowners are considering what significant others think during times of market uncertainty, whether there is a tight energy market or institutional pressures for change, it might make sense to have key referents serve as campaigners of energy efficiency and conservation.

I found that the belief construct may be the most significant factor to consider when persuading homeowners or occupants to conserve energy. Although attitude and perceived behavioral control were also significant, at a moderate level, it is important that advocates of energy conservation do not ignore the influence of consumers' subjective social norms and education level in their long-term energy efficiency and conservation planning. Homeowners, ratepayers, and other energy stakeholders who support energy efficiency and conservation practices may be influential in shaping other people's attitudes toward energy efficiency and conservation during times of uncertainty and risk in the energy and housing market.

I also showed the implications of belief in predicting people's attitude toward energy conservation. Of all the salient beliefs (normative belief, behavioral beliefs, and control beliefs), control belief had the strongest predictive power and highest path coefficient when regressed against the outcome variable ($r = 0.686$, $p < .001$), while behavioral belief showed the second most predictive power when regressed against intent ($r = 0.490$, $p < .001$). Based on these findings, it would be wise for homeowners to focus on shaping their self-control, as well as their behaviors, in assessing the probability that they will conserve energy based on the beliefs they hold about environmental pollution and climate change. These beliefs also play a role in shaping homeowners' attitude toward energy conservation. Policymakers could influence these belief constructs by focusing on strategic leadership roles and sharing positive information about energy efficiency and conservation for sustainable community development and positive social change.

Theoretical Implications

Although most studies on PEBs are based on the TPB (e.g., Greaves et al., 2013; de Leeuw et al., 2015; Macovei, 2015), I found that the addition of perceived behavioral control, which is not present in other behavioral theories such as the TRA (Fishbein &

Ajzen, 1975), was a determinant in the adoption of energy conservation behavior among homeowners. Because perceived control is unique to the TPB, it was important to include it in this study. Contextually, omitting homeowners' perceived control as a factor and relying on simple adoption models, as applied in the TRA, may not fully explain homeowners' behavioral intent to conserve energy.

This study had another theoretical implication, in that it served as a lens as to how other contexts, such as homeowners' demographics, could be used alongside variables from the TPB in studying people's intent to behave in a certain way. The theoretical model adapted in this study may offer scholars, public policymakers, and other energy stakeholders a research tool, by targeting consumers in energy efficiency advocacy and marketing campaigns and finding new ways to protect the environment through energy conservation (Moise & Macovei, 2014). In addition, the three external beliefs identified in this study can be instrumental in applying the TPB for the adoption of energy conservation and other PEBs.

Other unknown demographic and psychological determinants could be influencing behavioral intent in the context of household energy consumption. In the results from the regression analysis, I found a significant relationship between subjective social norm and homeowners' attitude toward energy conservation. This relationship is not present in Ajzen's (2006) TPB classical model, which represents a prospect to further test this theoretical finding. Future scholars who use the TPB should incorporate a path analysis of subjective social norm leading to behavioral attitude by looking at other ways to explore this relationship in a different context. Although this study was tailored toward reducing household energy use through homeowners' PEBs using the TPB model, other theories, such as the TRA and the VBN, may offer insight into the role of subjective social norm and how it affects intent and the attitude to act.

Using Ajzen's (2006) theoretical framework, I expected that homeowners with higher income and education might be sensitive to perceived social norms. Thus, income and education could moderate the connection between subjective social norms and the intent to act, and between subjective social norms and the attitude toward a behavior. In the TPB model Ajzen did not incorporate the effects of income, education, age, and gender on the intent to act, and few researchers have included income and education in studies involving this theoretical model.

Using the TPB as a theoretical framework, Abrahamse and Steg (2011) used demographic variables to explain additional variance in energy use and the intent to reduce it. In line with the assumptions of the TPB, behavioral variables mediate the relationship between homeowners' demographics and their intent to conserve energy (Ajzen & Fishbein, 1980). As referenced in Abrahamse and Steg, energy use and the intent to reduce it in the Netherlands was more strongly explained by demographic predictors than by the behavioral variables from the TPB and VBN combined. Abrahamse and Steg revealed that households with higher income, as well as those that are larger in size, used more energy than those with lower incomes and smaller in size. Abrahamse and Steg also revealed that older respondents tended to use more energy than younger respondents.

Demographic variables act as opportunities and constraints for energy consumption patterns. Although the findings from Abrahamse and Steg (2011) are intriguing, they are unique to countries in Western Europe and may not be applicable across the theory in different countries and regions. The role of demographic factors in predicting behavior in the TPB studies is still unknown and inconclusive. Similarly, the role of income, age, gender, number of occupants, and education played a role in the context of this study. The TPB remains a robust model and no permanent change to the theory is recommended.

The usefulness of the TPB depends on the correct operationalization and measurement of its traditional variables. Before concluding that the intent to conserve energy is a poor model fit for Ajzen's TPB model, further exploration and additional testing needs to be done, with possible inclusion of additional demographic variables to predict beliefs about energy conservation and environmental pollution. For further analysis, there may be other intervening variables, crossover effects, and other theoretical explanations for the lack of a perfect model fit in this study.

Implications for a Positive Social Change

The findings from this study may promote positive social changes through PEBs by shaping the discussion about social behaviors and household energy use in pursuing carbon emissions reduction environmental sustainability. Society is concerned about how the impact of increased energy use and greenhouse gas emission on the environment can be eliminated. Hence, stakeholders engaged in promoting energy efficiency and conservation should consider the outcomes of this study as a tool for planning and implementing carbon emissions reduction and environmental programs for a positive social change.

Although state and local government officials continue to take steps in advancing energy efficiency and conservation through alternative energy adoption, few scholars have explored the effects of human activities on the environment to understand the impediments and challenges to the adoption of PEBs in curbing greenhouse gas emission and climate change (Lubell, Feiock, & Ramirez, 2005). Lyon and Yin (2010) recommended that more resources should be directed to a sustainable policy development on the effects of waste-energy through homeowners' behavioral actions.

The findings in this study may have implications for public policy and future research. In-depth knowledge and understanding of what drives energy consumption and conservation in residential buildings can be a tool in contributing to a more effective design and delivery of consumer-focused strategies, based on behavioral interventions, in promoting energy conservation. Developing innovative and cost-effective solutions to reduce energy end-use and that are generalizable to broad segments of the buildings sector is asocial and environmental issue of priority at the international, federal, state, and local levels.

Although an exhaustive summary of all possible implications is beyond the scope of this study, policymakers and practitioners are encouraged to consider the potential opportunities created by these behavioral interventions in determining how best to shift household energy consumption by advancing homeowners' PEBs in the desired direction. Although promoting the uptake of alternative energy sources and acceptance of energy efficient technology is important in solving carbon emission-related problems, long-term behavioral changes in the use of such technologies, and the curtailment of increasing use of energy, are at the core of achieving reductions in residential energy use.

Theoretically, the attitude toward the act of conserving energy and the perceived likelihood to conserve energy could be achieved by the belief that a more sustainable use of energy may lead to a cleaner and healthier environment. It is important to enhance homeowners' perceived possibilities of conserving energy by emphasizing that household occupants do not have to experience too much discomfort while conserving energy. This is important from a policy perspective, as the effectiveness of interventions aimed at encouraging homeowners to reduce their energy use may be enhanced when a broader set of theory-based behavioral and psychological determinants are targeted. One of the benefits of the growing awareness of greenhouse gas emissions and environmental pollution is that informed homeowners and other energy consumers may leverage their electoral power to influence public policy and positive social changes in their constituents.

