FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

BEHIND THE METER AND INTO THE MIND: UNRAVELING THE MULTIDIMENSIONAL BEHAVIORAL AND TECHNOLOGICAL DETERMINANTS OF RESIDENTIAL ELECTRICITY DEMAND CURTAILMENT INTENTION IN THE UNITED STATES OF AMERICA – THE CUSTOMERS' PERSPECTIVE

A dissertation submitted in partial fulfillment of

the requirements for the degree of

DOCTOR OF BUSINESS ADMINISTRATION

by

Gregory Arthur John Desrosiers

2024

To: Dean William G. Hardin III
College of Business

This dissertation, written by Gregory Arthur John Desrosiers, and entitled Behind the Meter and Into the Mind: Unraveling the Multidimensional Behavioral and Technological Determinants of Residential Electricity Demand Curtailment Intention in the United States of America – The Customers' Perspective, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

Hemang Subramanian

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The dissertation of Gregory Arthur John Desrosiers is approved.

Dean William G. Hardin III
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Florida International University, 2024

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DEDICATION

I dedicate this to my wife, Dawna, our two wonderful daughters, Juliette, and Chantelle, and our two rescue dogs, Sweetie, and Biscuit.

Dawna, in the vast tapestry of life, you are the brightest thread that weaves through my every moment, brightening my world with love, joy, and companionship. You are the radiant sun whose boundless energy powers our family through life's journey! With every beat of my heart, I am endlessly grateful for the gift of your presence in my life. As I am about to plant my personal summit flag on the pinnacle of business academia, I am profoundly aware that this assent would have been orders of magnitude more difficult without your unwavering esprit de corps, meditative patience, and encouragement on all things. This triumph is equally yours as it is mine, my love. It is with you that I see the constellations reveal themselves one star at a time. I love you (more than Butter Tarts).

Juliette and Chantelle, *filiaes meae pretiosissimae*, you are like the powerful aurora borealis, radiantly dancing across the canopy of heaven, my two celestial Muses illuminating inspiration in my heart and mind. I dedicate my doctoral dissertation to you both with the hope that it serves as a tangible example of personal sacrifice, perseverance, resilience, and the veiled enlightenment that success comes from incorporating knowledge from past failed attempts. Life is a series of challenges, and it is not about getting everything right, but rather about never giving up, and seeking wisdom from all past failures. In dedicating this dissertation to you, I openly share that I did not get everything right. I made mistakes, had moments of serious frustration and doubt, incorporated those learnings, never gave up, and, in the end, there was newly generated knowledge for all humankind. May my journey inspire you to embrace challenges with courage and determination, knowing that failure is a beautifully disguised teacher, and a steppingstone on the path towards future success! My love for you both is as infinite as future time itself, encompassing my entire being.

Finally, in the solitude of numerous late nights, as the world slept and the stars adorned the sky, Sweetie & Biscuit, you remained steadfast by my side, offering silent companionship and unwavering loyalty. With each gentle nudge and affectionate gaze, you reminded me of the joy found in the simplest moments of life amidst the complexities of scholarly pursuit. Though your contributions may go unrecognized in academic circles, your impact on my journey towards my doctoral degree is immeasurable. For every sleepless night spent in pursuit of knowledge, you were there, offering unconditional love and companionship without expectation or demand. You have been cherished confidants, silent witnesses to the trials and triumphs of academia. Thank you for always being there. Rest assured, you are loved and cherished beyond measure of this pragmatist.

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Having completed my Doctorate in Business Administration, I reflect on my academic journey and the proverb that "A journey of a thousand miles begins with a single step" (Laozi, 1127, 2023, Chapter 64) resonates in my mind. I deeply appreciate all the support and guidance from those who have helped me pursue something that was once only a distant dream but is now a tangible reality.

First and foremost, I would like to thank my parents, Marc and Doreene Desrosiers. At the heart of every forward stride lies the solid ground of home, where your enduring love, wise counsel, and consistent backing have propelled me onward. Mom and Dad, thank you. Mom, those early (forced) lessons on time management (i.e. making me plan and create weekly schedules to prepare for upcoming junior high exams) have been lifelong essential tools that have allowed me to reach this significant scholastic achievement. Dad, you taught me everything you know and, guess what, I'm still s_____! Love you both very much.

I am indebted to the whole team at Smart Grid Ventures LLC and our clients. To be more precise, I acknowledge and express my gratitude for all their unwavering belief in my abilities and their commitment to holding me responsible and accountable, regardless of the prevailing circumstances. As a practitioner-scholar, I derive invaluable insights with our engagements, navigating through real-world business challenges, both significant and nuanced. Managing and expanding a business is an enlightening journey but unattainable in isolation. I am grateful for each of you as guiding lights on this journey, illuminating the path, and making the destination brighter. With much affection, thank you.

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Lastly, I would like to thank those that rejected my PhD application in 2009 at Drexel University. At that time, your program did not have a Doctorate in Business Administration (DBA). I now understand that my pragmatic practitioner-scholar approach to applying scholarly knowledge to actual and existing real-world business problems would not have fit whatsoever with the raison d'être of that PhD program. That rejection allowed me to process, heal, and ultimately overcome and practice what I now espouse to my daughters, and clients alike, regarding learning from past failures. Thank you.

It certainly takes a village to raise a child*,* and I am humbled to be part of this tribe.

ABSTRACT OF THE DISSERTATION

BEHIND THE METER AND INTO THE MIND:

UNRAVELING THE MULTIDIMENSIONAL BEHAVIORAL AND

TECHNOLOGICAL DETERMINANTS OF RESIDENTIAL ELECTRICITY

DEMAND CURTAILMENT INTENTION IN THE UNITED STATES OF AMERICA –

THE CUSTOMERS' PERSPECTIVE

by

Gregory Arthur John Desrosiers

Florida International University, 2024

Miami, Florida

Professor George Marakas, Major Professor

Electric utilities in the U.S. struggle to meet peak demand, especially for utilities with abundant solar or wind energy. They must either increase electricity supply or reduce demand to meet the need. This doctoral research explores the demand reduction aspect. In an industry with low customer-centric engagement, this research asked what factors contribute to U.S. residential electric utility customers intention to voluntarily curtail electricity demand (kW) at their primary residence, limited to early evening peak demand.

A quantitative exploratory methodology was employed by administering a cross-sectional survey design. This research examined 35 hypothesized relationships using the Theory of Interpersonal Behavior and the Theory of Planned Behavior as a theoretical framework. Residential utility customers were the unit of analysis and observation in this 23-construct quantitative study. Following the four-phase methodological rigor demonstrated in Straub (1989), all phases used the researcher developed, self-reported, online survey questionnaire. Online crowdsourcing recruited Phase 3 & 4 participants. To test the effects of three independent variables, eight moderators, four three-way moderators, and five mediators on our intention variable - hierarchical linear regressions were performed on each hypothesized relationship, using 427 geographically diverse participants.

The results revealed 17 significant, 11 non-significant, and 7 untested relationships. We found that increasing customers' Attitude, Subjective Norms, Personal Moral Norms, Perceived Behavioral Control, and Affect contribute to their intention. Increasing these constructs can be effectuated by increasing the individuals' Environmental Awareness and Electricity Savings Knowledge while lowering their Energy Concerns. Considering the moderating role of Personality (two of the five factors) and Habits, strategic and comprehensive campaigns will benefit electric utilities. The resultant model helps readers comprehend the complex interactions between these relationships and emphasizes the pragmatic value of both significant and non-significant findings. Research limitations and future research considerations are included.

Electric utilities are encouraged to experiment with the research findings as a customer-centric early evening peak demand strategy. Utilities have a formidable, yet under-utilized, resource in addressing the growing peak demand challenge – their very customers' hearts and minds.

It's time to get from behind the meter and into the mind!

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3MD	Three-Way Moderation (variable)
ACEEE	American Council for an Energy-Efficient Economy
AFF	Affect (construct)
AMI	Automated Metering Infrastructure
APA	American Psychological Association
App	Application (a software application operating on a smartphone)
ARRA	American Recovery and Reinvestment Act
ATT	Attitude (construct)
AVE	Average Variance Extracted
BRT	Behavioral Reasoning Theory
BTM	Behind the Meter
BTS	Bartlett's Test of Sphericity
CAGE	Cultural, Administrative, Geographic, and Economic framework
CAISO	California Independent System Operator
CCT	Consumer Choice Theory
CMB	Common Method Bias
CMV	Common Method Variance
CV	Control Variable
DGV	Degree of Gamification in Notification (construct)
DNM	Descriptive Norms (construct)
DPN	Degree of Personalization in Notification (construct)

DV	Dependent Variable
ECN	Energy Concern (construct)
EFA	Exploratory Factor Analysis
ESA	Entertainment Software Association
FIs	Feedback Interventions
FIT	Feedback Intervention Theory
FIU	Florida International University
FFM	Five-Factor Model of Personality (the “Big Five”)
FIU	Florida International University
GHG	Greenhouse Gas
HAB	Habits (construct)
HAN	Home Area Networking
HTMT	Heterotrait - Monotrait Ratio
IDV	Independent Variable
IEA	International Energy Agency
IECC	International Energy Conservation Code
INM	Injunctive Norms (construct)
INT	Intention (construct)
IOT	Internet of Things
IOU	Investor-Owned Utility
IRB	Institutional Review Board
KMO	Kaiser-Meyer-Olkin

kW	Kilowatts, a measure of electric power (the rate that energy is used)
kWh	Kilowatt-hours, a measure of energy (1kW sustained for one hour(h))
LPG	Liquified petroleum gas
MED	Mediation (variable)
MOD	Moderation (variable)
Mturk	Amazon Mechanical Turk
NCN	Notification Channel (construct)
NEP	New Ecological Paradigm Scale
NPS	New Policies Scenario
NTC	Need for Thermal Comfort (construct)
OIT	Organismic Integration Theory
PAF	Principal Axis Factoring
PA PUC	Pennsylvania Public Utility Commission
PBC	Perceived Behavioral Control
PMN	Personal Moral Norms (construct)
PPL	PPL Electric Utilities (originally Pennsylvania Power & Light)
RI	Rational Inattention
RIE	Rhode Island Energy
RI PUC	Rhode Island Public Utility Commission
SD	Standard Deviations
SDS	Sustainable Development Scenario
SDT	Self-Determination Theory

SNM	Subjective Norms (construct)
SPSS	Statistical Package for the Social Sciences
TC	Thermal Comfort (construct)
TCC	Thermal Comfort Coolness (construct)
TCW	Thermal Comfort Warmth (construct)
TEDM	Theory of Explanation-Based Decision Making
TIB	Theory of Interpersonal Behavior
TON	Timeliness of Notification (construct)
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
US$	United States dollar ($)
USD	United States dollar ($)
U.S. E.I.A.	U.S. Energy Information Administration
UTAUT	Unified Theory of Acceptance and Use of Technology (2003)
UTAUT2	Unified Theory of Acceptance and Use of Technology (2012)
V2G	Vehicle-to-Grid
VIF	Variance Inflation Factor
W	Watts, a measure of electric power (rate that energy is used; 1 joule/sec)

I. INTRODUCTION

The material below will help ground the challenges and opportunities we face with electricity demand management, energy efficiency programs, and U.S. utilities' adoption and implementations of energy efficiency programs and smart meters.

Problem Statement

Across the United States electric utilities continue to be challenged with meeting Peak Demand on their electric grids. Peak Demand is a term used in the industry that represents <u>a period of time</u> when the customers need for energy (demand) is the highest (peak). These periods of time (or 'episodes') can be in the morning (e.g., in winter when homes are being warmed) or in the afternoon (e.g., in the summer when homes are being cooled.) People are generally using little power during the day but then, over a short period of time, are using much more energy (kids coming home from school, more lights are turned on, washing dishes, watching tv, washing clothes, electric vehicles are being plugged in at home to charge for the next day, et cetera). This requires the utility to meet the demand and ramp up power generation over a short period of time. One key aspect of reliably operating the grid is ensuring adequate available generation during times of peak electricity demand and predicting when a peak is likely to occur during the year. Prediction of demand peaks and valleys is a science that can even take into account solar eclipse impacts on energy production (Penn, 2024; Peters, 2024; Walton, 2024). Currently, most regions in the United States experience peak demand during the summer months, largely driven by space cooling loads (Keskar et al., 2023). However, peak demand can also occur during summer heat waves or during a winter cold wave (NGEMC, 2024). When utilities cannot meet the demand, blackouts can occur. The annual number of major electrical grid failure or "blackout" events in the United States - those with a duration of at least one hour and impacting 50,000 or more utility customers - increased by more than 60% from 2015 through 2019 (Stone et al., 2021). When blackouts occur, there is a possibility of loss of human life. Anderson & Bell (2012) found that mortality increased 122% for accidental deaths, 25% for non-accidental deaths, and 28% overall for all age groups during a blackout event. Heat is already one of the most dangerous type of severe-weather events (Flavelle, 2021), with one report indicating that since 2010 there have been ~12,000 premature deaths annually in the contiguous United States (Shindell et al., 2020) due to heat. Blackouts in the summer are not the only concern. Winter Storm Uri in February 2021 led to 246 deaths in Texas as a result of blackouts (Diaz, 2022; Hellerstedt, 2021).

To reduce the peak demand there are only a couple options in this equation – increase the supply (i.e., make more energy) or decrease the demand (i.e., have customers require less energy over the period of time). Both have their respective challenges to implement. This research is focused on the 'decrease the demand' side of this equation.

Increase Supply – the challenges

Increasing supply to meet the demand sounds simple enough but the reality is that most utilities either need to purchase that energy from other utilities, which is expensive, or build more power plants and fire them up when needed, equally expensive and costs are passed down to customers (Specian et al., 2021, 2023). Adding complexity to the challenge is the increased adoption of solar and other renewable energy sources such as wind power. A recent report from the US Department of Energy (2023) projects that electricity generated from green energy sources increases from 42% in 2022 to 72% - 81% in 2030. This growth is greatest in solar generation (+7-8 times 2022 levels) followed by wind generation (+2-3 times 2022 levels). Solar can, and does, help when the sun is out during those morning periods, however solar does not help in the evening. *The daily patterns of solar generation and energy use can lead to excess supply of unused solar energy at mid-day, followed by a rapid increase in demand from the electric grid in late afternoon and early evening* (Krietemeyer et al., 2021). In 2013, CAISO (California Independent System Operator) published a chart that shows the difference in electricity demand and the amount of solar energy throughout a 24-hour period on one spring day. This chart has become famous in the industry and has been labeled The Duck Curve (CASIO, 2013).

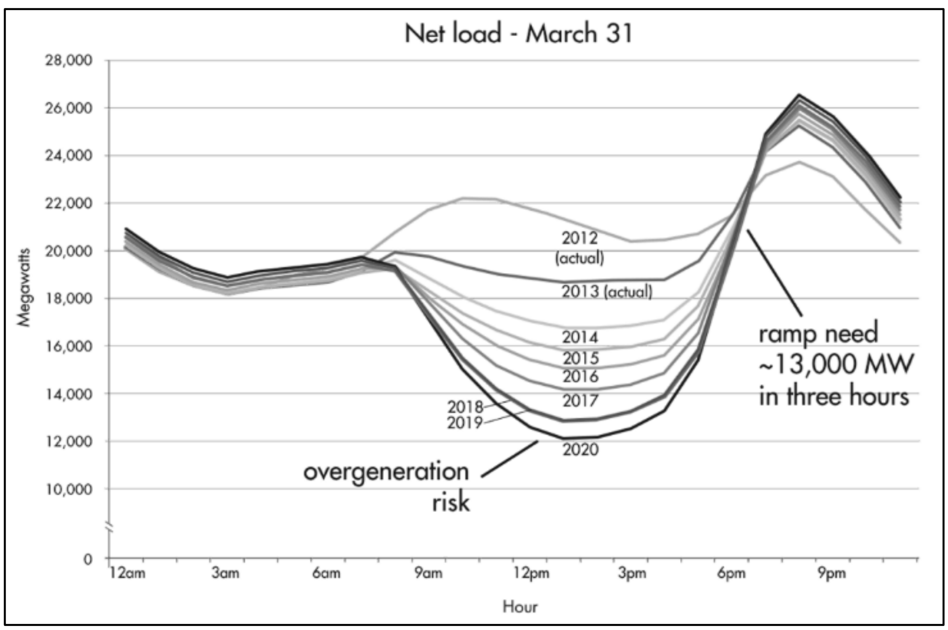

Figure 1: The Duck Curve

The Duck Curve was also, perhaps, *the first major acknowledgement by a system operator that solar energy is no longer a niche technology and that utilities need to plan* *for increasing amounts of solar energy* (U.S. Department of Energy, 2017) and is particularly true for states where solar is now contributing significantly to electricity generation (US E.I.A, 2017). Wind power has a similar challenge especially in the winter when energy from wind power tends to increase in the evenings but tapers off in the morning as the morning peak demand begins (Susser, 2018). While these green energy sources might not be of concern everywhere in the United States, it will play a role as the price point for these technologies make adoption easier for consumers and more of these energy sources come online.

Compounding the issue even more, across the United States the ratio of annual peak-hour electricity demand to average hourly demand has risen over the past 20 years (U.S. E.I.A., 2014). "*This means that utilities are increasingly building and maintaining more capacity to meet peak demand but are, on average, getting less usage from it. Less usage means less kWh sales or revenues to pay for that expensive capacity"* (Tong & Wellinghoff, 2016). Faced with these challenges, many utilities are seeing declining revenues and rising costs and appear to be faced with a choice of raising their electricity rates (potentially discouraging consumption across the board - when Peak Demand is not a problem/challenge) or find other ways to charge customers.

As part of the increase supply (make more energy) aspect to address Peak Demand, the above aspects all compound the problem the utility faces when working to manage Peak Demand in an environmentally and cost-effective manner.

Decrease Demand – the challenges

The other side of the Peak Demand equation, and the focus of this research, would be to reduce the need for electricity specifically over those challenging periods of time. In fact, *utilities across the country are making peak demand reduction a priority by focusing on the user side of the equation* (Susser, 2018). This is not surprising because utilities are more likely to undertake demand response curtailment programs, which do **not** decrease sales (Specian et al., 2023). However, this would require the utility to appeal to their customers to use less energy for those few hours. It's not that the utility doesn't want the customer to use energy – it's when the customers are using energy. "*Behavior change can save energy quickly when people and businesses understand what to do and why*" (IEA, 2022). Without energy efficiency progress since 2000, an additional 12% of energy would have been required globally. This progress has helped prevented 12% more greenhouse gas emissions (*Market Report Series: Energy Efficiency 2018*, 2018). Realizing the

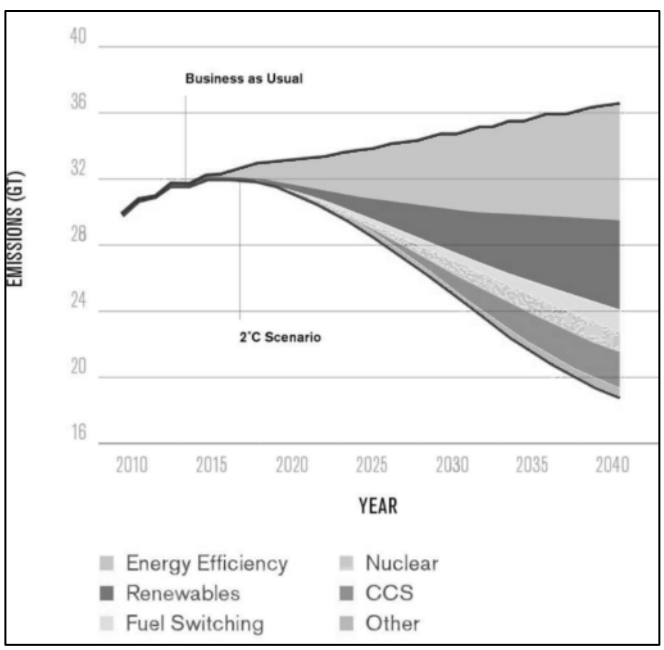

Figure 2: Global Carbon Dioxide Emissions Reduction Potential

existing efficiency potential would deliver huge cuts in energy demand. The energy savings brought about by energy efficiency improvements yield a range of benefits, including lower GHG emissions and air pollution, increased household purchasing power through reduced spending on energy, enhanced energy security through reduced imports and expanded access to modern energy services (*Market Report Series: Energy Efficiency 2018*, 2018). To meet the Paris Agreement targets cost-effectively, the International Energy Agency ("IEA") calls for increases in energy efficiency to drive half (Figure 2) of targeted emissions reductions with renewables and carbon capture and storage driving much of the remainder (*Market Report Series: Energy Efficiency 2018*, 2018).

It's no surprise that *governments and firms around the world have adopted policies and programs to increase energy efficiency and capture these benefits*. *Still, there is a broadly held view that various barriers to the adoption of energy-efficient technologies have prevented the realization of a substantial portion of these benefits* (Gerarden et al., 2017). Existing research shows that the uptake of energy efficiency investments - such as electric vehicles or more energy efficient refrigerators - remains inefficiently low, and that two of the most effective policies to increase adoption in higher income countries are: 1) carbon taxes that internalize negative externalities, and 2) nudges that increase the salience of energy savings (Berkouwer & Dean, 2021; Gerarden et al., 2017). Energy efficiency programs have had an impact, however, still fall well below their potential. "*Peak demand reduction is also an important aspect of utility-sector energy efficiency programs*." (Specian et al., 2023) Spending and savings on electric energy efficiency programs (Figure 3) have been steady but are recently declining (ACEEE, 2022; Specian et al., 2023;

Subramanian et al., 2022) – right when we might need them to help address the customer side of the Peak Demand equation.

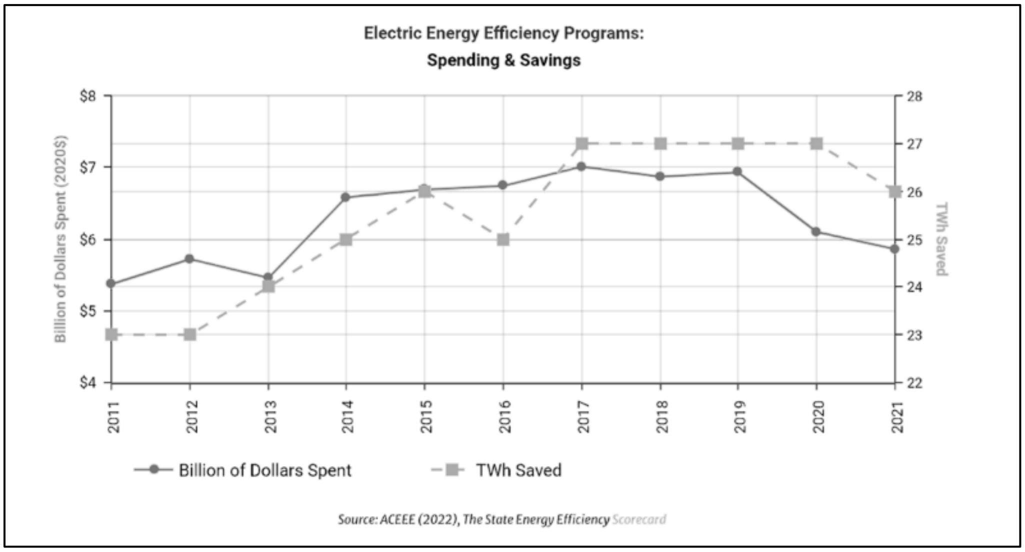

Figure 3: Utility Investments in Energy Efficiency Programs

In the United States, many of the States do not score well in terms of energy efficiency programs (Figure 4). Figure 5 is from the recently released 2023 Utility Energy Efficiency Scorecard report (Specian et al., 2023). Their findings of the United States' largest utilities reveals that total energy efficiency spending, by the utilities scored in both the 2020 and 2023 editions of Utility Scorecard, has dropped 4.9%. "*This decrease in energy efficiency program spending has led to a 5.4% decrease in achieved energy savings and a 19% drop in peak demand reduction achieved. The average (mean) peak demand reduction from energy efficiency was 0.71% of total peak demand, while the median peak demand reduction was 0.55%"* (Specian et al., 2023).

People who do not realize that energy costs and demand are going up will be far less likely to take steps to conserve energy or seek out energy efficiency improvements. ACEEE's 2022 report, for example, calls on utilities to take the lead in expanding efficiency services for low-income customers, while partnering with local community-

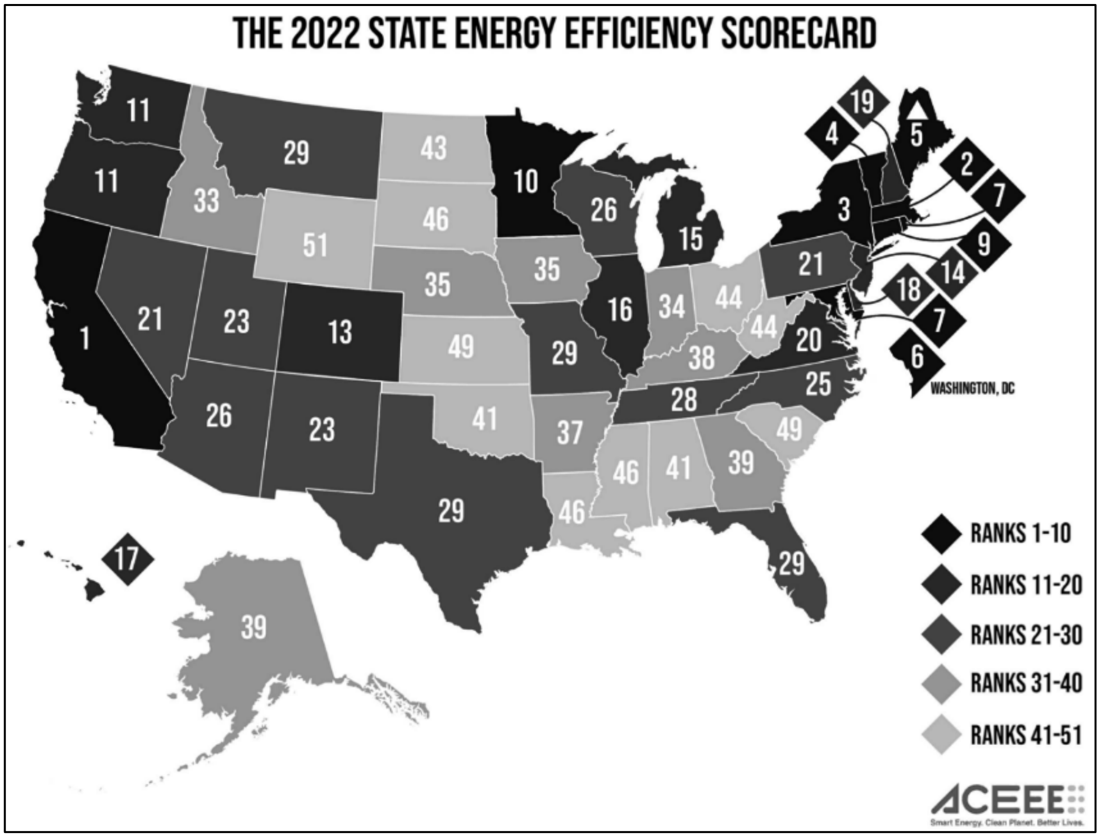

Figure 4: 2022 State Energy Efficiency Scorecard

based organizations to inform their program design. Energy efficiency is a proven low-cost clean energy resource, but Southeastern utilities and regulators continue to underinvest and deprioritize it. Southeast US is among the highest electricity bills in the country and the lowest investment in energy efficiency. North and South Carolina account for 64% of total efficiency savings in the Southeast, despite making up 24% of the region's retail sales. There appears to be a disconnect between what some utilities are saying and what their subsidiaries are doing. Southern Company has publicly committed to being carbon neutral by 2050, but subsidiary Alabama Power has pursued 2 gigawatts of new gas-burning power plants, approximately 20% of its entire generation portfolio, while taking no action on clean distributed energy resources already approved by its Commission. Energy efficiency is

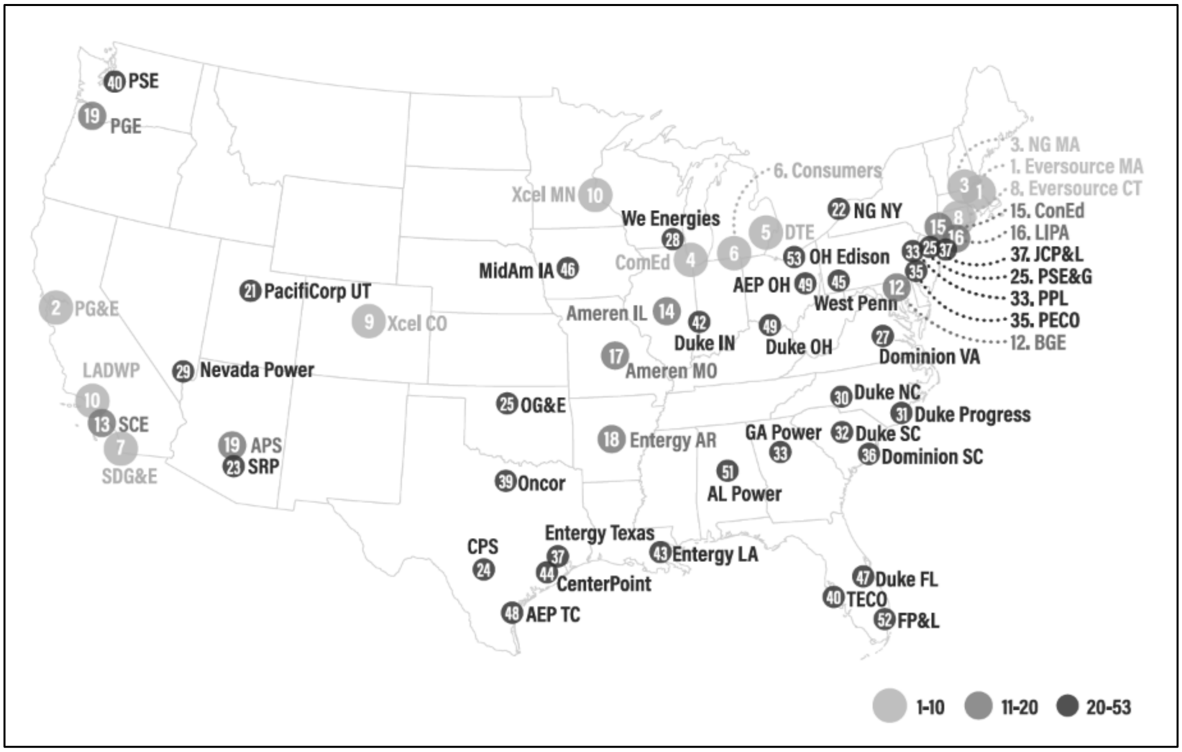

Figure 5: Utility Energy Efficiency Achievement Rankings by Geography

most successful when utilities receive financial incentives for performance. The logic is simple, if utilities save customers money by reducing energy, they get to share in the financial benefits. The Florida legislature authorized utilities to receive performance incentives in 2008, but to date this has not been put into practice.

If the energy efficiency programs, which are designed to educate and help customers use energy to maximize their benefit while reducing their costs, are not being well adopted or implemented is there another vehicle by which the utility can help with their very Peak Demand challenge?

Digital smart meters, that electric utility companies have deployed across the United States, are not being leveraged to their full capacity to help customers understand their energy usage behaviors. By understanding energy usage behaviors, customers can make informed decisions on when to use energy that maximizes their savings while simultaneously aiding the utility in lowering demand on the electric grid during peak periods of time in the day. Mooney (Mooney, 2015a, 2015b) shares that "*smart meters aren't waking Americans up and making them conscious of their energy use - because they aren't being paired with what behavioral research shows us is needed for that to happen*". The number of linked devices with automated controls has increased by about 33%

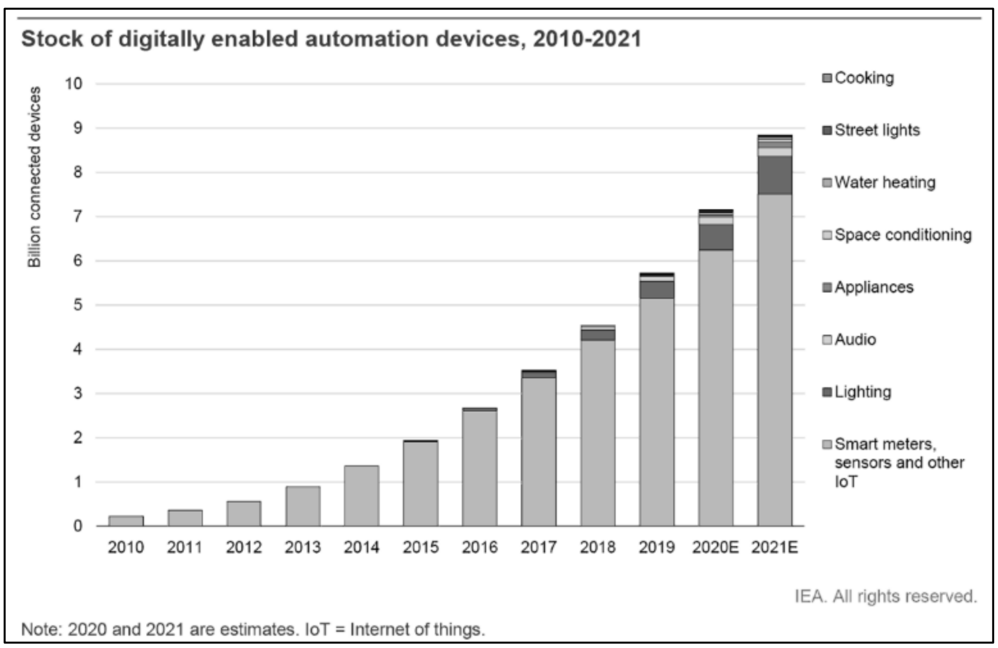

Figure 6: Digitally Enabled Device Growth Over Time

annually over the last five years, from 7 billion in 2016 to 9 billion in 2021 (Figure 6). Smart meter implementation has aided utilities and other energy efficiency-related enterprises in developing new business models. If data access and utilization frameworks are in place, smart meters enable market participants to access meter-based information pertaining to the consumption of electricity in real time or near real time. When linked to a customer's in-home or mobile display (i.e., their smartphone), smart meters can provide users with valuable information and control over energy consumption that can help them reduce energy waste. From an installed base of 1 billion in 2019, smart meter deployment is anticipated to reach almost 1.3 billion by 2025, with an estimated market size of USD 17 billion by that time. Deployment is returning to pre-pandemic levels. "*In 2021 Enel started rolling out 300 000 smart meters in São Paulo and India announced earmarked funding to install 25 million prepaid smart meters between 2021 and 2023. In April 2021 Saudi Arabia completed the installation and replacement of more than 10 million smart meters in less than 13 months"* (IEA, 2021). In the United States deployment and plans to continue the deployment of smart meters continues with several large Investor-Owned Utilities (IOU) starting their deployments, such as National Grid in New York and PPL in Kentucky. Others are in the process of pursuing regulatory approvals such as Rhode Island Energy in Rhode Island.