Chapter Summary and Conclusion

I established that there are several individual-level predictors of residential energy use and the intent to conserve energy. As evidenced in the TPB, the research framework was divided into two categories to explain the variability in residential energy use: behavioral determinants (beliefs, attitude, subjective social norm, and perceived control) and sociodemographic factors (personal income, household size, household composition, and education level). This approach may be viable in the context of homeowners' intent to adopt a PEB and conserve energy. Although the influence of individual predictors within each of these categories has not been consistent or conclusive across studies, I sought to establish some precision to the literature, which was achieved by further discussing the findings that have emerged in the literature. I highlighted the importance of taking multiple predictable elements into account when designing and delivering strategies that aim at reducing energy use through the intent to adopt a PEB. By shedding further light on what drives homeowners' intent to conserve energy, I provided practitioners and policymakers with insight for developing a robust and cost-effective solution that targets these individual-level predictors of household energy use and PEBs. The findings from this study may also help in advancing the design and delivery of behavioral change interventions that will ultimately assist individual homeowners, households, and community stakeholders in curbing carbon emissions and environmental change by achieving greater sustainability and positive social change in the use of energy both now and in the future.

References

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology 25*, 273–291. https://doi.org/10.1016/j.jenvp.2005.08.002

Abrahamse, W., & Steg, L. (2009). How do sociodemographic and psychological factors related to households' direct and indirect energy use and savings? *Journal of Economic Psychology*, *30*, 711–720. https://doi.org/10.1016/j.joep.2009.05.006

Abrahamse, W., & Steg, L. (2011). Factors related to household energy use and intent to reduce it: The role of psychological and sociodemographic variables. *Human Ecology Review, 18*(1). Retrieved from http://humanecologyreview.org/

Ajzen, I. (1988). *Attitudes, personality, and behavior*. Chicago, IL: Dorsey Press.

Ajzen, I. (2005). *Attitudes, personality, and behavior* (2nd. ed.). Milton-Keynes, England: Open University Press / McGraw- Hill.

Ajzen, I. (2011). Behavioral interventions: Design and evaluation guided by the theory of planned behavior. In M. M. Mark, S. I. Donaldson, & B. C. Campbell (Eds.), *Social psychology for program and policy evaluation* (pp. 74-100). New York, NY: Guilford.

Ajzen, I. (2006). Constructing a TPB questionnaire: Conceptual and methodological considerations. Retrieved June 27, 2011, from http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf

Ajzen, I. (2015). Consumer attitudes and behavior: The theory of planned behavior applied to food consumption decisions. *Rivista di Economia Agraria, 70*(2), 121-138. Retrieved from http://www.fupress.net/index.php/rea

Ajzen, I. (1985). From intent to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11- 39). Heidelberg, Germany: Springer.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior Human Decision Process, 50*, 179–211. Retrieved from https://www.journals.elsevier.com/organizational-behavior-and-human-decision-processes/

Ajzen, I. (2011). The theory of planned behavior: Reactions and reflections. *Psychology & Health, 26*(9), 1113-1127. https://doi.org/10.1080/08870446.2011.613995

Ajzen, I. (2014). The theory of planned behavior is alive and well, and not ready to retire: A commentary on Sniehotta, Presseau, and Araújo-Soares. *Health Psychology Review*. http://dx.doi.org/10.1080/17437199.2014.883474

Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behavior to leisure choice. *Journal of Leisure Research, 24*, 207-224. Retrieved from http://js.sagamorepub.com/jlr

Ajzen, I., & Fishbein, M. (1972). Attitudes and normative belief as factors influencing behavioral intent. *Journal of Personality and Social Psychology, 21*(1), 1-9. https://doi.org/10.1037/h0031930

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin, 84,* 888-918. https://doi.org//10.1037//0033-2909.84.5.888

Ajzen, I., & Fishbein, M. (2004). Questions raised by a reasoned action approach: Comment on Ogden (2003). *Health Psychology, 23,* 431-434. https://doi.org/10.1037/0278-6133.23.4.431

Ajzen, I., & Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *The handbook of attitudes* (pp. 173-221). Mahwah, NJ: Erlbaum.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., & Klobas, J. (2013). Fertility intent: An approach based on the theory of planned behavior. *Demographic Research, 29*(8), 203-232. https://doi.org/10.4054/demres.2013.29.8

Alibašić, H. (2013). *The impact of applied sustainable energy management on local governments*. (Unpublished doctoral dissertation). Retrieved from ProQuest (UMI No. 3605554)

Allison, P. D. (1987). Estimation of linear models with incomplete data. In C. C. Clogg (Ed.), *Sociological methodology, 1987* (pp. 71–103). San Francisco, CA: Jossey-Bass.

Allison, P. D. (1999). Multiple regression: *A primer (1999).* London, England: Sage Publications.

Allison, P. D. (2001) *Missing data*. Thousand Oaks, CA: Sage.

Allison, P. D. (2002). Missing data: Quantitative applications in the social sciences. *British Journal of Mathematical and Statistical Psychology*, *55*(1), 193-196. Retrieved from http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)2044-8317

Anderson, N. H. (1971). Integration theory and attitude change. *Psychological Review, 78,* 171-206. https://doi.org/10.1037/h0030834

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behavior: A meta- analytic review. *British Journal of Social Psychology, 40*, 471- 499. https://doi.org/10.1348/014466601164939

Armitage, C. J., & Conner, M. (1999). Predictive validity of the theory of planned behavior: The role of questionnaire format and social desirability. *Journal of Community and Applied Social Psychology, 9*, 261-272. https://doi.org/10.1002/(sici)1099-1298(199907/08)9:4%3C261::aid-casp503%3E3.0.co;2-5

Auffhammer, M., & Mansur, E. T. (2014). *Measuring climatic impacts on energy consumption: A review of the empirical literature.* Retrieved from http://www.dartmouth.edu/~mansur/papers/Auffhammer_Mansur_climateadaptenergy.pdf

Bhattacharjee, S., & Reichard, G. (2011). Socioeconomic factors affecting individual household energy consumption: A systematic review. American Society of Mechanical Engineers Fifth International Conference on Energy Sustainability.

Blake, J. (1999). Overcoming the “value-action gap in environmental policy: Tensions between national policy and local experience. *The International Journal of Justice and Sustainability, 4*(3), 257-278. https://doi.org/10.1080/13549839908725599

Bryman, A., & Cramer, D. (2008). *Quantitative data analysis with SPSS 14, 15 & 16: A guide for social scientists*. Hove, England: Psychology Press.

Bryman, A., & Cramer, D. (2009). Constructing variables. In M. Hardy (Ed.), *Handbook of data analysis*. Thousand Oaks, CA: Sage.

Bryman, A., & Cramer, D. (2011). *Quantitative data analysis with IBM SPSS statistics 17, 18 and 19: A guide for social scientists*. Hove, England: Psychology Press.

Burns, R. B., & Burns, R. A. (2008). *Business research methods and statistics using SPSS.* Thousand Oaks, CA: Sage.

Chan, L., & Bishop, B. (2013). A moral basis for recycling: Extending the theory of planned behavior. *Journal of Environmental Psychology*, *36*, 96-102. https://doi.org/10.1016/j.jenvp.2013.07.010

Charter, M. (1999). *Greener marketing: A global perspective on greening marketing practice*. Sheffield, UK: Greenleaf Publishing.

Cheon, J., Lee, S., Crooks, S. M., & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers and Education, 59*(3), 1054–1064. http://dx.doi.org/10.1016/j.compedu.2012.04.015

Ciocirlan, C. E. (2009). Analyzing the relative strength of policy instruments to stimulate renewable energy markets: A comparative state analysis. *Journal of Comparative Policy Analysis*, *11*(4), 515-538. doi: 10.1080/13876980903222948.