Figure 7 shows the growth of advanced meters from 2007 through 2018. According to EIA data, over this period, the number of advanced meters in operation has increased almost thirteen-fold in the United States from 6.7 million meters to more than 86.8 million meters. Between 2017 and 2018, approximately 8 million additional advanced meters were installed nationwide, resulting in a 4.5% increase in the advanced meter penetration rate, from 51.9% in 2017 to 56.4% in 2018.

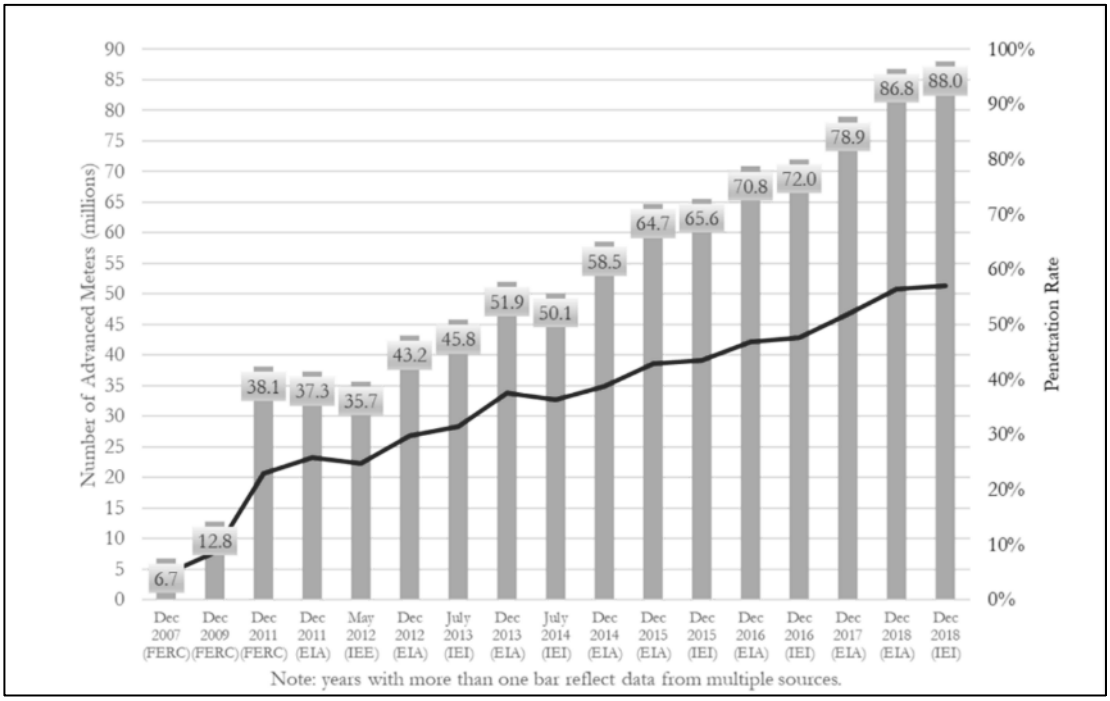

Figure 7: Smart Meter Growth in the United States

Yet, smart meters might not be living up to the customer benefits espoused during many regulatory approvals in the past 15 years. While the innovation, a smart meter, exists and has been adopted by the utilities – the subsequent customer benefits have not received the same adoption. One view is that we are still early in this consumer context of technological diffusion. Utilities also had financial motivations to adopt these new meters when the 2009 American Recovery and Reinvestment Act (ARRA) came about. This allowed many utilities to replace an aged manual meter reading system while benefiting from taxpayer and ratepayer-funded billion-dollar smart meter investments.

According to Trabish (2022), less than 3% of 2009's taxpayer- and ratepayer-funded smart meters now deliver full customer benefits. Almost 17.4 million ARRA-funded smart meters have been deployed by utilities since the 2009 Energy Department funding by 77 representative investor-owned utilities — 89.7% with real-time data access capability — but only 2.9% are "enabled" by utilities. If the customers cannot see the data, how can they be enlisted to help with the Peak Demand problem?

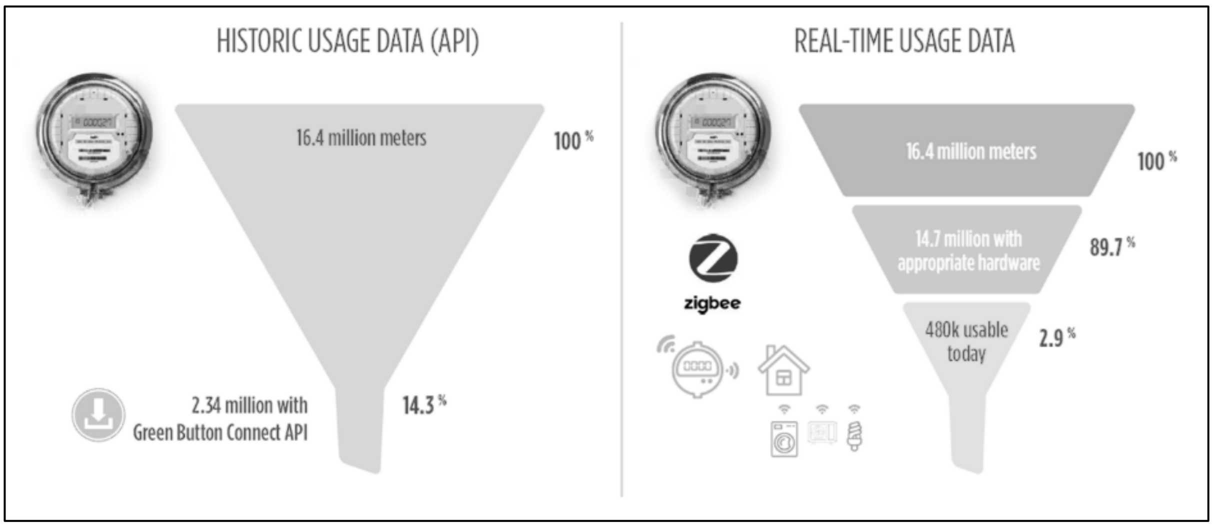

Figure 8: Smart Meters Delivering Real-Time Data to Customers

Utilities desire to provide customers with accurate information, combined with the backend processes and procedures may be part of the challenge to overcome. As an example, provided from Murray and Hawley (2016), the largest solar installation company in the US wanted to provide its clients with online energy management services. It is assumed that customers that install solar panels are surely both fiscally motivated, and possibly more energy-conscious than the typical consumer. The company intended to expand its products to include stand-alone energy efficiency services, such as targeted recommendations and retrofits, in addition to providing their clients with information about their energy usage to help them understand the value of solar panels in which they just invested. In 2014 the company launched their app on the Google Play Store and Apple App Store. Customers' real-time energy use is displayed by the app along with a comparison of their solar production. One might have expected this innovative company to utilize the very smart meters espoused to provide this type of data. California, where this company has many customers, also benefited from widespread adoption of AMI. However, the existing utility's HAN pairing process was found to be so time-consuming that this innovative company now installs their own electric AMI meter – a meter that should be unnecessary and now is simply a redundant piece of equipment on the side of the customer's home.

Another industry process meant to allow customers to share their information with 3rd party companies is called Green Button Connect. The intent was well founded, allowing customers the ability to get and share their data as easily as pressing a button. Green Button Connect, however, requires the utility to offer such a program and the process by which customers can share the data is often that – a process. The value that customers get from being able to share their data, and the granularity of that data, is questionable. Figure 9 provides an example of the type of data that customers get from the Green Button Connect process, which customers can then elect to share between their utility and 3rd parties, versus the type of data that can be transmitted wirelessly and locally to the customer, theoretically bypassing the utility processes if the HAN pairing process wasn't as cumbersome as reported in the California solar installer example.

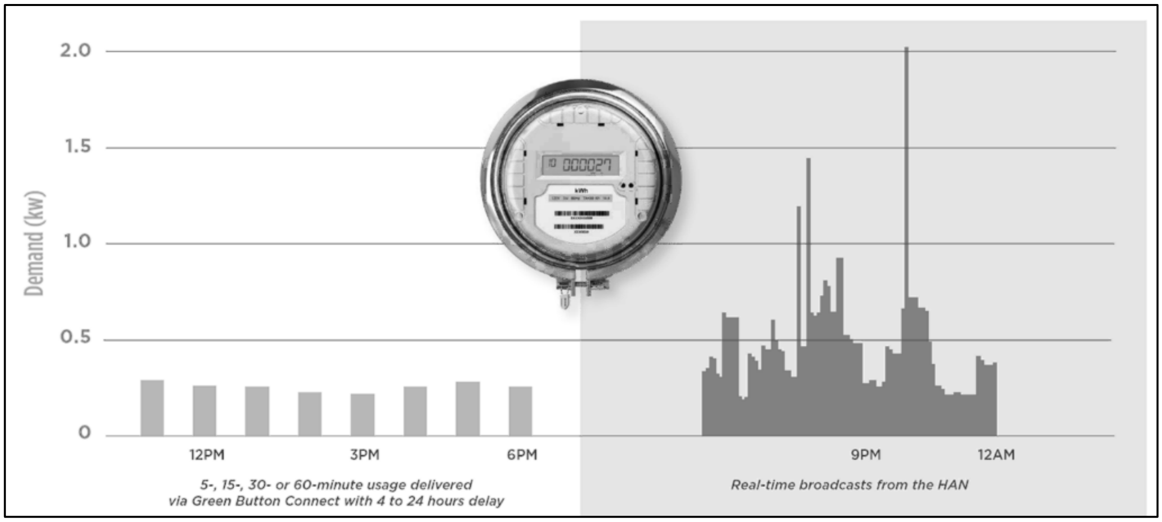

Figure 9: Green Button Connect/Utility versus Real-Time

While many electric utilities do provide a level of 60-minute, 15-minute, or 5-minute granular data on their webpages for customers, this information is often delayed by an hour or more. In some drastic cases, when utilities experience problems with their webpage integrated billing systems, data might not be visible nor available for weeks. As a result, customers cannot see their usage online and receive an estimated bill because of the utility not being able to procedurally and regulatorily validate the consumption information that was transmitted by the meters. This unfortunate series of events recently occurred in Pennsylvania during the last half of December 2022 into the 2nd quarter of 2023 (O'Boyle, 2023; PA PUC, 2023; PPL Electric Utilities, 2023; Priest, 2023; Ward, 2023; Worthington, 2023) and is likely to cost the utility millions in litigation and settlements (Haddock, 2023; Hagen-Frederiksen, 2024; PA PUC, 2024).

However, in the context of this research, Mooney (Mooney, 2015a, 2015b) shares that smart meters aren't waking Americans up and making them conscious of their energy use - because they aren't being paired with what behavioral research shows us is needed for that to happen. Behavior change can save energy quickly when people and businesses understand what to do and why (IEA, 2022). Yet, consumers largely remain rationally inattentive to how much electricity they're using at home. This observation is echoed in Gerarden et al., (2017) where they note potential *behavioral explanations include: inattentiveness and salience issues; myopia or short sightedness; bounded rationality and heuristic decision making; prospect theory and reference-point phenomena; and systematically biased beliefs*. Attari et al., (2010) found that the public's perceptions of energy consumption and associated savings "*underestimated energy use and savings by a factor of 2.8, with small overestimates for low-energy activities and large underestimates for high energy activities*."

In summary, utilities are facing a challenge managing their Peak Demand. This research is focused on the customer perspective, therefore the focus is on the demand reduction aspect of the challenge - not the increase supply aspect of the peak demand challenge. As discussed above, behavior change can save energy demand quickly however:

- Customers are not changing their routine energy use behaviors
- Customers are rationally inattentive to their energy use as a whole
- Utility investments in Energy Efficiency Programs are declining
- Smart Meters, though well deployed, do not appear to be readily and easily providing timely, understandable, and actionable data to customers regarding their energy use behavior

- Backend processes designed to get customers accurate data are slow and, when there are technology problems, might be inaccurate and unavailable for many weeks

Our research will focus on the factors of the first bullet, customer behavior change with respect to their energy use during peak demand time periods.

Theoretical Research Relevance: Contribution to Theory

This proposed research operationalizes aspects of Triandis' Theory of Interpersonal Behavior. Habit, for example, has been an underdeveloped issue that warrants academic and industry attention (Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). Triandis' model is useful in relation to energy behaviors because, it is theorized, much of these energy behaviors deal with habits and routines. Even though Triandis' model has not been as widely used as some of the simpler behavior change models, it is increasingly of interest to researchers who want to "*explore the influence of habitualization on everyday behaviors"* (Bamberg & Schmidt, 2003, p. 269).

This imbalance of increasing energy demand and insufficient energy supply requires more efforts (Z. Wang et al., 2014). Greater knowledge and understanding of precisely what drives energy consumption and conservation in households, alongside when, where, how, why and for whom this occurs, can make a valuable academic contribution. "*The overall success of any tailored intervention to motivate and sustain positive change in consumer behavior can be enhanced by gaining greater knowledge of the specific antecedents (i.e., predictors) of such behavior, as well as by better understanding the underlying explanatory variables (i.e., mediators) and factors that may* *influence the nature, intensity, frequency, and duration of that behavior (i.e., moderators)*" (Frederiks et al., 2015). In the context of the American electric utility customers intention to voluntarily curtail their electricity demand during peak demand events, these various antecedents, mediators, and context specific moderators are at the heart of this study and will contribute to theory.

Additionally, in a regulated monopoly like the electric utility industry, customers have not had a lot of options with which electric company they do business with or how they receive their usage information. Consumers largely remain "rationally inattentive" to how much electricity they're using at home. The information is just too obscure and difficult to obtain - and there are a lot of other ways to spend your day, as well as seemingly easier ways to either save money or, in the context of this research, reduce demand. Recent literature has focused on whether agents perfectly know and comprehend the price of a good (i.e., price "salience"). In many settings they do not. Another setting has garnered less attention: that in which there is uncertainty about non-price attributes (exceptions include Jin and Leslie (2003), Gabaix and Laibson (2006)). A common form of this uncertainty arises in household choice settings, where we consume services, not inputs directly. Advancements in car dashboard displays have increased drivers' knowledge of the gasoline required to travel a mile (Stillwater & Kurani, 2012). But information about the household production function is lacking in other markets, leaving individuals uncertain as to how common actions like watering the lawn or cooling a house by one degree translates into water and electricity usage (Jessoe & Rapson, 2014), savings, and other benefits (e.g., environmental, carbon footprint, et cetera). Despite strong evidence in other decision environments and general theoretical frameworks for analysis, very little is known about the impacts of loss aversion and reference points on energy-efficiency investments (Gerarden et al., 2017) or actions.

Regulatory economics theory advises that anything other than basic, or minimal, customer expenses are an optional expense (a "discretionary" expense) that diminishes the company revenues (Crew & Kleindorfer, 2002). However, if we are to focus on the 'reduce demand' side of the equation for the regulated electric utility, we must invest "in the customer" and not just the power plants. Customers are investing in solar panels which is part of the challenge (see Figure 1: The Duck Curve). This research suggests that investing in the customer is no longer an optional or discretionary expense, in contrast to regulatory economic theory.

In stark contrast to the literature around regulatory economic theory, market-based asset theory in marketing hypothesizes that customers are an asset that increase profits and shareholder value (Srivastava et al., 1998), however the theory does not consider whether, how, or if it works the same in a monopolistic regulated market, such as the electric utilities in the US. In these same competitive customer-centric markets, the positive effect of customer engagement on firm performance has been well documented (E. W. Anderson et al., 2004; E. W. Anderson & Mansi, 2009). Engaging customers is therefore a key goal for firms in such markets (Gruca & Rego, 2005; Morgan & Rego, 2006).

The insights that this research explores contributes to the overall customer behavior intention theories as it pertains to regulated electric industries during critical peak demand periods. This researcher believes that this customer-centric focus during peak demand periods is underserved, and the research will contribute to the shared understanding in this industry. While this research does not propose to measure the overall economic benefits of customers reducing their peak demand, the theoretical contribution towards these two economic theories – regulatory economics and market-based asset – is inferred.

Practical Research Relevance: Contribution to Business

This researcher believes that a formidable, yet under-utilized, resource for the electric utilities is their very customers' hearts and minds. Residential customers are an unexplored and therefore under-tapped avenue to address Peak Demand challenges faced by electric utilities in the United States. If utilities are to try to decrease electricity demand during Peak Demand events, they would benefit from understanding the customer behaviors and, by leveraging the technology they have at their disposal, engage with their customers to a degree hitherto impossible ahead of and during critical points in time (e.g., ahead of predicted peak demands).

"Most regions in the United States experience peak electricity demand during the summer months. Several regions, however, are dual peaking with distinct summer and winter peaks of roughly equal magnitude. Deep decarbonization of our energy system could lead to greater instances of dual or winter peaking power systems across the country. This seasonal shift has important implications for grid operations" (Keskar et al., 2023). *Behavior change can save energy quickly when people and businesses understand what to do and why* (IEA, 2022). Many of the efficiency goals that business has will require collaboration with the customer. Being a natural monopoly, the electric utility industry is not known to be one that has collaborated closely with customers. It's possible this is as a result of the conflicting theoretical guidance with respect to how much customer engagement is beneficial within the electric utility industry, utility managers are unsure

how much to invest in programs as most customers have no alternative supplier choices (Hoffman et al., 2014; PWC, 2015). This research contributes to the business by raising awareness that there are other aspects to customer engagement that are relevant to the electric utility.