Clement, C. A., Henning, J. B., & Osbaldiston, R. (2014). Integrating factors that predict energy conservation: The theory of planned behavior and belief about climate change. *Journal of Sustainable Development*, *7*(6), 46-69. https://doi.org/10.5539/jsd.v7n6p46

Conner, M. (2014). Extending not retiring the theory of planned behavior: A commentary on Sniehotta, Presseau, and Araujo-Soares. *Health Psychology Review, 9*(2), 141-145. http://dx.doi.org/10.1080/17437199.2014.899060

Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenue for further research. *Journal of Applied Social Psychology, 28*(15), 1429-1464. https://doi.org/10.1111/j.1559-1816.1998.tb01685.x

Cook, C., Heath, F., & Thompson, R. L. (2000). A meta-analysis of response rates in web- or Internet-based surveys. *Education and Psychology Measures, 60*(6), 821–36. https://doi.org/10.1177/00131640021970934

Cook, R. D. (1977). Detection of influential observations in linear regression. *Technometrics, 19*(1), 15-18. https://doi.org/10.2307/1268249

Cook, R. D., & Weisberg, S. (1982). *Residuals and influence in regression.* New York, NY: Chapman and Hall.

Costanzo, M., Archer, D., Aronson, E., & Pettigrew, T. (1986). Energy conservation behavior: The difficult path from information to action. *American Psychologist, 41*, 521–528. https://doi.org/10.1037/0003-066x.41.5.521

Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Upper Saddle River, NJ: Pearson Education.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of theoretical models. *Management Science*, 35, 982-1003. https://doi.org/10.1287/mnsc.35.8.982

Dilaver, Z., & Hunt, L. C. (2011). Industrial electricity demand for Turkey: A structural time series analysis. *Energy Economics,* 33(3), 426-436. https://doi.org/10.1016/j.eneco.2010.10.001

Dixon, R. K., McGowan, E., Onysko, G., & Scheer, R. M. (2010). U. S. energy conservation and efficiency policies: Challenges and opportunities. *Energy Policy, 38*, 6398– 6408. https://doi.org/10.1016/j.enpol.2010.01.038

Doris, E., Kreycik, C., & Young, K. (2009). *Policy overview and options for maximizing the role of policy in geothermal electricity development*. Golden, CO: National Renewable Energy Laboratory.

de Leeuw, A., Valois, P., Ajzen, I., & Schmidt, P. (2015). Using the theory of planned behavior to identify key belief underlying pro-environmental behavior in high-school students: Implications for educational interventions. *Journal of Environmental Psychology, 42*, 128-138. https://doi.org/10.1016/j.jenvp.2015.03.005

Energy Information Administration. (2011). Annual energy outlook 2011. Retrieved from www.eia.gov/forecasts/aeo/

Energy Information Administration. (2010). Average electricity price by state. Retrieved from http://www.eia.doe.gov/electricity/page/at_a_glance/sales_tabs.html

Energy Information Administration. (2015). Drivers of U.S. Household energy consumption, 1980-2009. Retrieved from https://www.eia.gov/analysis/studies/buildings/households/

Energy Information Administration. (2011a). EIA – 2011 International energy outlook (DOE/EIA-0484(2011). Retrieved from http://www.eia.gov/forecasts/ieo/pdf/0484 (2011).pdf.

Energy Information Administration. (2011). International energy outlook 2011. Retrieved from <http://www.eia.gov/forecasts/ieo/pdf/0484(2011).pdf>

Energy Information Administration. (2013). Monthly energy review, DOE/EIA-0384 (2013), Washington, DC. Retrieved from https://www.eia.gov/totalenergy/data/monthly/

Energy Information Administration. (2009). Residential Energy Consumption Survey, DOE/EIA- Forms EIA 457A-G (2005), Washington, DC. Retrieved from https://www.eia.gov/consumption/residential/

Energy Information Administration. (2014). Short-term energy outlook, December 2014, Washington, DC. Retrieved from https://www.eia.gov/outlooks/steo/report/

Engel, D., & Kammen, D. M. (2009). *Green jobs and the clean energy economy.* Copenhagen Climate Council –Thought Leadership Series Report #8 (Copenhagen, Denmark). Retrieved from http://climatechange.ca.gov/eaac/documents/member_materials/Engel_and_Kammen_Green_Jobs_and_the_Clean_Energy_Economy.pdf

Evans, J. D. (1996). *Straightforward statistics for the behavioral sciences.* Pacific Grove, CA: Brooks and Cole Publishing.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). Thousand Oaks, CA: Sage Publications.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intent, and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Fishbein, M., & Cappella, J. N. (2006). The role of theory in developing effective health communications. *Journal of Communication, 56,* S1-S17. https://doi.org/10.1111/j.1460-2466.2006.00280.x

Fowler, F. J. (1999). *Survey research methods. Applied social research methods series* (4th Ed.). http://dx.doi.org/10.4135/9781452230184

Fowler, F. J. (2002). *Survey research methods* (3rd ed.). Thousand Oaks, CA: Sage.

Francis, J. F., Eccles, M. P., Johnston, M., Walker, A., Grimshaw, J., Foy,…Bonetti, D. (2004). *Constructing questionnaires based on the theory of planned behavior: A manual for health services researchers.* Newcastle upon Tyne: UK Centre for Health Services Research, University of Newcastle.

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth.

Fraser, R., Ajzen, I., Johnson, K., Hebert, J., & Chan, F. (2011). Understanding employers' hiring intent in relation to qualified workers with disabilities. *Journal of Vocational Rehabilitation, 35*(1), 1-11. https://doi.org/10.1007/s10926-009-9220-1

Frederiks, E. R., Stenner, K., & Hobman, E. V. (2015a). The sociodemographic and psychological predictors of residential energy consumption: A comprehensive review. *Energies, 8*, 573-609. doi:10.3436/en8010573

Frederiks, E. R., Stenner, K., & Hobman, E. V. (2015b). Household energy use: Applying behavioral economics to understand consumer decision-making and behavior. *Renewable and Sustainable Energy Reviews Energy Reviews, 41*, 1385–1394. https://doi.org/10.1016/j.rser.2014.09.026

Gatersleben, B., Steg, L., & Vlek, C. (2002). Measurement and determinants of environmentally significant consumer behavior. *Environment and Behavior, 34*, 335–362. https://doi.org/10.1177/0013916502034003004

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th ed.). Boston, MA: Allyn & Bacon.

Gillingham, K., Newell, R., & Palmer, K. (2009). Energy efficiency economics and policy. *Annual Review of Resource Economics, 1,* 597-619. Retrieved from http://www.annualreviews.org/journal/resource

Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications in health-related behavior. *American Journal of Health Promotion*, *11*, 87 98. https://doi.org/10.4278/0890-1171-11.2.87

Gram-Hannsen, K. (2014). New needs for better understanding of household's energy consumption behavior, lifestyle or practices? *Danish Building Research Institute, Aalborg University, Denmark: Architectural Engineering and Design Management, 10*(1–2), 91–107. http://dx.doi.org/10.1080/17452007.2013.837251

Greaves, M., Zibarras, L. D., & Stride, C. (2013). Using the theory of planned behavior to explore environmental behavioral intent in the workplace. *Journal of Environmental Psychology, 34*, 109-120. https://doi.org/10.1016/j.jenvp.2013.02.003

Green, D. P., & Shapiro, I. (1996). *Pathologies of rational choice theory: A critique of applications in political science*. New Haven, CT: Yale University Press.

Groves, R. M. (1989). *Survey errors and survey costs*. New York, NY: Wiley and Sons.

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on attitude-behavior relationships: A natural experiment with curbside recycling. *Environment and Behavior, 27*, 699–718. https://doi.org/10.1177/0013916595275005

Guerra, S. O., Itard, L., & Visscher, H. (2009). The effect of occupancy and building characteristics on energy use for space and water heating in Dutch residential stock. *Energy Build, 41*, 1223–32. https://doi.org/10.1016/j.enbuild.2009.07.002

Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). A meta-analytic review of the theories of reasoned action and the theory of planned behavior in physical activity: Predictive validity and contribution of additional variables.