One of the main documented complaints is the cumbersome process for getting visibility to the granular and understandable data. This research aids both utilities and meter manufactures by increasing awareness on how they can support consumers' acceptance of smart meter systems by allowing their technologies to provide the best level of data, during critical times, and at the right frequency. Meter makers need to create these technologies carefully for functionality and operational ease. "*Consumption feedback can include comparisons of customized saving plans, forecast scenarios, neighborhood consumption data, and eco-alerts to maintain consumption at desirable levels"* (Alkawsi & Baashar, 2020).

Additionally, with this research focusing on the customer's intention to voluntarily curtail electricity demand, software application developers will begin to understand users' requirements in an overlooked market. Developers will gain an understanding of individual perceptions and customers perceptions within the energy sector. Those in the IoT environment benefit from this research with respect to energy enabled data and notifications facilitated by the smart meter. These factors can inspire developers to design functions and interfaces that are in-line with factors that have 1) a positive relationship towards peak demand reduction and 2) reduce the negative relationship factors.

One of the reasons why it is important to get the attention of the customer regarding their energy use, during a peak demand period of time, is because most people simply don't know how much energy they use. Most residential domestic customers are trapped in the 'direct debit' dilemma - they only receive a monthly or a quarterly bill on their energy use for which payment goes directly from their bank account, hence not even having to open their bills (Brandon & Lewis, 1999; Darby, 2006; Roberts & Baker, 2003). This can lead to little knowledge about how much electricity people use in their homes. If electricity bills are indeed opened, they include information which is not always clearly presented and can be confusing to the customer. Both items can lead to reinforcing their rational inattentiveness towards their energy use.

The practical research benefits to the utility are an increased understanding, during a critical point of time in their operation of the electric grid, of what drives voluntary electricity curtailment intentions of their residential customers along with when, why, how, and to what degree does this matter for which customers.

Research Question

Backed by academic literature, peer-reviewed journal articles, reputable industry literature, and this practitioner-researcher's 25+ years of experience in the utility industry implementing complex end-to-end system integrations, this research was conducted to understand the following:

What are the factors that contribute to U.S. residential electric utility customers intention to voluntarily curtail electricity demand at their primary residence during an electric utility peak demand time period?

Behaviors related to energy conservation are sometimes categorized into curtailment behaviors (i.e., ongoing day-to-day actions to reduce consumption, such as setting thermostats, switching off lights, limiting use of heating/cooling and ventilation systems, etc.) and efficiency behaviors (i.e., once-off actions to save energy, such as investing in home improvements like insulation, solar panels, energy-efficient appliances, new technology, etc.) (Abrahamse et al., 2005; Gardner & Stern, 1996). Though these are closely linked, this research is focused on curtailment behaviors. This research was not about reducing total Electric Energy Usage (kWh) but, instead, was focused on reducing Demand (kW) through voluntary curtailment intentions of residential customers through the factors that may influence the behavior change. It's not that the utility doesn't want the customer to use energy, it's <u>when</u> the customers are using energy. The focus on curtailment makes business sense because utilities are more likely to undertake demand response curtailment programs, because those programs do **not** decrease sales (Specian et al., 2023).

This study was primarily conducted for the benefit of the electric public utility companies within the forty-eight contiguous United States. Even though the customers are the secondary benefactors, the research took the perspective of the residential electric utility customer.

The research question, research methodology, and data analysis approach outlined successfully:

1) Identified the behavioral, contextual, and situational factors associated with customers' intention to voluntarily curtail their electricity demand at their primary residence.

2) Helped determine behavioral, contextual, and situational factors associated with individual and environmental barriers that led to certain customers being unwilling to voluntarily curtail their electricity demand

In addition to the stated objectives, exploring the research question allowed the researcher to explore:

- If the intention to voluntarily curtail electricity demand is different when the facilitating conditions are different:
    - To what degree does the notification channel matter?
    - To what degree does the timeliness, personalization, and inclusion of gamification elements in the notification matter in this context?
    - To what degree do financial incentives shape the customers attitude and control over the curtailment behavior?
- To what degree does the customer's personality have on their intention to voluntarily curtail their electricity demand during a peak demand period?
- Is environmental awareness and electricity savings knowledge a significant aspect of the customers behavior intention in this context?
- Does the opinion of others matter to customers' intention to voluntarily curtail their electricity demand at their residence?

II. LITERATURE REVIEW

Venkatesh et al., (2016) noted "*it is necessary to draw on other theoretical perspectives to identify and examine specific characteristics*" of adoption. Additionally, understanding consumers intentions by applying single model/theory is not enough to understand specific characteristics due to dynamic nature of these models (Naranjo-Zolotov et al., 2019). As a result, many theories and frameworks are synthesized as part of this research, model, and construct justifications. There have been many academic writings that have worked towards understanding why people do the things they do. From the early work of Fishbein and Ajzen, (1977) designed to understand the factors that shape beliefs, attitudes, and intentions to the addition work and rework done by Ajzen (1991) in his development of the Theory of Planned Behavior ("TPB") which, along with others such as Triandis (1977), Sheppard et al., (1988) and Taylor and Todd (1995), helped to show how intention leads to, or is a good predictor, of behavior. Later research helped focus these concepts so that they were fitting within the varying contexts the world provides us to research. Additional theories provide insights as they each view their aspect of behavior from a slightly different lens. The theories that have been synthesized and are touched upon in this section are Rational Choice Theory - Consumer Choice Theory (CCT), Prospect Theory vis-à-vis the Energy Efficiency Gap, Rational Inattention (a blend of Information Theory and Economics), Behavioral Reasoning Theory (BRT), Self-Determination Theory (SDT) & Organismic Integration Theory (OIT), Theory of Planned Behavior, Theory of Interpersonal Behavior, Persuasion Theory & Cognitive Response Theory, and Gamification Theory.

This dissertation studied additional factors that would influence a customer's intention to voluntarily change their electric energy use behavior in an industry where customer-centricity engagement is low. Indeed, there are trust issues between customers and the energy advice that their utilities provide to them (Craig & McCann, 1978; Ester & Winett, 1981; Stern, 1992). A review of the existing literature related to behavior change concepts has been conducted while also gathering context specific examples where academic research has been conducted within the electric utility space. Additionally, articles and studies from non-peer reviewed, but reputable large scale commercial institutions, have been studied when those articles discuss energy demand challenges that face the utility and customer. The synthesis of this information forms the basis from which the research model was developed, and the additional factors added.

Behavioral Change

Rational Choice - Consumer Choice Theory

"Consumer choice theory is a subset of rational choice theory" (Hands, 2010), with a focus on consumer purchase decisions. "*The term "consumer choice theory" will mean the contents of the consumer choice chapter in mainstream microeconomics textbooks; the consumer is assumed to have complete and transitive preferences (and thus could be represented by an ordinal utility function) and chooses the most preferred bundle from the affordable set defined by the standard linear budget constraint. Since the textbook version of consumer choice theory did not stabilize as "the" theory of consumer choice until the late 1940s"* (Hands, 2010). Consumer choice is at the heart of the way that not only economists, but members of the general public, think about how market economies

work. Market economies are based on consumer sovereignty – consumers freely choose the goods that they most prefer (given the constraints they face) – and such free choice is an essential, and moral, difference between market economies and other ways of organizing economic activity (Hands, 2010). Evidence suggests that interest in energy-saving programs is driven by consumers' recognition of their present bias, and that goal setting can be quite effective at reducing energy consumption when goals are achievable. "*Consumers choosing realistic goals persistently save substantially more, achieving savings of nearly 11%, than those choosing very low or unrealistically high goals"* (Harding & Hsiaw, 2014).

In the following research, we explored industry context specific independent variables and moderators to determine if there is any significance towards a consumer's intention to voluntarily curtail their electricity demand, during peak demand period of time, when the goals are achievable, reasonable, and limited to a few hours (i.e., they will still be able to perform the electricity need but at a different time).

Prospect Theory (the Energy Efficiency Gap)

Prospect Theory (Kahneman & Tversky, 1979) at its roots highlights discrepancies between behavior and expected utility theory (Thaler, 1980).

Energy-efficient technologies offer considerable promise for reducing the financial costs and environmental damages associated with energy use, but it has long been observed that these technologies may not be adopted by individuals and firms to the degree that might be justified, even on a purely financial basis (Gerarden et al., 2017). There is a broadly held view that various barriers to the adoption of energy-efficient technologies have prevented the realization of a substantial portion of these benefits. Empirical insights have been formalized in prospect theory and other alternatives to expected utility theory. Yet despite strong evidence in other decision environments and general theoretical frameworks for analysis, very little is known about the impacts of loss aversion (Gerarden et al., 2017).

One could view electric energy demand curtailment as a form of loss – the loss of being able to perform the consumption of energy. Compounding the complexity is the possibility that the loss (using less energy) might result in an increase in thermal discomfort for a period of time (i.e., feeling warmer or cooler depending on the season and curtailment type). In the following research, we explored industry context specific independent variables and moderators, including extrinsic motivation and thermal discomfort, to determine if consumers process these as part of their intention to voluntarily curtail electricity demand during peak demand periods of time.

Rational Inattention

"*In an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.*" (Simon, 1971, pp. 40–41).

Rational inattention (RI) builds on the observation that humans cannot pay full attention to all available information but can choose to pay more attention to what they perceive as more important. Rational inattention blends information theory and economics. The basic idea is to impose a technological constraint on the amount of information a person can process per unit of time and to derive the implications of this assumption on people's behavior (Tutino, 2013). Rational inattention advances the earlier literature on information acquisition by relaxing assumptions of what information can be acquired. It also brings classical economics and behavioral economics closer together (Maćkowiak et al., 2023). A key assumption underpinning central theorems in economics is that agents are fully informed. Yet information is rarely free to decision makers.

Rational inattention can be considered an “as-if model" or a benchmark that applies well in repeated choice situations, or in choices over the long term. In these cases, the individual thinks about their best strategy once, and then applies it many times with little additional effort. Alternatively, it can be a strategy that the individual gradually learned through experience or stumbled upon it due to some evolutionary reasons. It is likely that when it comes to our everyday consumption decisions, we know what information is useful for us to decide well (Maćkowiak, B., et al., 2021). However, this is not the case in the context of energy consumption. Consumers largely remain “rationally inattentive” to how much electricity they're using at home. The information is just too obscure and difficult to obtain — and there are a lot of other ways to spend your day, as well as seemingly easier ways to save money (Mooney, 2015b).

In the following research, we explored if the referenced information obscurity and lack of energy consumption awareness can be overcome via timely, personalized, and gamified notifications regarding curtailment opportunities and electricity demand savings. By understanding if these informational factors moderate the customer's electricity demand behavior, we move closer towards leveraging the data and value that has been potentially missing from the smart meter deployments. *In the case of smart meters, what still seems missing in most cases are user interfaces that relay information from the meter in real time, and translate it into dollars and cents* (Mooney, 2015b).

Behavioral Reasoning Theory

Behavioral Reasoning Theory (BRT) (Westaby, 2005) determines the linkage between beliefs or values, reasons for and against (Westaby & Fishbein, 1996), global motives (attitude, subjective norm and perceived behavioral control), intentions, and user behavior measures. The reasons for and reasons against constructs represent important aspects of BRT. Reasons constitute specific cognitions that individuals use to make decisions with confidence and even explain their intentions or behavior (Westaby, 2002).

In BRT, the beliefs or values and reasons are context-specific, unlike Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB). BRT is built upon TRA, TPB, Theory of Explanation-Based Decision Making (TEDM) (Pennington & Hastie, 1993), and Reasons Theory (Westaby & Fishbein, 1996).

Our research used behavioral sciences to find ways of lowering or shifting electric energy demand through the customers actions. As a result, customers will perform that value judgement for themselves – the reasons for and the reasons against – and we proposed several constructs that are context specific when making an electricity demand curtailment intention decision.

Self-Determination Theory & Organismic Integration Theory

"Self-Determination Theory (SDT) is a theory of human motivation toward active engagement and development in social contexts" (Deci & Ryan, 1985). "*SDT stipulates that individuals have intrinsic and extrinsic motivations, which explain their interaction with the social environment"* (Ryan & Deci, 2000). "*Intrinsic motivation drives individual behavior because of inherent satisfaction, while extrinsic motivation drives individual behavior because of separate rewards"* (Ryan & Deci, 2000). Nicholson (2015) developed "*a theoretical framework for meaningful gamification starting with Self-Determination Theory"*. Organismic Integration Theory (OIT) is a sub-theory of self-determination theory from the field of education created by Deci and Ryan (2004). "*SDT is focused on what drives an individual to make choices without external influence. OIT explores how different types of external motivations can be integrated with the underlying activity into someone's own sense of self. Rather than state that motivations are either internalized or not, OIT presents a continuum based upon how much external control is integrated along with the desire to perform the activity. If there is heavy external control provided with a reward, then aspects of that external control will be internalized as well, while if there is less external control that goes along with the adaptation of an activity, then the activity will be more self-regulated"* (Nicholson, 2012).

In our research, we explored variables such as external motivation as an aspect of facilitating conditions through an extrinsic motivation. A sense of self, noted in OIT, is touched upon as part of the personal moral norms social construct incorporated as a part of both Theory of Planned Behavior and Theory of Interpersonal Behavior.

Theory of Planned Behavior

The theory of planned behavior (TPB), described in Icek Ajzen's (1988) book, with "*only brief summaries of its various aspects"*(Ajzen, 1991, p. 181) covered in the often cited (1991) paper titled The Theory of Planned Behavior, is an extension of the Theory of Reasoned Action (TRA) that he worked on with Fishbein in the mid-70s and early 80s (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1977). Ajzen explains that TPB was designed to help predict and explain human behavior in specific contexts. TPB has been widely used in many different contexts. According to the theory, an individual's Behavior is driven by their Intentions. Those intentions are driven by their Attitude toward the Behavior in question, their Perceived Behavioral Control, and Subjective Norms. Attitude refers to the individual's feelings (but not emotion) to perform the behavior. The more the individual has a positive attitude towards the behavior the greater the intention to perform the behavior. Perceived Behavior Control was added to TPB and plays an important part. While actual behavior control is self-evident, the individual's perception of control and its impact on intentions is of greater psychological interest. The more an individual believes they have control over performing the behavior, the greater their intention to perform that behavior. Items that are part of an individuals Perceived Behavior Control are items that make the individual believe the behavior is either easy or difficult to perform. These things include their knowledge, skills, and, if applicable to the context, their resources such as time or money. Subjective Norms carried over from TRA and are an aspect of socially determined consensual standards commonly called Social Norms. Subjective Norms are akin to Injunctive Norms, also called Prescriptive Norms, and are an individual's perception of what other people important to them think they should do regarding the specific behavior. Individuals tend to comply with the expectations or viewpoints of important people in their lives at that point in time. For example, I don't have an intention to smoke cigarettes because I have a perception that those close to me (my kids, my wife, my close friends) would frown upon me performing the behavior of smoking cigarettes. This is the concept of Subjective/Injunctive Norm; it's the perceived approval of others important to you regarding you performing the behavior. The more an individual believes, or perceives, those close to them would favorably approve of performing the behavior in question, the Theory of Planned Behavior says that the intention to perform the specific behavior increases.

For all its use, Theory of Planned Behavior does have some shortcomings, has been criticized, and there have been several extensions of TPB. Ajzen (2002) even notes "*Notwithstanding the theory's overall success, vexing problems remain.*" Bertoldo & Castro (2016) note that TPB constructs are rational predictors due to being a self-interest theory. In the context of environment behavior it has been suggest that subjective norms alone do not influence intention and action but so does the individuals moral norms towards the behavior (Broman Toft et al., 2014). Interestingly enough, Ajzen (1991, p. 199) notes "*moral issues may take on added salience ..and a measure of perceived moral obligation could add predictive power to the model*." Indeed, personal moral norms have been found to significantly improve TPB's explanatory power with significant effects on intention to perform environmental type behaviors (Botetzagias et al., 2015; Fornara et al., 2016; F. G. Kaiser & Scheuthle, 2003; S. Wang et al., 2016). In a similar vein, Bamberg & Moser (2007) have suggested adding internal attribution, values and emotions, and problem awareness. The last shortcoming we'll note is that there is an important distinction on social influence between injunctive norms, discussed above, and descriptive norms. These are separate sources of motivation (Deutsch & Gerard, 1955; Rivis & Sheeran, 2003) and their distinction as separate constructs have been supported by various factor analysis (Grube et al., 1986; Sheeran & Orbell, 1999; K. M. White et al., 1994). Descriptive norms are what we perceive those same significant others actually do themselves in regard to the behavior. Rivis & Sheeran (2003) found that by adding the construct of descriptive norms to TPB there was a significant 5% increase in the variance in intentions above the TPB predictors alone. Additional increases in the model's improved explanatory power when descriptive norms was added have been found by others in the context of various environmental behaviors (De Leeuw et al., 2015; Greaves et al., 2013; Manning, 2009).