Journal of Sport and Exercise Psychology, 24(1), 3-32. https://doi.org/10.1123/jsep.24.1.3

Hargreaves, T. (2011). Practicing behavior change: Applying social practice theory to pro-environmental behavior change. *Journal of Consumer Culture, 11*(1), 79–99. Retrieved from http://journals.sagepub.com/home/joc/

Harland, P., Staats, H., & Wilke, H. A. M. (1999). Explaining pro-environmental intent and behavior by personal norms and the theory of planned behavior. *Journal of Applied Social Psychology, 29*, 2505–2528. Retrieved from http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1559-1816

Hartwick, J., & Barki, H. (1994). Explaining the role of user participation in information system use. *Management Science*, *40*(4), 440-465. https://doi.org/10.1287/mnsc.40.4.440

Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the theories of reasoned action and planned behavior to exercise behavior: A meta-analysis. *Journal of Sport and Exercise Psychology, 19*(1), 36-51. https://doi.org/10.1123/jsep.19.1.36

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education, 18*(2). http://dx.doi.org/10.1080/00958964.1987.9943482

Holloway, D., & Bunker, R. (2006). Planning, housing and energy use. *A Review of Urban Policy and Research, 24*(1), 115-126. Retrieved from http://www.tandfonline.com/loi/cupr20

Huber, G. P., & Power, D. J. (1985). Retrospective reports of strategic level managers: Guidelines for increasing their accuracy. *Strategic Management Journal, 6*, 171-180. https://doi.org/10.1002/smj.4250060206

Huebner, G. M., Hamilton, I., Chalabi, Z., Shipworth, D., & Oreszczyn, T. (2015). Explaining domestic energy consumption – The comparative contribution of building factors, sociodemographic factors, behavior and attitudes. *Applied Energy, 159*, 589-600. https://doi.org/10.1016/j.apenergy.2015.09.028

Intergovernmental Panel on Climate Change. (2014). *Climate change 2014: Synthesis report*. *Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland.

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior. *Journal of Applied Social Psychology, 35*, 2150-2170. https://doi.org/10.1111/j.1559-1816.2005.tb02213.x

Kavousian, A., Rajagopal, R., & Fischer, M. (2013). *Determinants of residential electricity consumption: Using smart meter data to examine the effect of climate, building characteristics, appliance stock, and occupants' behavior*. Stanford, CA: Elsevier Ltd.

Kemp, R. J. (2015). *Household energy consumption in the United States, 1987-2009: Socio-economic status, demographic composition, and energy service profiles*. (Unpublished doctoral dissertation). Retrieved from ProQuest (UMI 2015.3704738)

Kennedy, C., J., Steinberger, B., Gasson, T., Hillman, M., Havránek, D., Pataki, A.,… Villalba Mendez, G. (2009a). Methodology for inventorying greenhouse gas emissions from global cities. *Energy Policy, 38*(9), 4828-4837. https://doi.org/10.1016/j.enpol.2009.08.050

Kennedy, C., J. Steinberger, B. Gasson, T. Hillman, M. Havránek, D. Pataki, A.,… Villalba Mendez, G. (2009b). Greenhouse gas emissions from global cities. *Environmental Science and Technology, 43*(19), 7297-7303. d01:10.1021/es900213p

Klobas, J. E., & Ajzen, I. (2015). Making the decision to have a child. In D. Philipov, A. C. Liefbroer, & J. E. Klobas (Eds). *Reproductive decision-making in a macro-micro perspective* (pp. 41-78). Amsterdam: Springer.

Knabe, A. (2012). Applying Ajzen's theory of planned behavior to a study of online course adoption in public relations education. *Dissertations (2009).* Retrieved from http://epublications.marquette.edu/dissertations/186

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–260. http://dx.doi.org/10.1080/13504620220145401

Koyuncu, N., & Kadilar, C. (2010a). On improvement in estimating population mean in stratified random sampling. *Journal of Applied Statistics, 37*(6), 999-1013. https://doi.org/10.1080/02664760903002675

Koyuncu, N., & Kadilar, C. (2010b). On the family of estimators of population mean in stratified random sampling. *Pakistan Journal of Statistics, 26*(2), 427-443. Retrieved from http://www.pakjs.com/

Krishna, R., Maithreyi, R., & Surapaneni, K. M. (2010). Research bias: A review for medical students. *Journal of Clinical and Diagnostic Research*. Retrieved from http://www.jcdr.net/articles/PDF/677/565-

Lavrakas, P. J. (2008). *Encyclopedia of survey research methods.* http://dx.doi.org/10.4135/9781412963947

Leary, M. R., Toner, K., & Gan, M. (2011). Self, identity, and reactions to distal threats: The case of environmental behavior. *Psychological Studies*, *56*(1), 159-166. https://doi.org/10.1007/s12646-011-0060-7

Lehman, P. K., & Geller, E. S. (2004). Behavior analysis and environmental protection: Accomplishments and potential for more. *Behavior and Social Issues, 13*(1), 13–32. https://doi.org/10.5210/bsi.v13i1.33

Leslie P., Pearce J., Harrap R., & Daniel S. (2012). The application of smart phone technology to economic and environmental analysis of building energy conservation strategies. *International Journal of Sustainable Energy, 31*(5), 295-311. https://doi.org/10.1080/1478646x.2011.578746

Liefbroer, A. C., Klobas, J. E., Philipov, D., & Ajzen, I. (2015). Reproductive decision-making in a macro-micro perspective. *Reproductive Decision-Making in a Macro-Micro Perspective*. 1-15. doi:10.1007/978-94-017-9401-5_1

Lindfield, M. (2010). Cities: A global threat and a missed opportunity for climate change. *Environment and Urbanization Asia, 1*(2), 105-129. doi:10.1177/097542531000100202

Little, R. J. A., & Rubin, D. B. (2002). *Statistical analysis with missing data* (2nd ed.). New York, NY: John Wiley & Sons.

Lovelock, B. (2010). Disability and going green: A comparison of the environmental values and behaviors of persons with and without disability. *Disability and Society, 25*(4), 467-484. https://doi.org/10.1080/09687591003755856

Lubell, M., Feiock, R. C., & Ramirez, E. (2005). Political institutions and conservation by local governments. *Urban Affairs Review*, *40*(6), 706-729. https://doi.org/10.1177/1078087404274137

Lyon, T. P., & Yin, H. (2010). Why do states adopt renewable portfolio standards? An empirical investigation. *The Energy Journal, 31*(3), 133–157. https://doi.org/10.2139/ssrn.1025513

Mack, P., & McWilliams, T. (2013). Determinants of residential heating and cooling energy consumption. *Issues in Political Economy, 22,* 26-55. Retrieved from http://blogs.elon.edu/ipe/

Macovei, O. I. (2015). Determinants of consumers' pro-environmental behavior toward an integrated model. *Journal of Danubian Studies and Research*, *5*(2), 261-275.

Retrieved from http://www.worldcat.org/title/journal-of-danubian-studies-and-research/oclc/851571339

Maleki, A., & Karimzadeh, S. (2011). A survey of relationship between the environmental attitudes and environmental knowledge and energy consumption behavior among citizens of Urmia, West Azerbaijan, IRAN. *International Journal of Social Sciences and Humanity Studies, 13*(1). Retrieved from http://www.sobiad.org/eJOURNALS/journal_IJSS/index.html

Mancha, R. M., & Yoder, C. Y. (2015). Cultural antecedents of green behavioral intent: An environmental theory of planned behavior. *Journal of Environmental Psychology, 43*, 145-154. https://doi.org/10.1016/j.jenvp.2015.06.005

Mathieson, K. (1991). Predicting user intent: Comparing the technology acceptance model with theory of planned behavior. *Information Systems Research*, *2*, 173-191. https://doi.org/10.1287/isre.2.3.173

Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research: Design and interpretation.* Thousand Oaks, CA: Sage Publications, Inc.

Miller, C. D. (1991) *Handbook of research design and social measurement.* (5 ed.). London, England: Sage Publications Inc.

Miller, K. (2005). *Communications theories: Perspectives, processes, and contexts*. New York, NY: McGraw-Hill.

Moise, D., & Macovei, O. I. (2014). Green events: The new responsibility of the organizations. *Romanian Journal of Marketing, 3,* 35-39. Retrieved from https://www.researchgate.net/journal/1844-6523_Romanian_Journal_of_Marketing

Nair, G., Gustavsson, L., & Mahapatra, K. (2010). Factors influencing energy efficiency investments in existing Swedish residential buildings. *Energy Policy, 38*, 2956-2963. doi:10.1016/j.enpol.2010.01.033

Nathans, L. L., Oswald, F. L., & Nimon, K. (2012). Interpreting multiple linear regression: A guidebook of variable importance. *Practical Assessment, Research & Evaluation, 17*(9). Retrieved from http://pareonline.net/

Northeast Energy Efficiency Partnership. (2017). An overview: Assisting the Northeast/Mid-Atlantic region in reducing total carbon emissions by 80% by 20150. *NEEP Issue Brief- CEAC Working Groups- 7.6.16*

Nunnally, J. C., & Bernstein, I. (1994). Elements of statistical description and estimation. In J. C. Nunnally & I. H. Bernstein (Eds.), *Psychometric theory* (3rd ed.). New York, NY: McGraw Hill.

Organization for Economic Development and Co-operation. (2011). OECD environmental outlook to 2050. Retrieved on from https://www.oecd.org/env/cc/49082173.pdf

Ofori-Boadu, A. N. Y. A. (2012). *The impact of state energy programs and other contextual factors on U.S. buildings energy consumption* (doctoral dissertation). Retrieved from ProQuest. (UMI 3507543)

O'Keefe, L. (2014). A choice experiment survey analysis of public preferences for renewable energy in the United States. *Journal of Environmental and Resource*

Economics at Colby, 1(1), Article 9. Retrieved from http://digitalcommons.colby.edu/jerec/vol01/iss01/9

Osbaldiston, R., & Schott, J. P. (2012). Environmental sustainability and behavioral science: A meta-analysis of pro-environmental behavior experiments. *Environmental Behavior, 44*, 257–299. https://doi.org/10.1177/0013916511402673

Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS* (3rd ed.). New South Wales: Crows West.

Paul, J., Modi, A., & Patel, J. (2016). Predicting green product consumption using theory of planned behavior and reasoned action. *Journal of Retailing and Consumer Services, 29*, 123–134. https://doi.org/10.1016/j.jretconser.2015.11.006

Poortinga, W., Steg, L., & Vlek, C. (2004). Values, environmental concern and environmental behavior: A study into household energy use. *Environment and Behavior, 36*, 70–93. https://doi.org/10.1177/0013916503251466

Pothitou, M., Athanasios, K., Liz, V., & Sai G. (2014). A framework for targeting household energy savings through habitual behavioral change. *International Journal of Sustainable Energy*, *35*(7), 1-15. https://doi.org/10.1080/14786451.2014.936867

Reinecke, J., Schmidt, P., & Ajzen, I. (1997). Birth control versus AIDS prevention: A hierarchical model of condom usage among young people. *Journal of Applied Social Psychology, 27*(9), 743-759. doi: 10.1111/j.1559-1816. 1997.tb00657.x

Regional Greenhouse Gas Initiative. (2017). An initiative of the Northeast and Mid-Atlantic states of the U.S. Retrieved from https://www.rggi.org/

Santin, O. G., Itard, L., & Visscher, H. (2009). The effect of occupancy and building characteristics on energy use for space and water heating in Dutch residential stock. *Energy and Buildings, 41*, 1223–1232. https://doi.org/10.1016/j.enbuild.2009.07.002

Saunders, M., Lewis, P., & Thornhill, A. (2003) *Research methods for B=business student* (3rd ed.). Essex, England: Pearson Education Limited.

Savitz, M. (2009). Expanding opportunities for energy efficiency. Editor's note*. The World Bank.* Retrieved from http://siteresources.worldbank.org/EXTEAPASTAE/Resources/ASTAE-Vietnam-Expanding-OpportunitiesEE-Web.pdf

Schatzki, T. (1996) *Social practices: A Wittgensteinian approach to human activity and the social,* New York, NY: Cambridge University Press.

Schmidt, S., & Weigt, H. (2013). A review of energy consumption from a socio-economic perspective: Reduction through energy efficiency and beyond. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2376169

Schumacker, R. E., & Lomax, R. G. (2010). *A beginner's guide to structural equation modeling* (3rd ed.). New York, NY: Routledge.

Sheppard, B., Hartwick, J., & Warshaw (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modification and future research. *Journal of Consumer Research*, *15*(4), 325-343.

https://doi.org/10.1086/209170

Shrimali, G., & Kniefel, J. (2011). Are government policies effective in promoting the deployment of renewable electricity resources? *Energy Policy, 39,* 4726-4741. doi.org/10.1016/j.enpol.2011.06.055

Steel, P., & König, C. J. (2006). Integrating theories of motivation. *Academy of Management Review, 31*(4), 889–913. https://doi.org/10.5465/amr.2006.22527462

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behavior: An integrative review and research agenda. *Journal of Environmental Psychology, 29,* 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004

Steinmetz, H., Knappstein, M., Ajzen, I., Schmidt, P., & Kabst, R. (2016). How effective are behavior change interventions based on the theory of planned behavior? A three-level meta-analysis. *Zeitschrift für Psychology, 224*(3), 216-233. https://doi.org/10.1027/2151-2604/a000255

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*, 407-424. https://doi.org/10.1111/0022-4537.00175

Stern, P. C., & Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues, 50*, 65-84. https://doi.org/10.1111/j.1540-4560.1994.tb02420.x

Stern, P. C., Dietz, T., Abel, R., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*, 81-97. Retrieved from http://humanecologyreview.org/

Sütterlin, B., Brunner, T. A., & Siegrist, M. (2011). Who puts the most energy into energy conservation? A segmentation of energy consumers based on energy-related behavioral characteristics. *Energy Policy, 39*(12), 8137e52. http://dx.doi.org/10.1016/j.enpol.2011.10.008

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. Boston, MA: Allyn and Bacon.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha*. International Journal of Medical Education, 2,* 53-55. http://dx.doi.org/10.5116/ijme.4dfb.8dfd

Taylor, S., & Todd, P. (1995). An integrated model of waste management behavior: A test of household recycling and composting intentions. *Environment and Behavior*, *27*, 603-630. https://doi.org/10.1177/0013916595275001

Taylor, S., & Todd, P. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly, 19*(4), 561-570. https://doi.org/10.2307/249633

Tonglet, M. Phillips, P. S., & Read, A. D. (2004). Using the theory of planned behavior to investigate the determinants of recycling behavior: A case study from Brixworth, UK. *Resources, Conservation and Recycling, 41*,191-214. https://doi.org/10.1016/j.resconrec.2003.11.001

Turner, J. (1989). A theory of social interaction. Social forces: *American Journal of Sociology, 95*(3), 809-811. https://doi.org/10.1086/229357

U.S. Census Bureau. (2012b). Table A-3. Selected measures of personal income dispersion: 1967 to 2010. Retrieved from https://www.census.gov/content/dam/Census/library/publications/2012/demo/p60-

243.pdf

U.S. Census Bureau. (2015). Current population survey, 1968 to 2015 annual social and economic supplements. Retrieved from https://www.census.gov/mp/www/cat/people_and_households/current_population_survey.html