Theory of Interpersonal Behavior

There is considerable overlap between Triandis' Theory of Interpersonal Behavior (TIB) and the Theory of Planned Behavior. Both have the constructs of Attitude towards the behavior, the influence of Social Norms towards the behavior, and Intention leading to the Behavior being performed. There are, however, several differences. One of the main differences is in the cognitive level that the individual enacts in explaining and predicting performing the behavior. Theory of Planned Behavior's positioning is that the individual's behavior is under the control of the individual's active awareness and consciousness. Triandis suggests that when an individual is performing a behavior that has become a habit, their level of consciousness is less. In other words, as the habit behavior increases the level of consciousness decreases. As a result, TIB includes the construct of habit and defines habit as "*situation-behavior sequences that are or have become automatic, so that they* *occur without self-instruction. The individual is usually not 'conscious' of these sequences as a prediction of behavior*" (Triandis, 1979, p. 204). Triandis has additionally advised that "*when the behavior is institutionalized or routinized - that is when it has a significant habit component – adding this information to the information about behavior intentions greatly increases the predictability of the behavior*" (Triandis, 1977, p. 206).

Another difference between TPB and TIB is that Triandis is unique in that TIB includes an affective measure of attitude towards the intention to perform the behavior. This Affect construct is separate from the Attitude construct found in TPB and other models of behavior such as Behavioral Reasoning Theory. Affect toward a behavior refers to the emotions a person feels at the thought of the behavior (Triandis, 1977, p. 9). As a result, the thought of performing a particular behavior may be associated with either a pleasant stimulation or, the reverse, an unpleasant emotion and reaction of disgust, anxiety, distress, or other unpleasant feeling for the individual. The theory positions that if an individual has a more favorable emotional reaction towards the thought of performing the behavior, the higher the intention is towards performing the behavior.

Another difference between TIB and TPB is the consideration of facilitating conditions. TPB indirectly incorporates facilitating conditions and does not call out what encapsulates them. With respect to TPB's facilitating conditions "*the subjective perception of these factors influences the performance of behavior in a direct way as a subjective representation of the actual degree of objective behavioral control and in an indirect way via its effect on the intention building process*" (Bamberg & Schmidt, 2003, p. 269). Triandis explains that within TIB facilitating conditions include an individual's 1) ability to perform the behavior, 2) level of arousal with respect to the act, 3) the difficulty of performing the behavior, 4) their knowledge on how to perform the behavior or act, and 5) any environmental factors that increase the probability of performing the behavior or act (Triandis, 1977, p. 195). Per Bamberg & Schmidt (2003) and the Probability of the Act Equation provided by Triandis (1977, p. 9), facilitating factors in TIB should be considered as moderators between intention, habit, and behavior. However, Triandis notes that "*while this is current thinking, it does not prevent future research from suggesting other ways of conceiving the problem*" (Triandis, 1977, p. 195) of how to best apply facilitating condition components for the respective context.

Lastly, another difference between Theory of Interpersonal Behavior and Theory of Planned Behavior is that TIB does not have the Perceived Behavioral Control construct found in TPB.

Given the overlap between these theories, some researchers have empirically tested and compared them in the contexts of predicting exercise intention (Valois et al., 1988), condom use (Boyd & Wandersman, 1991; Godin et al., 1996), and car use (Bamberg & Schmidt, 2003). In all these merged studies, the predictive power increase was attributed to one or more of the TIB constructs. Bamberg & Schmidt (2003) noted that "*this result confirms the position of Triandis that the subjective norm construct used by the TPB is probably too narrow to reflect all the social factors influencing the intention building process.*" It has been acknowledged that TIB has been used far less than other more parsimonious behavior models. Bamberg & Schmidt (2003, p. 280) additionally point out in their discussion "*if one subsumes the subjective norm and the role beliefs under one broader social factor, the more parsimonious proposition of the TPB is empirically confirmed that attitude toward a behavioral alternative, the perceived behavioral control,* *and the social factor are the three main determinants of the intention building process*." This researcher concurs with this observation within their context of vehicle use by 320 university students in Germany. However, that study's context is different than our research in many regards. There is, however, literary support for a merger of these two very similar theories. As observed by both Jackson (2005) and Martiskainen (2007), when used, Triandis' Theory of Interpersonal Behavior appears to have additional explanatory value over Ajzen's model. Most of the literary criticism towards the Triandis' model is that it "*has not been as widely used in empirical research as it could have been*" (Martiskainen, 2007, p. 25). This dissertation is a step in the direction of more empirical research using TIB.

Persuasion Theory & Cognitive Response Theory

If the intention of communicating a message to an audience is to change attitudes or behaviors, and suggest that they go without something (i.e., air-conditioning or heating) for a period of time, it may take more than a financial incentive to move people to change. There is extensive literature on the art of persuasion that can be traced back to Aristotle's three pillars of rhetoric: 1) Ethos, 2) Pathos, and 3) Logos. Ethos refers to the presenter's ability to be considered a trusted and credible source of information. If the message comes from a trusted source, the audience is more likely to be persuaded. Pathos is the ability of the presenter to appeal to emotions and feelings of the audience. Logos is the ability of the presenter to convince the recipient by using logic and reasoning. As an example, this linear approach suggests that if a customer is exposed to a persuasive message regarding electric energy curtailment to help with fellow energy users in their time of need and prevent deaths; as a result of hearing and understanding this persuasive message from a trusted source, the individual changes their attitude towards curtailment and acts accordingly. Assuming for the moment that this holds true, one of the challenges facing the electric utility is on the Ethos category. There are trust issues between customers and the energy advice that their utilities provide to them (Craig & McCann, 1978; Ester & Winett, 1981; Stern, 1992). Craig & McCann's (1978) classic example is the most telling in that the messaging from the utility, Con Edison, on how to cut air-conditioning, went either "*ignored or mistrusted*" and individuals who received those brochures didn't perform any actions and, therefore, didn't save on their next month's electric bill. However, those that received the exact same brochures with the Public Service Commission saved 7% on their electric bills.

The Aristotelian linear approach, though reasonable, has a few limitations (Petty et al., 2002) and empirical evidence indicates that learning can occur without any change in attitude. Equally, attitude and behavior change can occur without any assimilation of the persuasion message (Greenwald, 1968; Petty & Cacioppo, 1996). In 1968, Greenwald proposed Cognitive Response Theory to overcome some of the shortcomings noted in the Aristotelian Persuasion rhetoric. This model suggests that attitude change is extensively mediated by people's cognitive response to the persuasion message. This places a greater emphasis on the individuals as active participants in the persuasion process. These individuals not only need to think about the message, but their internal processing and thoughts on the message are recalled easier than what the actual message itself was and these determine the extent of influence (Greenwald, 1968; Petty et al., 2002, p. 131). These internal thoughts depend on the history, involvement and context of the individual rather than by simple message learning (Jackson, 2005).

Gamification Theory

Nicholson (2015) developed "*a theoretical framework for meaningful gamification starting with Self-Determination Theory*". "*Evidence suggests that games can encourage positive behavior change. Several studies of individual game mechanics have demonstrated that they significantly influence behavior. Anderson et al., (2013) developed a model of how badges influence behavior that accurately predicted user actions on the question-and-answer website, Stack Overflow*"(Grossberg et al., 2015). "*They found that badges are a powerful motivational tool and that users are willing to put in a significant amount of work to attain them. Another study found that introducing points and a meaningful framework to the simple task of annotating images motivated participants to create a greater number of higher quality annotations*" (Mekler et al., 2013). A third study, a recent review of 24 research papers on gamification, found that "*according to a majority of the reviewed studies, gamification does produce positive effects and benefits*" (Hamari et al., 2014).

As noted by Grossberg et al., (2015), gamified energy efficiency solutions can be as simple as a competition between neighborhoods to save the most energy, or they can be as complex as a social-media-enabled smartphone app linking real-time energy-use data to the fate of imaginary creatures in a virtual world. There are other game design elements that are available to the gamification designer that can bring about an increase in intrinsic motivation. Using game design elements to help build intrinsic motivation and, therefore, meaning in non-game settings is known as meaningful gamification. What they have in common is the appeal of all games as compared to everyday life:

- Clear goals and rule of play, whereas in the real-world goals can be murky and rules selectively applied
- A compelling storyline ("Underdog wins!") compared to the miscellaneous, disconnected activities of everyday life
- Short-term challenging but achievable tasks, whereas real-world challenges are often long-term and insurmountable
- Quick feedback compared to the real world's slow feedback cycles (Gartner Inc., 2011)

Gamification and serious games appear to be of value within the domain of energy consumption, conservation, and efficiency, with varying degrees of evidence of positive influence found for behavior, cognitions, knowledge and learning and the user experience. A common feature across many articles reviewed was the limited amount and quality of empirical evidence, which suggests that "*more rigorous follow-up studies are required to address this gap*" (Johnson et al., 2017). This dissertation is a step in the direction of more empirical research that incorporates gamification.

Theory Synthesis – Factors Affecting Behavior

Changing one's own behavior is difficult. Changing someone else's behavior is even more so. Yet behaviors do change, and academic literature provides frameworks and insights. Literature suggests that individuals can change behaviors via their intentions to change. Behavior change intentions lead to acting upon changing the behavior in question.

These intentions, and ultimate behavior change, are a complex combination of an individual's emotions, unconscious automatic habits, morals, knowledge, skill, environmental factors, level of arousal, intrinsic and extrinsic motivations, and social and normative factors.

Given the above review of behavior change theories, upon review of behavioral change literature, a merge of the Theory of Planned Behavior and Theory of Interpersonal Behavior in this context of voluntary residential electricity curtailment intention appears the most fruitful. Theory of Interpersonal Behavior considers the internal and external factors influencing behavior and additionally includes the complex constructs of affect (feelings engendered) and habit. Energy Consumption behaviors are theorized to be under the unconscious control of habit (Martiskainen, 2007). TPB adds perceived behavior control and, per Ajzen (1991), "*perceived behavioral control is compatible with Bandura's (1977, 1982) concept of perceived self-efficacy*". In our context, understanding how this construct interacts with curtailment behavior intention is of psychological interest. Many of our moderators interact with the relationship between perceived behavior control and intention.

However, these theories simply provide the conceptual foundation and framework. A literature review of context specific constructs is discussed in the below Influencers of Energy Behavior section. However, Influencers of Energy Behavior will be preceded by a foundational baselining and review of Energy Consumption in the United States with a focus on the residential sector variables.

Energy Consumption

Foundational Understandings

It's important to briefly review exactly what Energy Consumption is and what past research has discussed on the topic. Energy Consumption by itself is not a behavior but is a consequence of many behaviors (Becker et al., 1981; Becker & Seligman, 1978). This energy consumption can be characterized as "*the routine accomplishment of what people take to be the 'normal' way of life.*" (Shove, 2004). Due to the aforementioned rational inattentiveness with respect to energy use (Rational Inattention), it was theorized in this research that the information and measurements for energy use are confusing and obscure to many residential consumers. As a result, for greater understanding, this researcher feels an analogy is important to have in our minds as we begin to discuss these behaviors. An analogy that is readily understood by many would be if we consider weight gain akin to energy consumption. The behavior itself is not weight gain but weight gain is a consequence of many different behaviors, or actions, that contribute to weight gain. If we wish to slow, maintain, or reverse weight gain we would need to reduce, or curtail, the behaviors/actions that contribute to that weight gain. Sticking with this analogy, we want to specifically determine what influences individuals to perform those 'weight gain behaviors' between certain periods of time, for example from 8pm till midnight. In this analogy, we are picking this time frame because we recognize that performing these 'weight gain behaviors' during that time contributes to 'weight gain' yet we want to understand to what degree other variables may or may not contribute to the individual performing those 'weight gain behaviors/actions' during that time period. The weight of the individual is the result and is measured in either pounds or kilograms. The 'weight gain behaviors/actions' might be measured in calories consumed as some foods are calorie dense and others are calorie light. As a result, this researcher feels this weight gain analogy is important to have in our minds as we refocus the discussion on Energy Consumption.

As noted, energy consumption is not the behavior but is a consequence of many different energy using behaviors. The residential customer is performing this behavior because they are performing a function, or using a service, that the energy consuming device produces and provides for the individual and their residence. These energy consuming devices require energy to operate and provide to the residential customer the ability to heat or cool the home, provide lighting, provide heat to cook food or boil water, heat water to wash clothing, provide cooling to maintain food longer and possibly create ice cubes, allow for individuals to be entertained by watching television or online programs, allow for WiFi to be broadcast within the home so that other devices can be used, and so forth. The amount of energy that is required for these very services and functions are not readily visible to customers. Figure 10, from Pereira et al., (2022), is an example of data that is not yet readily available to residential customers yet helps illustrate which devices are contributing to demand and at what points in time. For many of these items, the use of these devices and appliances are based on routine and habit (Pierce et al., 2010) in order for individuals to perform routine tasks (Shove, 2003, 2004). Each of these energy consuming devices uses a different degree of energy when in use, some are more intense and therefore each make a different contribution to the energy load, or demand, at that moment in time.

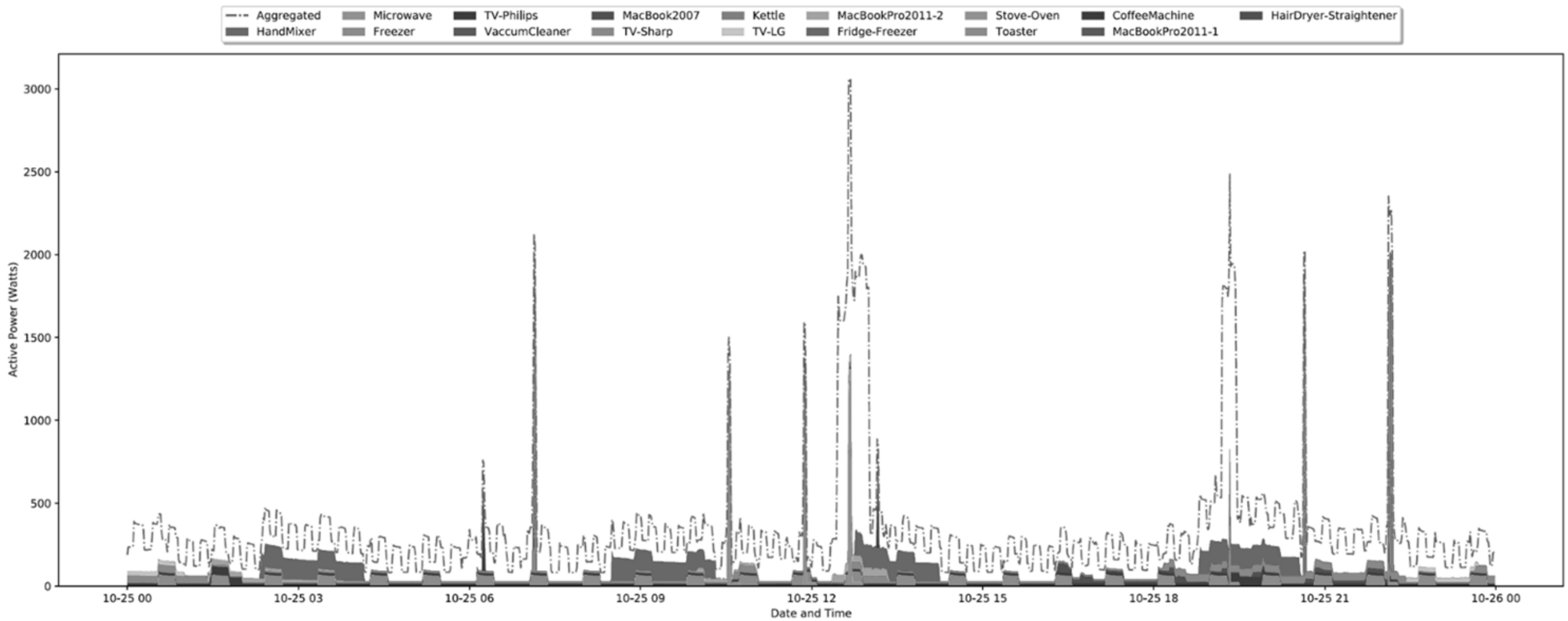

Figure 10: Example of Residential Watts, per device, throughout the day

As discussed in the Problem Statement section, the utility company's ability to meet demand during certain periods of time is challenging at different times of the day and depending on the intensity at that moment, requires more generation to be produced on the grid as a result. Figure 11 (Lakeland Electric, 2023) provides a visual that conveys the concept of demand, as measured in watts (W) or, more commonly due to the practical significance and the volume of electricity used by devices, kilowatts (kW). Watts and

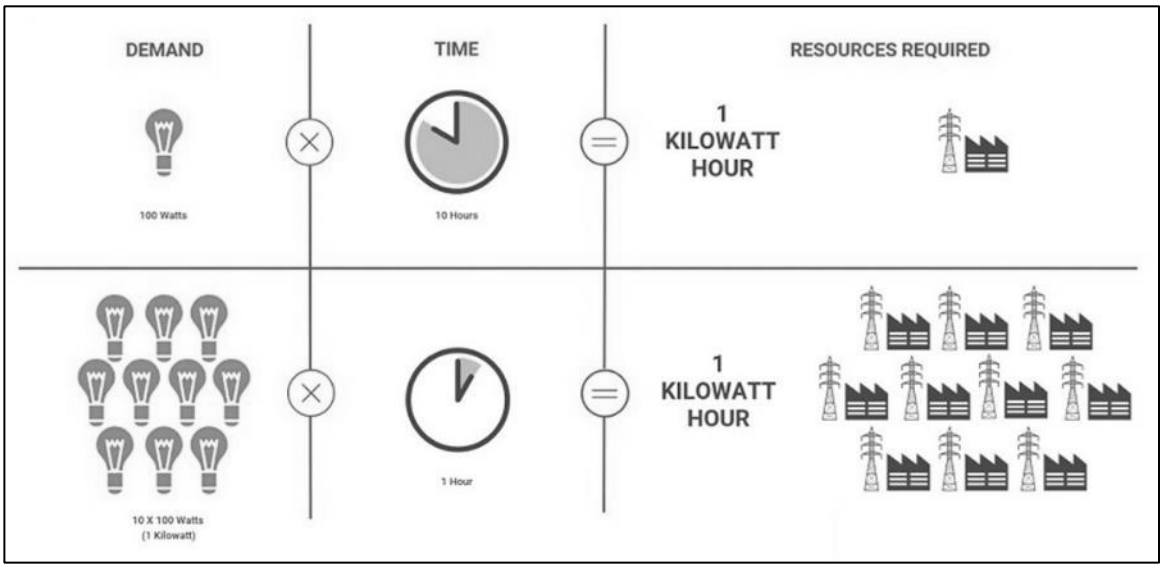

Figure 11: Demand and Energy: Generation resources required for 1 kWh

kilowatts are a measure of power – referencing our analogy, the more kW the more "calorie dense" the object is. In Figure 11, each individual light bulb has the same demand. Depending on how many of them are turned on, and for how long, determines the energy used as measured in Kilowatt-hours (kWh). Energy, kWh, is a composite unit of energy equal to 1kW sustained for one hour. Energy (kWh) and Power (kW) <u>are different</u>. Figure 11 attempts to explain this foundational understanding that power (kW) and energy (kWh) are **<u>not</u>** the same, which typically confuses many customers (Bartusch et al., 2011).