U.S. Department of Energy. (2009a). 2009 Buildings energy data book. Retrieved from http://buildingsdatabook.eren.doe.gov/docs/DataBooks/2009_BEDB_Updated.pdf

U.S. Department of Energy. (2010). Building energy data book 2010. Tech. Rep. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. Retrieved from http://buildingsdatabook.eren.doe.gov/DataBooks.aspx; 2011

U.S. Department of Energy – Energy Efficiency and Renewable Energy. (2010a). Recovery Act and state energy program. Retrieved from http://www1.eere.energy.gov/wip/recovery_act_sep.html

U.S. Environmental Protection Agency. (2006). Annual report: Energy Star and other climate protection partnerships. Retrieved May 30, 2016, from https://www.energystar.gov/ia/news/downloads/annual_report_2006.pdf

U.S. Environmental Protection Agency. (2012). The ENERGY STAR for buildings and manufacturing plants: ENERGY STAR. Retrieved from https://yosemite.epa.gov/opa/admpress.nsf/79c090e81f0578738525781f0043619b/adbc3191da31203c852579ac00536836!OpenDocument

U. S. Environmental Protection Agency. (2016*). Greenhouse gas emissions.* U.S Greenhouse Gas Inventory Report: 1990-2014. Retrieved from https://www.epa.gov/sites/production/files/2016-04/documents/us-ghg-inventory-2016-main-text.pdf

Valenzuela, C., Valencia, A., White, S., Jordan, J. A., Cano, S., Keating, J.,…Potter, L. B. (2014). An analysis of monthly household energy consumption among single-family residences in Texas, 2010. *Energy Policy, 69,* 263–72. https://doi.org/10.1016/j.enpol.2013.12.009

Van Raaij, W. F., & Verhallen, T. M. M. (1983). A behavior model of residential energy use. *Journal of Economic Psychology, 3,* 39-63. Retrieved from https://www.journals.elsevier.com/journal-of-economic-psychology/

Vlek, C., & Steg, L. (2007). Human behavior and environmental sustainability: Problems, driving forces and research topics. *Journal of Social Issues, 63*(1), 1–19. https://doi.org/10.1111/j.1540-4560.2007.00493.x

White, K., & Simpson, B. (2013). When do (and don't) normative appeals influence sustainable consumer behavior? *Journal of Marketing, 77*(2), 78-95. https://doi.org/10.1509/jm.11.0278

Wilson, C., & Dowlatabadi, H. (2007). Models of decision making and residential energy use. *Annual Review of Environment and Resources, 32,* 169–203.doi: 10.1146/annurev.energy.32.054366.141137

World Bank. (2017). Access to electricity (% of population). Retrieved August 17, 2017, from http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

Yin, R. K. (2008). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: SAGE.

Yousafzai, S., Foxall, G., & Pallister, J. (2011). Explaining Internet banking behavior: Theory of reasoned action, theory of planned behavior, or technology acceptance model? Retrieved July 27, 2011, from http://www.cardiff.ac.uk/carbs/faculty/yousafzais/AlhamdAllah.pdf.

Zemore, S. E., & Ajzen, I. (2014). Predicting substance abuse treatment completion using a new scale based on the theory of planned behavior. *Journal of Substance Abuse Treatment, 46*(2), 174-182. https://doi.org/10.1016/j.jsat.2013.06.011

Appendix A: Final Survey Questionnaire

A Study of Homeowners' Behavioral Intentions to Conserve Energy

Please note: To be eligible to participate in this online survey, you must be a homeowner in the Northeast census region of the United States (New England and Mid-Atlantic). Also, eligible participants must have used their dwelling as primary residence for at least the last six months leading to this survey. This study examines attitudes and Intentions of homeowners to engage in a pro-environmental behavior and to conserve energy in their households.

Faced with the challenges of carbon emissions and pollution, energy conservation could be an important option to mitigate the effects of environmental pollution and climate change. Reduced energy consumption may create a positive social impact and frees up homeowners disposable income, which could be invested into pro-environmental factor support programs, increased savings, benefits to consume other essential and highly needed social programs such as sustainable healthcare, education, transportation, and sustainable housing. I'd like to learn more about the reasons why homeowners find the adoption of pro-environmental behaviors challenging; and why is it that some energy consumers believe that the burden of greenhouse gas emissions and environmental pollution should be borne by an entire society and not their personal concern. Only a small sample of homeowners has been randomly selected to participate in this survey. Therefore, your experience and thought on the subject of energy efficiency and conservation are very important. Please help by answering the survey questions to the best of your knowledge and ability. Your participation is absolutely voluntary and your responses will be completely anonymous. The questionnaire should take about 15 – 20 minutes to complete.

I understand that summer is here and you should be getting very busy. I hope you will find time within your very busy schedule to help complete this online survey by August 10, 2017.

If you have any questions or would like further information, please do not hesitate to contact me on (646) 203-3050 or email me at sallieu.jalloh@waldenu.edu. I am grateful for your kindness, and thank you for your generous help in completing this questionnaire to help me with my postgraduate research. By taking part in the survey, you are giving your permission to the researcher to use your anonymous responses for use in research publications and professional use. It will also help to understand the motivations and barriers behind the need to uptake pro-environmental behaviors and to conserve energy at the household level. This survey has been approved by the Walden University Institutional Review Board (IRB).

Thank you for your participation.

Sallieu M. Jalloh, ABD

Graduate Student: Walden University – Public Policy & Administration PhD Program

Instructions for Completing the Survey

There are 36 forced-choice questions in this survey. The questions in this survey use a seven-point rating scale (1-7). Please select the scale number that best describes your opinion about pro-environmental behaviors, based on your intent to conserve energy in your household. Please note, some of the questions and statements may appear to be similar in content, but there are literally subtle differences in context about what is being asked. The answers are on a continuous scale and the middle point (4) is neutral. You do NOT need to have owned a home or have used your dwelling as primary residence for more than a year, prior to this survey, to answer these questions.

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

1. Welcome to My Survey

Thank you for participating in my survey. Your feedback is important

There are 36 questions in this survey and a comment box at the end of the survey. The questions in this survey use a seven-point rating scale (1-7). Please select the scale number that best describes your opinion about pro-environmental behavior and your intent to conserve energy in your household. Most of the answers are on a continuous scale and the middle point (4) is neutral.
To answer these questions, you must be a homeowner in the Northeastern region of the United States. Also, you must have used your house/dwelling as a primary residence for at least six months leading to this survey.

This Survey was Designed by Sallieu M. Jalloh
Walden University
Public Policy & Administration

2017

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

2. *Section 1: Screening Section: Inclusion Criteria for Participation*

By clicking on the "OK" button below indicates that:
(1) You are at least 18 years of age and have voluntarily agreed to participate in this survey.
2. You have read and understood the informed consent and understood the information regarding the academic purpose and intent of this research study.

* 1. In which region of the United States do you live?

- 1. New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)
- 2. Middle Atlantic (New York, New Jersey, Pennsylvania)
- 3. East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin)
- 4. West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)
- 5. South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)
- 6. East South Central (Kentucky, Tennessee, Alabama, Mississippi)
- 7. West South Central (Arkansas, Louisiana, Oklahoma, Texas)
- 8. Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)
- 9. Pacific (Washington, Oregon, California, Alaska, Hawaii)

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

3. Screening Section

* 2. Do you currently own a home?

- Yes
- No

3

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

4. Screening Section

* 3. Do you currently use your home/dwelling as primary residence?