Energy Consumption in the United States of America

Energy Sources in the United States

Electricity is used in almost all homes in the United States, and retail electricity purchases accounted for 43% of total residential sector end-use energy consumption in 2021. Natural gas, which was used in 58% of homes in 2015, accounted for 42% of residential sector end-use energy consumption in 2021. Petroleum was the next most-consumed energy source in the residential sector in 2021, accounting for 8% of total residential sector energy end use. Petroleum includes heating oil, kerosene, and liquefied petroleum gas (LPG), which is mostly propane. Renewable energy sources such as geothermal energy, solar energy, and wood fuels - accounted for about 7% of residential sector energy end use in 2021 (U.S. E.I.A., 2021).

Total Electric Consumption (kWh)

Total U.S. electricity consumption in 2022 was about 4.05 trillion kWh, the highest amount recorded and 14 times greater than electricity use in 1950. Total annual U.S.

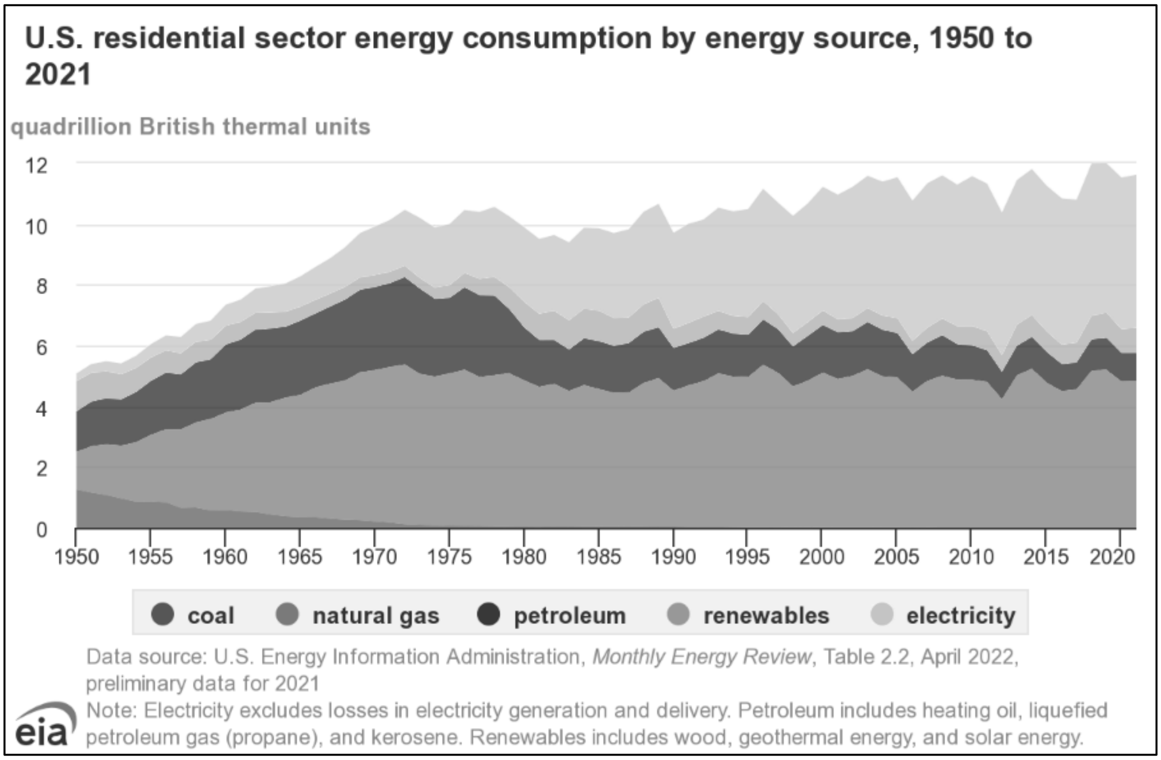

Figure 12: U.S. Residential Energy Consumption by Energy Source

electricity consumption increased in all but 11 years between 1950 and 2022, and 8 of the years with year-over-year decreases occurred after 2007 (U.S. E.I.A., 2023). Of that 4.05 trillion kWh, the Residential Sector represents 37.53% with 1.52 trillion kWh; the Commercial Sector represents 33.83% with 1.37 trillion kWh; the Industrial Sector represents 24.94% with 1.01 trillion kWh; Direct Use, which is the electricity used by the same industrial or commercial facility that has produced the electricity, represents 3.45% at 0.14 trillion kWh - the industrial sector accounts for most of that; and the Transportation

Sector, which is mostly public transit systems, represents the balance 0.25% with 0.01 trillion kWh balance (Figure 13, (U.S. E.I.A., 2023)).

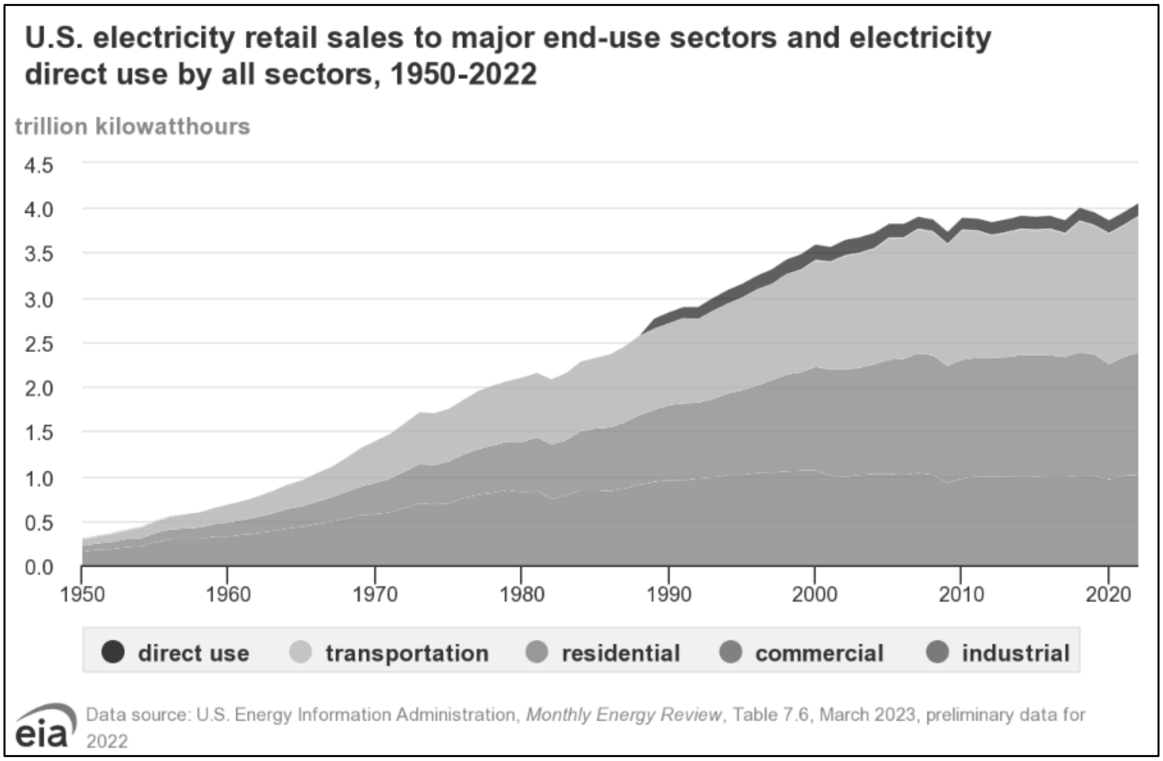

Figure 13: U.S. Electric Sales by Sector (1950 - 2022)

Residential Sector – Electric Consumption

In 2021, the average annual electricity consumption for a U.S. residential utility customer was 10,632 kilowatt-hours (kWh), an average of about 886 kWh per month. Louisiana had the highest annual electricity consumption at 14,302 kWh per residential customer, and Hawaii had the lowest at 6,369 kWh per residential customer (U.S. E.I.A., 2022a, 2022b).

What the U.S. residential sector is using the energy for provides additional insights into the energy consumption services important to individuals at home. Data from 2022 provides an updated view from the 2015 Residential Energy Consumption survey. However, the 2015 Residential Energy Consumption survey provides a more detailed

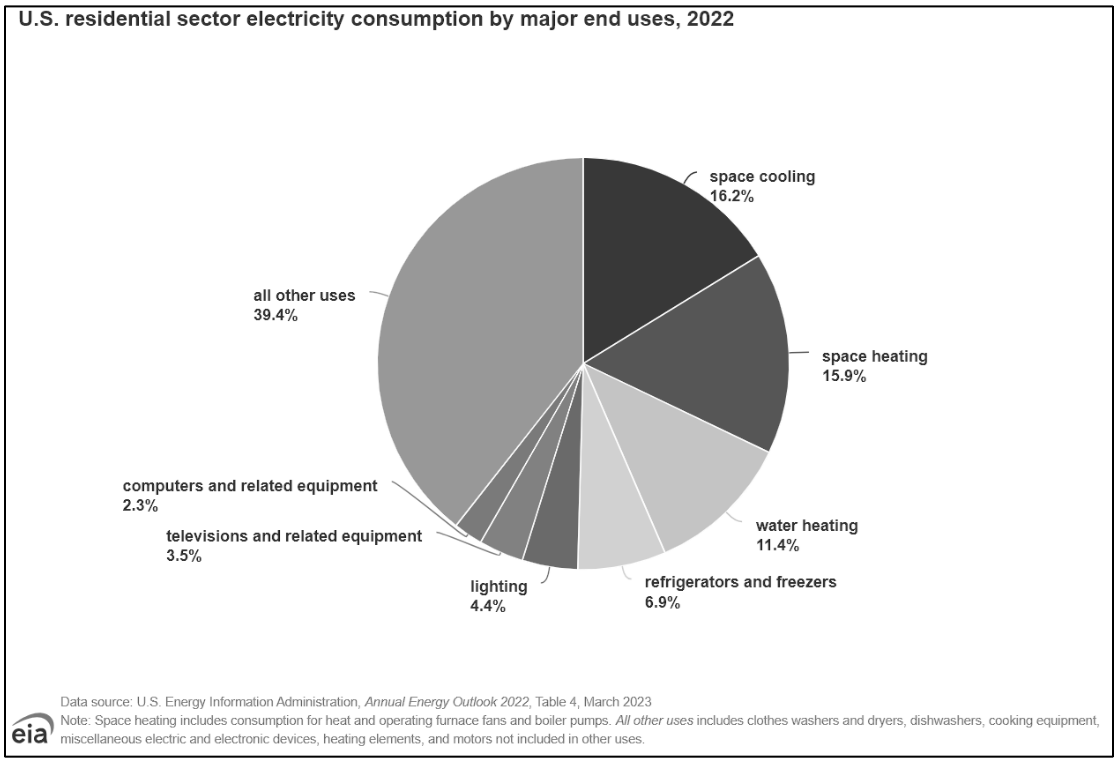

Figure 14: Residential Electricity Consumption by End Use (2022)

breakdown of end use than the 2022 Energy Outlook. The end uses remain in line with space cooling and heating accounting for the majority of energy use, followed by water heating. In 2015, lighting was higher than refrigeration (Figure 15) but in 2022 refrigeration came in after water heating (Figure 14). In 2022, similar to 2015 data, televisions and related equipment follow lighting. Computers and related equipment follow televisions in the 2022 dataset however did not have a call out in 2015. It's possible that the COVID-19 pandemic contributed to the increase in refrigeration (i.e., individuals purchasing and/or using a secondary fridge or freezer for food storage) and work from home policies increase computer and related equipment usage however that determination is outside the scope of this research. Suffice to note, of the main items that residences use electric for, it's practical to consider curtailment for all but refrigeration (i.e., it's impractical to turn off the fridge during a peak demand event but all others could be delayed, reduced, turned/powered off, or unplugged).

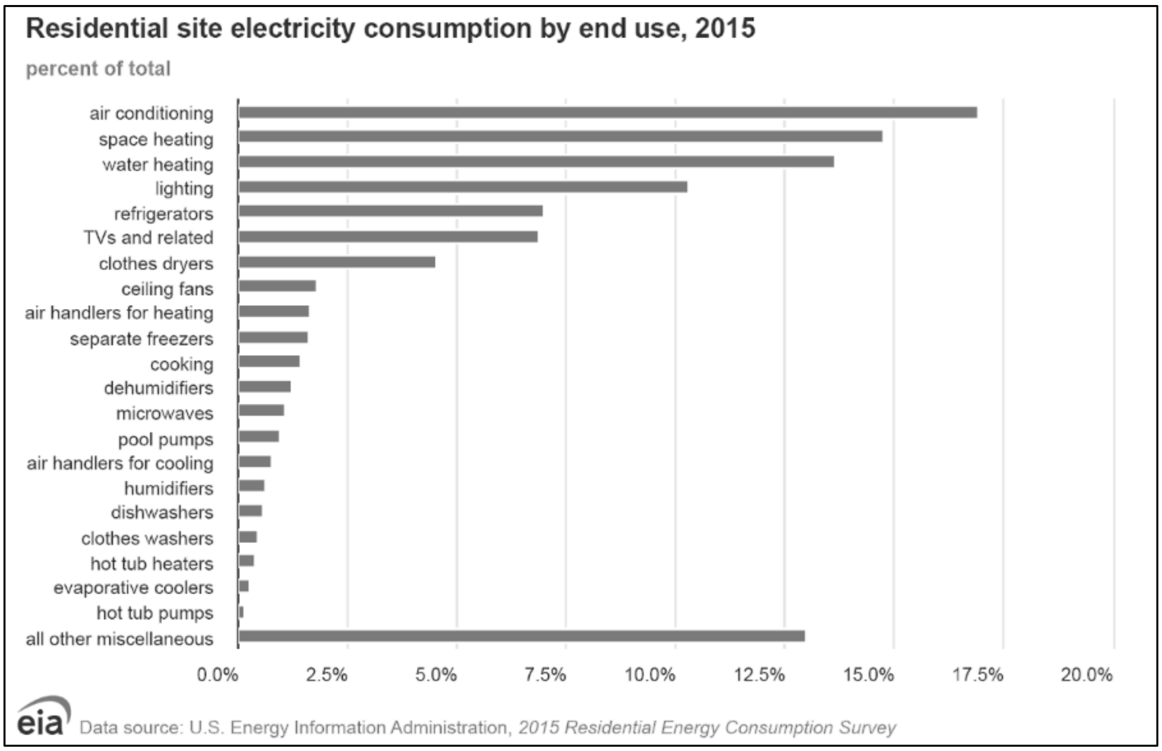

Figure 15: Residential Electricity Consumption by End Use (2015)

U.S. Census Regional and Housing Differences

As noted earlier, the average annual electricity consumption for a U.S. residential utility customer was 10,632 kilowatt-hours (kWh) however there are both geographic and housing type differences in annual electricity consumption across the United States. On average, apartments in the Northeast consume the least amount of electricity annually, while single-family detached homes in the South consume the most.

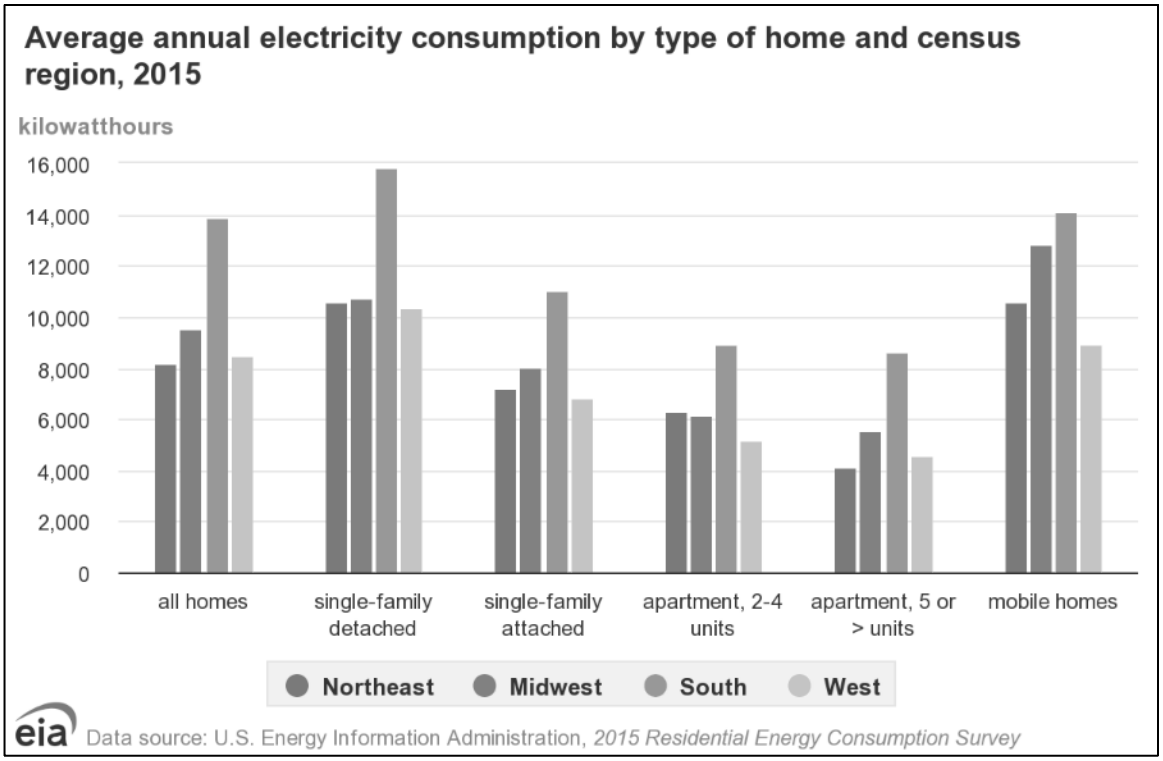

Figure 16: Electricity Consumption by Home and Census Region

Over time we've seen that the total energy consumption by region has been decreasing (Figure 17). However the decline in average household site energy consumption has been offset by the increase in the number of homes overall (Figure 19), "*resulting in relatively flat residential sector energy consumption since the mid-1990s*" (U.S. E.I.A., 2021).

As the data from 2015 reveals, end-use consumption differs by home type (Figure 18). A number of factors affect the amount of energy an individual household uses. Per the U.S. Energy Information Administration (2021) , several of these factors include:

- Geographic location and climate

- Type of home and its physical characteristics
- Number, type, and efficiency of energy-consuming devices in the home and the length of time they are in use

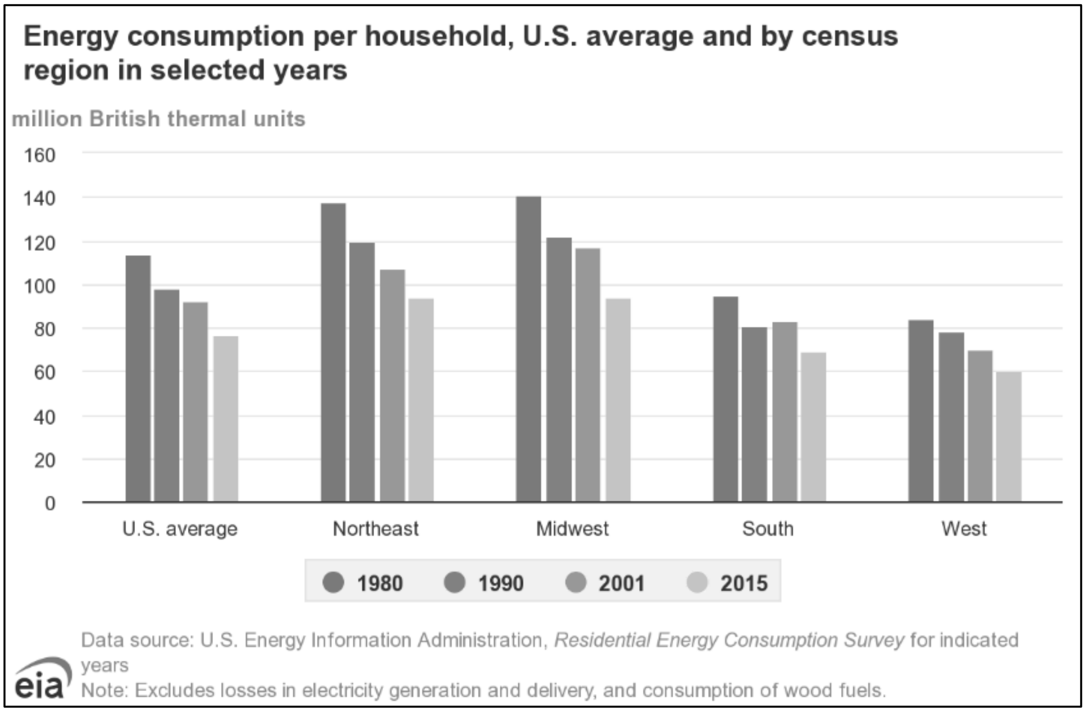

Figure 17: Energy Consumption by Census Region over Time

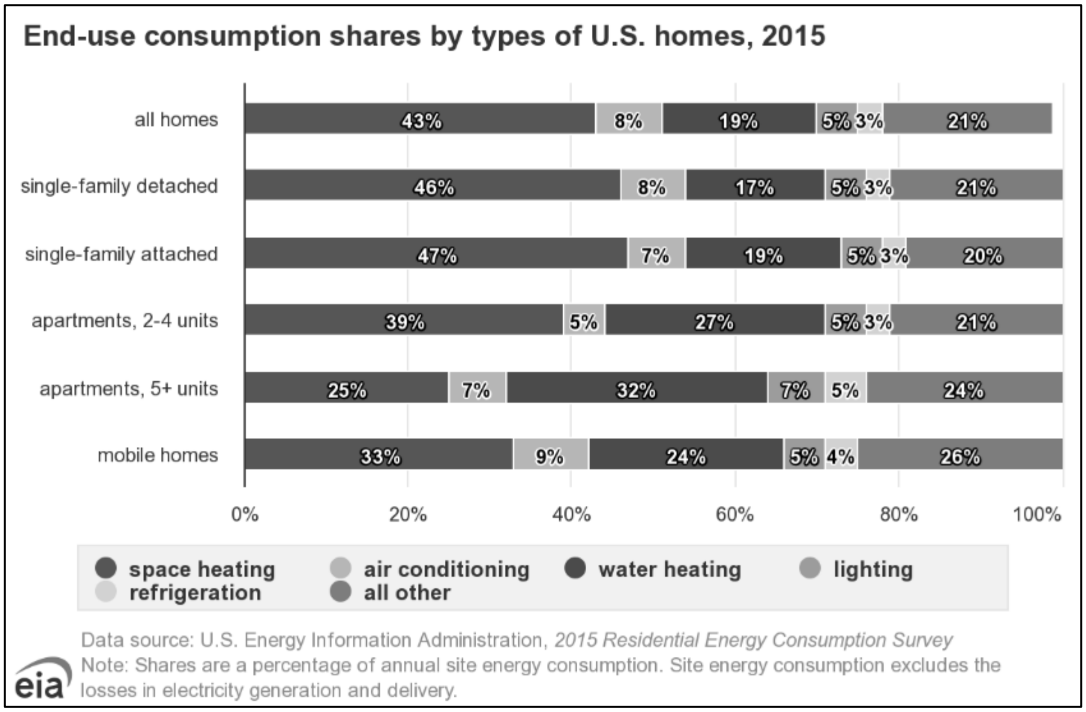

Figure 18: Electric End-Use Consumption by Home Type

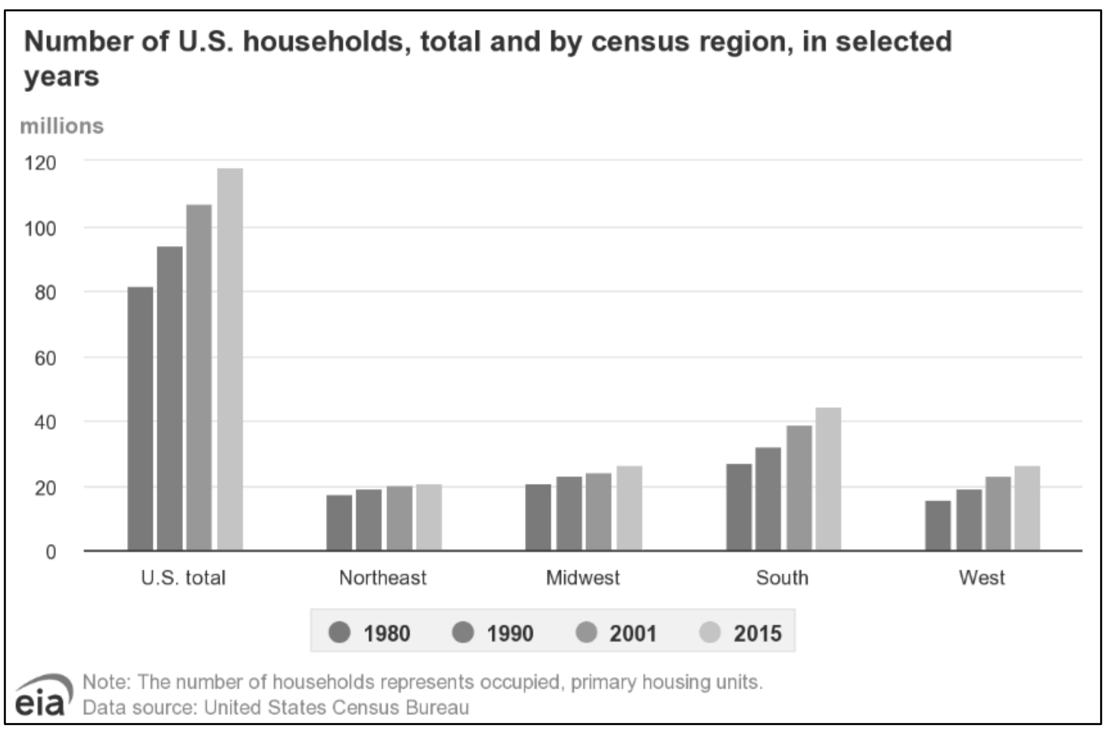

Figure 19: Number of U.S. Households by Census Region over time

Hourly Electric Consumption

Electricity consumption typically cycles each day with the lowest demand occurring around 5:00 a.m. and the highest demand occurring at some point during the day (depending on the season), before falling back down during late evening hours (U.S. E.I.A., 2020). The daily U.S. load cycle in the summer has a much wider range than in the winter because of the widespread use of air conditioning. Electricity consumption in the summer increases rapidly through the day along with temperature, reaching its maximum around 5:00 p.m. or 6:00 p.m. Average U.S. hourly electricity load peaks during the summer. During the winter, the daily cycle of U.S. total electricity load usually has a morning peak and an evening peak. Although the most common primary energy source for space heating is natural gas, about one-third of U.S. households primarily rely on electric furnaces or heat pumps (U.S. E.I.A., 2020). The patterns are generally consistent across the United States however, as depicted in Figure 20, the load curve does have variations between regions and seasons as a direct result of the different weather patterns across the country and seasonal variations.

These hourly fluctuations, which occur across the country in all seasons to a varying degree (Figure 20), are what create the demand (kW) challenge this research was focused on. Given the Foundational Understandings literature review section and the knowledge contained within, it is worth underscoring at this point that this research was not about reducing total Electric Energy Usage (kWh) but, instead, is focused on reducing Demand (kW) through curtailment intentions of residential customers. Customers who shift their demand (kW) to different times could consume the same amount of energy (kWh), while the utility can maintain the grid easier to meet the, now reduced, Peak Demand. Section et al, (1987) noted this very finding as part of their research regarding consumer response to continuous-display electricity-use monitors as part of a Time-of-Use pricing experiment. They noted that monitoring did not induce less total electric consumption, but continuous monitoring and feedback did significantly contribute to shifting electricity use from peak to off-peak periods. This was also recently commented on within the 2023 Utility Energy Efficiency Scorecard (Specian et al., 2023).

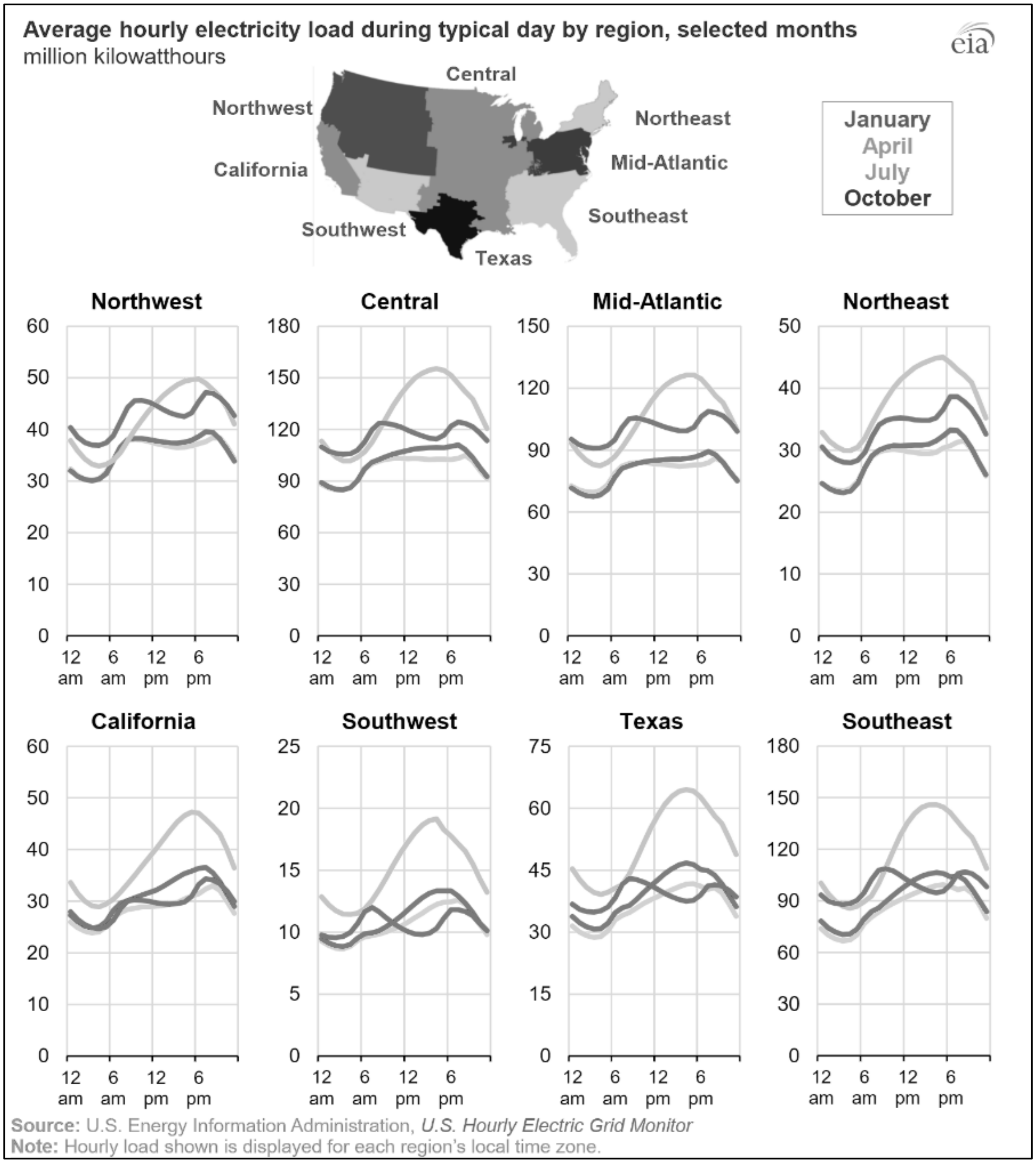

Figure 20: Hourly Electric Load by Region, by Quarter

Energy Consumption Summary

Energy Consumption by itself is not a behavior but is a consequence of many behaviors (Becker et al., 1981; Becker & Seligman, 1978). This energy consumption can be characterized as "*the routine accomplishment of what people take to be the 'normal'* *way of life.*" (Shove, 2004). Electricity is an essential part of modern life and important to the U.S. economy. People use electricity for lighting, heating, cooling, and refrigeration and for operating appliances, computers, electronics, machinery, and public transportation systems. Although near-term U.S. electricity demand may fluctuate as a result of year-to-year changes in weather, trends in long-term demand tend to be driven by economic growth offset by increases in energy end-use efficiency. The annual growth in total U.S. electricity demand is projected to average about 1% from 2022 through 2050 (U.S. E.I.A., 2023).

When people use the energy is a challenge for the utility. We've seen that electricity demand patterns are generally consistent across the United States however the load curve does have variations between regions and seasons as a direct result of the different weather patterns across the country and seasonal variations. These hourly fluctuations could be managed with some consistency; however, we've seen that patterns indicate there are specific periods of time where Peak Demands occur. Compounding the challenge, in some areas of the country, is the inclusion of green energy sources (e.g., solar and wind). As it happens, right when these green sources are naturally unable to produce their energy (i.e., at night or when the wind slows) is when customers are starting their electric energy use needs. This confluence of events exacerbates the demand cycle requiring utilities to increase supply in a very short period of time, when this same pattern is generally occurring across the USA. As a result, it costs utilities who need to purchase energy from neighboring utilities and states a very expensive proposition. While these green energy sources might not be of concern everywhere in the United States, it will play a role as the price point for these technologies make adoption easier for consumers and more of these energy sources come online.