- Yes
- No

4

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

5. Screening Section

* 4. **How long have you used your home/dwelling as a primary residence?**

- ◯ 0 - 6 Months
- ◯ 6 - 12 Months
- ◯ 12 - 18 Months
- ◯ 18 - 24 Months
- ◯ 24 - 36 Months
- ◯ 36 - 48 Months
- ◯ Over 48 Months

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

6. ***Section 2: Measuring Behavioral Intent and Homeowners' Beliefs.***

* 5. ***Intent to Conserve Energy:*** : I intend to conserve energy in my household based on my beliefs, attitude, subjective norm, perceive control, household income, household size, household composition, and education level

Likely: ___1___: _____2____:____3____:____4___:____5____:____6___:___7____: Unlikely

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

* 6. ***Beliefs (Behavioral, Control, & Normative):*** I believe that conserving energy in my household could be

Beneficial: ___1___: _____2____:____3____:____4___:____5____:____6___:___7____: Harmful

- 1- Extremely Beneficial
- 2- Quite Beneficial
- 3- Somewhat Beneficial
- 4- Neither
- 5- Somewhat Harmful
- 6- Quite Harmful
- 7- Extremely Harmful

* 7. ***Behavioral Belief: Behaving in a pro-environmental manner will conserve energy and reduce carbon emissions***

Likely:___1___: _____2____:____3____:____4____:____5___:____6___:___7____:Unlikely

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

* 8. ***Control Belief:*** **Conserving energy and adopting pro-environmental behavior would be appropriate for my household and community**

Likely: ___1___: _____2____:____3____:____4____:____5____:____6___:___7___: Unlikely

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

* 9. ***Normative Belief:*** **Conserving energy will be financially beneficial to my household**

Likely: ___1___: _____2____:____3____:____4____:____5____:____6___:___7___: Unlikely

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

7. ***Section 3: Measuring Behavioral Determinants***

This section is sub-divided into three parts:
Section 3 – Part 1: **For each of the statements in part 1 of this section, please select the answer choice and number scale that most accurately reflects your opinion on how your Attitude toward greenhouse gas emissions and climate change will influence your pro-environmental behavior and intent to conserve energy**

* 10. ***Attitude toward the Act:*** Because of my attitude toward greenhouse gas emissions and climate change, conserving energy would be
Beneficial: ___1___: _____2____:____3____:____4___:____5____:____6___:___7____: Harmful

- 1- Extremely Beneficial
- 2- Quite Beneficial
- 3- Somewhat Beneficial
- 4- Neither
- 5- Somewhat Harmful
- 6- Quite Harmful
- 7- Extremely Harmful

* 11. ***Direct Measure of Attitude:*** **Based on my knowledge of greenhouse gas emissions and climate change, energy conservation or conserving energy would be**

Desirable:___1___:___2____:____3____:____4____:___5____:____6___:___7___:Undesirable

- 1- Extremely Desirable
- 2- Quite Desirable
- 3- Somewhat Desirable
- 4- Neither
- 5- Somewhat Undesirable
- 6- Quite Undesirable
- 7- Extremely Undesirable

* 12. ***Indirect Measure of Attitude:*** **Based on my family's knowledge on greenhouse gas emissions and climate change, conserving energy would be**

Wise: ___1___:___2____:____3____:____4____:____5____:____6___:___7___: Foolish

- 1- Extremely Wise
- 2- Quite Wise
- 3- Somewhat Wise
- 4- Neither
- 5- Somewhat Foolish
- 6- Quite Foolish
- 7- Extremely Foolish

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

8. ***Section 3: Measuring Subjective Social Norm***

Section 3 – Part 2: **For each of the statements in part 2 of this section, please select the answer choice and number scale that most accurately reflects your opinion on how your Subjective Social Norm (social network and significant others) may think of your adoption of pro-environmental behaviors and consequently conserving energy.**

* 13. ***Subjective Social Norm:*** Most people who are important to me think that ________adopt pro-environmental behavior and conserve energy
I should: ___1__: __2__: __3_: __4__: __5_: __6_: __7__: I should not

- 1- I Should Definitely
- 2- I Should Probably
- 3- I Should Somewhat
- 4- Neither
- 5- I Should Probably Not
- 6- I Should Somehow Not
- 7- I Should Definitely Not

* 14. ***INJUNCTIVE:*** **The people in my life whose opinions I value most would ______ of me adopting a pro-environmental behavior to conserve energy:**

Approve: __1___: __2___:___3___:___4___:___5___:___6___:__7___:Disapprove

- 1- Very Much Approve
- 2- Quite Approve
- 3- Somewhat Approve
- 4- Neither
- 5- Somewhat Disapprove
- 6- Quite Disapprove
- 7- Very Much Disapprove

* 15. ***DESCRIPTIVE:*** **Most of my peers and significant others have adopted pro-environmental behavior in the past, or plan to adopt energy conservation behavior**

Completely true: _1_: _2_: _3_: _4_: _5_: _6_: _7_: Completely false

- 1- Completely True
- 2- Quite True
- 3- Somewhat True
- 4- Neither
- 5- Somewhat False
- 6- Quite False
- 7- Completely False

* 16. ***Indirect Measure of Subjective Norm:*** **My significant others (household, family members and friends) think that**

I should: ___1__: ___2__: ___3__: ___4__: ___5__: ___6__: ___7__: I should not
Adopt a pro-environmental behaviors to conserve energy.

- 1- I Should
- 2
- 3
- 4- Neither
- 5
- 6
- 7- I Should Not

* 17. ***Indirect Measure of Subjective Norm:*** **When it comes to using energy efficient appliances, how much do you want to do what your significant others think you should do to save energy?**

Likely:___1___:_____2____:____3____:____4____:____5____:____6___:___7____:Unlikely

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

* 18. ***Indirect Measure of Subjective Norm:*** **When it comes to adopting pro-environmental behaviors and energy conservation, how much do you want to do what your significant others and peers think you should do?**

Very much:___1___:____2____:___3____:___4____:____5____:___6___:___7____:Not at all

- 1- Very Much
- 2- Quite a lot
- 3- To Some Extent
- 4- Neither
- 5- Not Much
- 6- Quite a Little
- 7- Not at All

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

9. ***Section 3: Measuring Perceived Behavioral Control***

Section 3-Part 3: For each of the statements in part 3 of this section, please select the answer choice and number scale that most accurately reflects your opinion about how your Perceived Behavioral Control over pro-environmental will influence your behavioral intention to conserve energy in your household.

* 19. ***Perceived Behavioral Control:*** If I wanted to, I could adopt pro-environmental behaviors and conserve energy

Definitely True: __1__:__2__:__3__:__4__:__5__:__6__:__7__: Definitely False

- 1- Definitely True
- 2- Quite True
- 3- Somewhat True
- 4- Neither
- 5- Somewhat False
- 6- Quite False
- 7- Definitely False

* 20. *Direct Measure of Perceived Behavioral Control (Self Efficacy):* For me, adopting pro-environmental behavior and engaging in energy conservation to reduce carbon emissions would be

Possible: ___1___:___2___:___3___:___4___:___5___:___6___:___7___: Impossible

- 1- Extremely Possible
- 2- Quite Possible
- 3- Somewhat Possible
- 4- Neither
- 5- Somewhat Impossible
- 6- Quite Impossible
- 7- Extremely Impossible

* 21. *Direct Measure of Perceived Behavioral Control (Controllability):* How much control do you believe you have over adopting a pro-environmental behavior in your household?

Complete control: ___1__:__2__:___3__:___4__:___5__:___6__:__7__: No control

- 1- Complete Control
- 2
- 3
- 4- Neither
- 5
- 6
- 7- No Control At All

* 22. *Direct Measure of Perceived Behavioral Control (Controllability):* It is mostly up to me whether or not to adopt a pro-environmental behavior in my household

Strongly Agree: __1__: __2__: __3__: __4__: __5__: __6__: __7__: Strongly Disagree

- 1- Strongly Agree
- 2- Quite Agree
- 3- Somewhat Agree
- 4- Neither
- 5- Somewhat Disagree
- 6- Quite Disagree
- 7- Strongly Disagree

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

10. ***Section 4: Measure of Socio-Demographic Factors***

The following statements solicit your opinion about pro-environmental behaviors and energy conservation. For each of the following statements, please select the answer choice and number scale that most accurately reflects your opinion about how your socio-demographic characteristics may influence your intention to conserve energy:

* 23. ***Personal Income:*** Income is
Likely: ___1___:__2____:____3____:____4____:____5____:____6___:__7___: Unlikely
to influence my ability to adopt a pro-environmental behavior and to conserve energy.

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

* 24. **Based on my personal income, people whose opinion I value most are**
Likely:___1___:_____2____:____3____:____4____:____5____:____6___:___7____:Unlikely
to expect me to adopt a pro-environmental behavior and to conserve energy in my household.

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

* 25. ***Household Size:*** The number of occupants in my household is
Likely: ___1___:_____2____:____3____:____4____:____5____:____6___:___7____: Unlikely
to influence my ability and desire to engage in pro-environmental behavior and to conserve energy.

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

* 26. ***Household Composition:*** The age and gender of occupants in my household are
Likely: ___1___:_____2____:____3____:____4____:____5____:____6___:___7____: Unlikely
to influence my desire to engage in pro-environmental behavior and to conserve energy.

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- Quite Unlikely
- Extremely Unlikely

* 27. ***Education Level:*** To me, education level is
Likely: ___1___:_____2____:____3____:____4____:____5____:____6___:___7____: Unlikely
to influence my desire to engage in pro-environmental behavior and to conserve energy.

- 1- Extremely Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Extremely Unlikely

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

11. Section 5: Miscellaneous Questions

* 28. **In general, pro-environmental behavior is good and I enjoy conserving energy**

Agree:__1__:___2__:__3___:___4___:___5___:___6__:__7___:Disagree

- 1- Strongly Agree
- 2- Quite Agree
- 3- Somewhat Agree
- 4- Neither
- 5- Somewhat Disagree
- 6- Quite Disagree
- 7- Extremely Disagree

* 29. **How does your feeling about environmental pollution and climate change influence your intention to conserve energy?**

Very Much ___1__:____2___:___3___:___4___:___5___:___6__:__7____Not Much

- 1- Concern
- 2- Skeptical
- 3- Unsure
- 4- Indifferent
- 5- Anxious
- 6- Pressured
- 7- Worried

* 30. **If you wanted to use alternative energy sources and energy efficiency appliances, what barriers might prevent you from using one?**

- 1- Not enough income to purchase one
- 2- Number of occupants in my household
- 3- Age of household occupants
- 4- Gender of household occupants
- 5- Education level
- 6- Beliefs I have about greenhouse gas emissions and climate change
- 7- My attitude toward energy conservation and climate change
- 8- My perceived control and capability to use alternative energy and energy efficiency Appliance
- 9- My subjective social norm. That is family, friends, and significant others, and how they perceive my behavioral change and intention to adopt energy conservation.

* 31. **Have you ever used renewable energy sources in your household?**

- 1- Yes
- 2- No
- 3- Don't Know
- 4- Not Sure

* 32. **If you answered YES to question number 30, please select the source of renewable energy you have used**

- 1- Solar
- 2- Wind
- 3- Hydro Power
- 4- Geothermal Energy
- 5- Bio Energy

* 33. **If you answered NO to question number 30, how likely are you to engage in a pro-environmental behavior and adopt energy conservation?**

Likely:___1___:___2___:___3___:___4___:___5___:___6___:___7___:Unlikely

- 1- Very Much Likely
- 2- Quite Likely
- 3- Somewhat Likely
- 4- Neither
- 5- Somewhat Unlikely
- 6- Quite Unlikely
- 7- Very Much Unlikely

* 34. What is your gender?

- Female
- Male

* 35. In what year were you born? (enter 4-digit birth year; for example, 1976)

HOMEOWNERS' BEHAVIORAL INTENT TO CONSERVE ENERGY

12. End of Survey

Thank you for participating in this survey.

If you would like a copy of the final results, please email Sallieu Jalloh at sallieu.jalloh@waldenu.edu. Your answers to this survey will remain anonymous, and your identity will not be linked to your request.

If you are finished completing this survey, please complete the comment box and select DONE at the bottom of the screen.

Please see comment box below (ON NEXT PAGE)
THANK YOU

* 36. Did you feel that the survey took too much time, too little time, or about the right amount of time to be completed?

60.9%

Appendix B: Permission to Use Instrument

Authorization from Icek Ajzen to Use the TPB Survey Instrument


```
Date: Tue, 21 Feb 2017 15:06:42 +0000 (UTC)
From: Alhaji Jalloh <sallieujalloh1@yahoo.com>
Reply-To: Alhaji Jalloh <sallieujalloh1@yahoo.com>
To: "aizen@psych.umass.edu" <aizen@psych.umass.edu>
Message-ID: <895173285.1861725.1487689602866@mail.yahoo.com>
Subject: Re: Ph.D. Dissertation
MIME-Version: 1.0
Content-Type: multipart/alternative;
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References: <895173285.1861725.1487689602866.ref@mail.yahoo.com>
Content-Length: 2328

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Content-Type: text/plain; charset=UTF-8
Content-Transfer-Encoding: quoted-printable

 Good morning Sir,My name is Sallieu Jalloh, a Doctoral candidate at Walden=
 University. I am contacting you to kindly request the use of your theory -=
 theory of planned behavior - and related instrument for my doctoral disser=
tation. I am looking to utilize "the theory of planned behavior"=C2=A0to in=
vestigate primary homeowners' energy consumption and efficiency behaviors i=
n residential building.=20
If you have any questions, please feel free to contact me on my cell: (646)=
 203-3050.
Hopping to hear from you at your earliest convenience. Thank you for your a=
cademic support.=20
Sincerely,Sallieu Jalloh
------=_Part_1861724_1857623153.1487689602864
Content-Type: text/html; charset=UTF-8
Content-Transfer-Encoding: quoted-printable
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>  Good morning Sir,</div><div id=3D"yui_3_16_0_ym19_1_1487688888872_2892">=
My name is Sallieu Jalloh, a Doctoral candidate at Walden University. I am =
contacting you to kindly request the use of your theory - theory of planned=
 behavior - and related instrument for my doctoral dissertation. </div><div=
 id=3D"yui_3_16_0_ym19_1_1487688888872_2929">I am looking to utilize "the t=
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onsumption and efficiency behaviors in residential building. </div><div id=
=3D"yui_3_16_0_ym19_1_1487688888872_3080"><br></div><div id=3D"yui_3_16_0_y=
m19_1_1487688888872_3004">If you have any questions, please feel free to co=
ntact me on my cell: (646) 203-3050.</div><div id=3D"yui_3_16_0_ym19_1_1487=
688888872_3087"><br></div><div id=3D"yui_3_16_0_ym19_1_1487688888872_3088">=
Hopping to hear from you at your earliest convenience. Thank you for your a=
cademic support. </div><div id=3D"yui_3_16_0_ym19_1_1487688888872_3089"><br=
></div><div id=3D"yui_3_16_0_ym19_1_1487688888872_3090">Sincerely,</div><di=
v id=3D"yui_3_16_0_ym19_1_1487688888872_3091">Sallieu Jalloh</div></div></b=
ody></html>
```

Subject:	RE: Ph.D. Dissertation
From:	Icek Aizen (aizen@psych.umass.edu)
To:	sallieujalloh1@yahoo.com;
Date:	Tuesday, February 21, 2017 12:31 PM

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Best regards,

Icek Ajzen

Professor Emeritus

University of Massachusetts – Amherst

http://www.people.umass.edu/aizen

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