Blackouts, as a result of the grid not being able to meet Peak Demand, not only shut off the only revenue stream afforded the electric utility but also increase the possibility of loss of human life. Anderson & Bell (2012) found that mortality increased 122% for accidental deaths, 25% for non-accidental deaths, and 28% overall for all age groups during a blackout event.

This dissertation research is not about reducing total Electric Energy Usage (kWh) but, instead, is focused on reducing Demand (kW) through curtailment intentions of residential customers through factors that may influence the behavior change. "*While demand response initiatives provide added reductions during peak periods and complement the benefits of efficiency, demand response typically shifts demand rather than reducing overall consumption.*" (Specian et al., 2023). In other words, customers who shift their demand (kW) to different times could consume the same amount of energy (kWh) (Sexton et al., 1987; Specian et al., 2023), while providing the utility the opportunity to maintain the grid easier to meet the, now reduced, Peak Demand.

Influencers of Energy Behavior

While the behavior change theories provide a solid base to understand why people may intent to perform a specific behavior, several context specific constructs have been found to have significance with respect to intention and behaviors concerning either environmental or residential energy consumption needs and savings.

Energy Concern

Energy Concern is defined as an individual's affect associated with perceived importance of energy issues and conservation behaviors. Energy concern, however, is a rather general construct. When generalized concepts such as environmental concern have been theorized and tested as a direct causal relationship to intention or behavior, it performed weakly (Bamberg, 2003). However, when considered as an antecedent mediated by the situation specific constructs found in TPB, research has supported this mediated relationship structure (Bamberg, 2003; Chen et al., 2017; Chen & Knight, 2014; De Groot & Steg, 2007). For example, Chen & Knight (2014) found that within the work environment, at nine Chinese electric power companies, energy concern directly influenced the TPB constructs of attitude, perceived behavioral control, and injunctive norms but not behavioral intentions.

Electricity Savings Knowledge

Electricity Savings Knowledge is *an individual's possession of information regarding electricity savings* (Alkawsi & Baashar, 2020). Energy savings knowledge is a general construct and there exists a relationship between having knowledge and behavior (Z. Wang et al., 2011). However, similar to Energy Concern, research has found that Electricity Savings Knowledge influences behavior via the Attitude construct (Alkawsi & Baashar, 2020; Attari et al., 2010; Pivetti et al., 2020; Z. Wang et al., 2014; L. Wu et al., 2022). Additionally, research has found that an increase in knowledge, particularly in the field of pro-environmental behavior, is an important cognitive precondition for developing personal moral norms (Bamberg & Möser, 2007; Teksoz et al., 2012).

Environmental Awareness

Environmental Awareness is defined *as an individual's possession of an ecological worldview*. This construct is based on the New Ecological Paradigm Scale (NEP), initially called the '*new environmental paradigm*' developed by Dunlap and VanLere in (1978) and subsequently modified by Dunlap et al., (2000) into its present form. Past research has seen that having an awareness of environmental issues wholistically provides an essential cognitive basis which form attitudes (Pivetti et al., 2020; L. Wu et al., 2022), personal moral norms (L. Wu et al., 2022), curtailment behaviors (Jaciow et al., 2022), and feelings of guilt (Bamberg & Möser, 2007) which is akin to Theory of Interpersonal Behavior construct of Affect. Lillemo (2014) found that people with a higher level of environmental awareness were also significantly more likely to have electric energy curtailment behaviors.

Personality

Trait Theory is an approach to the study of human personality. Allport (1937), an early pioneer in the study of traits, laid the foundation for what is the modern psychological study of personality (Long, 1952). Allport (1937) positioned that Personality is one of the most abstract words in the English language, and that any abstract word suffering from excessive use, its connotative significance is very broad. However, the APA has published that personality is defined as *the enduring configuration of characteristics and behavior that comprises an individual's unique adjustment to life, including major traits, interests, drives, values, self-concept, abilities, and emotional patterns. Personality is generally* *viewed as a complex, dynamic integration or totality shaped by many forces, including hereditary and constitutional tendencies; physical maturation; early training; identification with significant individuals and groups; culturally conditioned values and roles; and critical experiences and relationships* (American Psychological Association, 2023). While there are different theories on personality, they all agree that personality helps determine behavior.

Allport (1937, p. 25) noted that the only way to re-vitalize the concept of personality is to trace its history and to distinguish between the psychological meanings and other meanings. Allport (1937) dedicates a whole chapter to defining personality via it's etymology, going back to ancient Greek theatrical drama, and discusses various Theological, Philosophical, Juristic, Sociological, and Psychological meanings. Digman (1990) provides a wonderful history of the development of the personality construct leading up to the development of the NEO-PI inventories, which is specifically tailored along the lines of the five-factor model, and reference to Goldberg (1981) being the 1st to coining the term "Big Five" (Goldberg, 1981, p. 159). The five-factor model (FFM) of openness, conscientiousness, extraversion, agreeableness, and neuroticism (O.C.E.A.N.), has been one of the most commonly-employed personality theoretical models in the psychological field (Abdollahi et al., 1999; Çikrikci et al., 2022; Milfont & Sibley, 2012; Poškus & Žukauskienė, 2017) including pro-environmental behaviors (Kvasova, 2015; Passafaro et al., 2015; Pavalache-Ilie & Cazan, 2018; Q.-C. Wang et al., 2021; Yazdanpanah et al., 2016; Yu & Yu, 2017). The five-factor constructs are determined by applying the NEO Personality Inventory - Revised series of questions (NEO-PI-R & NEO-

PI-3; (Costa Jr. & McCrae, 1997; Costa & McCrae, 1992, 2008; McCrae et al., 2005; Piedmont, 1998)).

Yu & Yu (2017) found that environmental attitudes were moderated by personality traits. Wang et al., (2021) found that the five-factors are associated with family energy conservation intention however each of the individual factors acted slightly differently in strength and significance. Their results, however do provide support that "*energy-saving schemes and interventions should incorporate individual difference, especially personality traits, to find out who need assistance or who has the potential to change behaviors"* (Q.-C. Wang et al., 2021, p. 11). In another energy savings behavior study done by Milfont & Sibley (2012, sec. Study 2), agreeableness and conscientiousness influenced self-reported energy-saving behavior and environmental commitment; greater electricity conservation was significantly associated with higher agreeableness, conscientiousness, and neuroticism; no significant relationships were observed with extraversion or openness.

Thermal Comfort

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 55P defines thermal comfort as "*a cognitive state when a person expresses satisfaction or contentment with his/her surrounding thermal environment and is assessed by subjective evaluation*" (Ramspeck, 2004). There have been many studies that have studied thermal comfort in the context of energy behaviors (Becker et al., 1981; Becker & Seligman, 1978; Chen et al., 2017; Du & Pan, 2021; Jareemit & Limmeechokchai, 2019; Langevin et al., 2013; Samuelson & Biek, 1991; Seligman et al., 1979; Tanabe et al., 2013; Wagner et al., 2007; H. Yan et al., 2016). Becker et al., (1981), in a longitudinal study, found that thermal comfort was the most important determinant of household energy use, rather than concern for energy prices and this has been supported by subsequent studies. Langevin et al., (2013) qualitatively studied energy behaviors with low-income homes and found that thermal comfort concern was a significant reason for not engaging in energy conservation. Thermal comfort applies for both warmth and coolness. Recognizing this, and in the context of the diverse climates found in the United States of America, Chen et al., (2017), leveraging Theory of Planned Behavior, and found for low-income households the need for warmness and coolness negatively predicted intentions to conserve energy. Given our research interest concerning peak demand, in this desire for thermal comfort Yan et al, (2016) found that individuals were more intolerant of low indoor temperatures, and would set a higher heating temperatures, on severe cold winter days compared to slightly cold winter days.

Feedback / Notification Channel

Kluger and DeNisi (1996) saw the need to propose Feedback Intervention Theory (FIT) due to the lack of consistent findings, assumptions about feedback that were commonly held, and that without a solid theory, at the time, many feedback related hypothesis were based on Thorndike's behavioristic law of effect (Thorndike, 1913, 1927). In developing FIT, they borrowed from control theory (Carver & Scheier, 1981), goal setting theory (Locke & Latham, 1991), action theory (Frese & Zapf, 1994), action identification theory (Vallacher & Wegner, 1987), and learned helplessness theory (Mikulincer, 1994). Kluger and DeNisi defined Feedback Interventions (FIs) as *actions taken by (an) external agent(s) to provide information regarding some aspect(s) of one's* *task performance* (Kluger & DeNisi, 1996, p. 255). This dissertation considers the feedback that a utility provides to their customers a form of Feedback Intervention. However, in the electric utility space, the feedback around the consumption of electricity that is provided to customers is like no other product. Kempton & Layne (1994) and Kempton & Montgomery (1982) use a wonderful analogy of shopping and paying for food from a grocery store when discussing energy consumption and feedback. They suggest imagining a scenario where you fill your shopping cart with items (i.e., total electrical consumption (kWh)) however there are no prices on the shelves (i.e., an *estimate* of energy use per item *if* you used it for only 1 hour), and you don't pay for what you gathered for about a month (i.e., the utility bill), at which point you receive an aggregated one-line item "food consumption" (i.e., your home's total kWh for that period of time). This scenario generally works to help the average individual conceptualize electric consumption. For our context, this researcher would add the caloric density of the food item (i.e., kW) to introduce the concept of 'demand' and a family sitting at the dinner table having dinner for ~2 hours, counting all those calories, to introduce the concept of 'peak demand'.

The need for these analogies underscores how different electricity consumption is from other consumer goods. Electricity is not consumed directly, it's invisible, its measurements are abstract for many, and the product is untouchable. This invisibility of energy resources has been discussed in academic literature in terms it's impact on feedback (Abrahamse et al., 2005; Becker & Seligman, 1978; Darby, 2001, 2003, 2006; Ehrhardt-Martinez & Donnelly, 2010; Fischer, 2008; Kempton & Layne, 1994; Kempton & Montgomery, 1982; Roberts & Baker, 2003; Sexton et al., 1987; Stern, 1992; Van Raaij & Verhallen, 1983). Fisher (2008) explains that this invisibility means that *the consumer* *usually receives little feedback on their consumption*, does not experience feedbacks "diminishing stock" cognition, and as a result *does not find herself in control of her consumption*. She goes onto explain that the electrical properties *make it hard for the consumer to develop an emotional involvement* resulting in electricity becoming a *"low interest" product* to many consumers.

As "low interest" as it might seem to some, feedback systems work. "*Feedback stimulates electricity savings…savings range from 1.1% to over 20%, usually between 5% and 12%*" (Fischer, 2008). Interestingly, there were a few instances where there were no savings (in the total kWh). One of these studies, Sexton et al., (1987), is directly applicable to our proposed research - there were no total kWh savings because the feedback provided to the customers "*stimulated heavy load-shifting activities*", and was attributed to the monitor device used because it "*acted as a catalyst to enhance consumers' dynamic adjustment to a long-run equilibrium*". Customers shifted their demand (kW) during a simulated "peak demand" time period but ended up using the same total kWh (i.e., they used the same or more energy in non-peak demand periods). Customers that faced the higher prices of energy were the customers that shifted the most. If we consider that Sexton et al., (1987) started their 2 year study in 1979, the monitoring device they used in the households acted like a very rudimentary smartphone app that provided near real-time awareness and feedback.

A critical insight found by Ehrhardt-Martinez & Donnely (2010) was that the design of the feedback matters. The feedback mechanisms of today are characterized well by EPRI (2009) , drawing from Darby (2001), and are summarized in Figure 21.

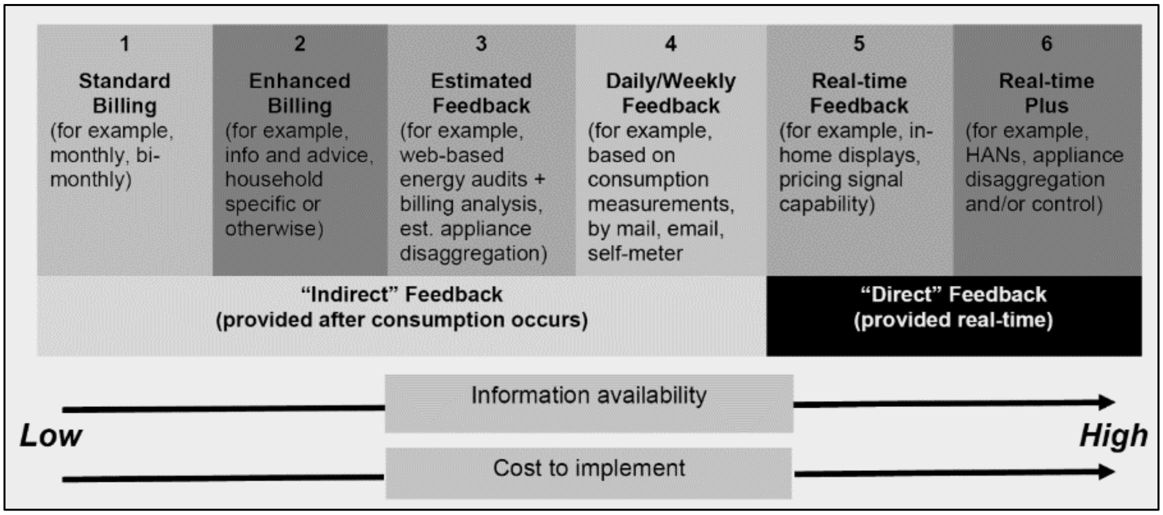

Figure 21: Notification/Feedback Channel Spectrum

Fisher (2008) summarizes that the most successful feedback, that satisfies the households and stimulates conservation, combines the following:

- Is based on actual consumption
- Is given frequently (ideally daily or more)
- Involves interaction and choice for households
- Involves appliance-specific breakdown
- Is given over a longer period
- May involve historical or normative comparisons
- Is presented in an understandable and appealing way (e.g., Egan (1999), Roberts & Baker (2003), Wilhite et al., (1999))

Summary

Behavior is a complex combination of our emotions, morals, habits, social and normative factors and changing any of these components can be challenging (Martiskainen, 2007). Energy Consumption by itself is not a behavior but is a consequence of many behaviors (Becker et al., 1981; Becker & Seligman, 1978). In general, electricity is a "low interest", highly complex product, that is an invisible and untouchable consumable, whose measures of total consumption and rate of usage are poorly understood by many of its users, and whose consumption is ultimately a consequence of the user's multiple behaviors, many of these behaviors controlled by an individual's unconscious automatic sequence of habits. When many individuals use energy at the same time, such as when a majority of people arrive home from work and start using electricity for their normal routines and needs, peak demand occurs. These peak demands occur across the country and throughout all seasons. These peak demand time periods continue to be challenging for the utility to manage with the increasing inclusion of green energy generation, such as solar and wind, whose ability to create energy is naturally and coincidentally ramping down when individuals' energy demand is ramping up. If the utility cannot meet the demand a blackout can occur. Blackouts have been increasing in recent years and when blackouts occur, there is a possibility of loss of human life.

Behavior can and does change. With respect to pro-environmental behaviors, such as energy use and curtailment behaviors, energy behavior has been found to be influenced by an individual's personality, energy concern, electric savings knowledge, environment awareness, thermal comfort, and the nature and manner that feedback, or notifications as conceptualized in this research, is delivered and data presented.

In our context, there is both literary support and academic interest for research that merges the Theory of Planned Behavior and the Theory of Interpersonal Behavior. As empirically tested by Bamberg (2003), Boyd & Wandersman (1991), Godin et al., (1996), and Valois et al., (1988); and as observed by Jackson (2005) and Martiskainen (2007), the union of TIB & TPB has additional explanatory value over using Ajzen's model on its own.

In the next section we will review our research model and hypotheses supported by the above literature review.

III. RESEARCH MODEL AND HYPOTHESIS

Chapter III provides an explanation of the Research Model, defines each of the constructs, and provides the reasoning supporting each hypothesis. Where applicable, additional literature is provided to justify and support the hypotheses being investigated with this research.

Research Model

A good model requires a balance between parsimony and explanatory completeness. This is certainly a yeoman's task when we consider developing a research model to study curtailment intention of an invisible and poorly understood product whose consumption is not a single behavior, but a culmination of behaviors controlled by an individual's unconscious sequence of use habits.

Our research model is based on a union of Triandis' Theory of Interpersonal Behavior (TIB) (Triandis, 1977) and Ajzen's Theory of Planned Behavior (TPB) (Ajzen, 1991). Venkatesh et al., (2016) noted "*it is necessary to draw on other theoretical perspectives to identify and examine specific characteristics*". Additionally, this research suggests that understanding consumers by applying single theory is not enough to understand specific characteristics due to the complex nature of behavior and the dynamic nature of these models. Similar approaches have been noted by prior researchers in a slightly different context (e.g. Naranjo-Zolotov et al., (2019)). However, as noted in the Literature Review, both theories of TIB and TPB do have a high degree of overlap. Triandis formally introduced the concepts of Affect, Habits, and Facilitating Conditions but did not have the construct of Perceived Behavioral Control found in the Theory of Planned Behavior. In the context of Electric Energy Demand Curtailment, the additional constructs within TIB appear to have face validity. For example, the concept of electric energy curtailment may bring forth different feelings and emotions within different individuals. Additionally, as discussed in a few areas of the Literature Review (Rational Inattention, Feedback / Notification Channel), most individuals do not think about their energy use - even while consuming it. As a result, the construct of Habit appears to be of valid theoretical inclusion in the context of Electric Energy Demand Curtailment.

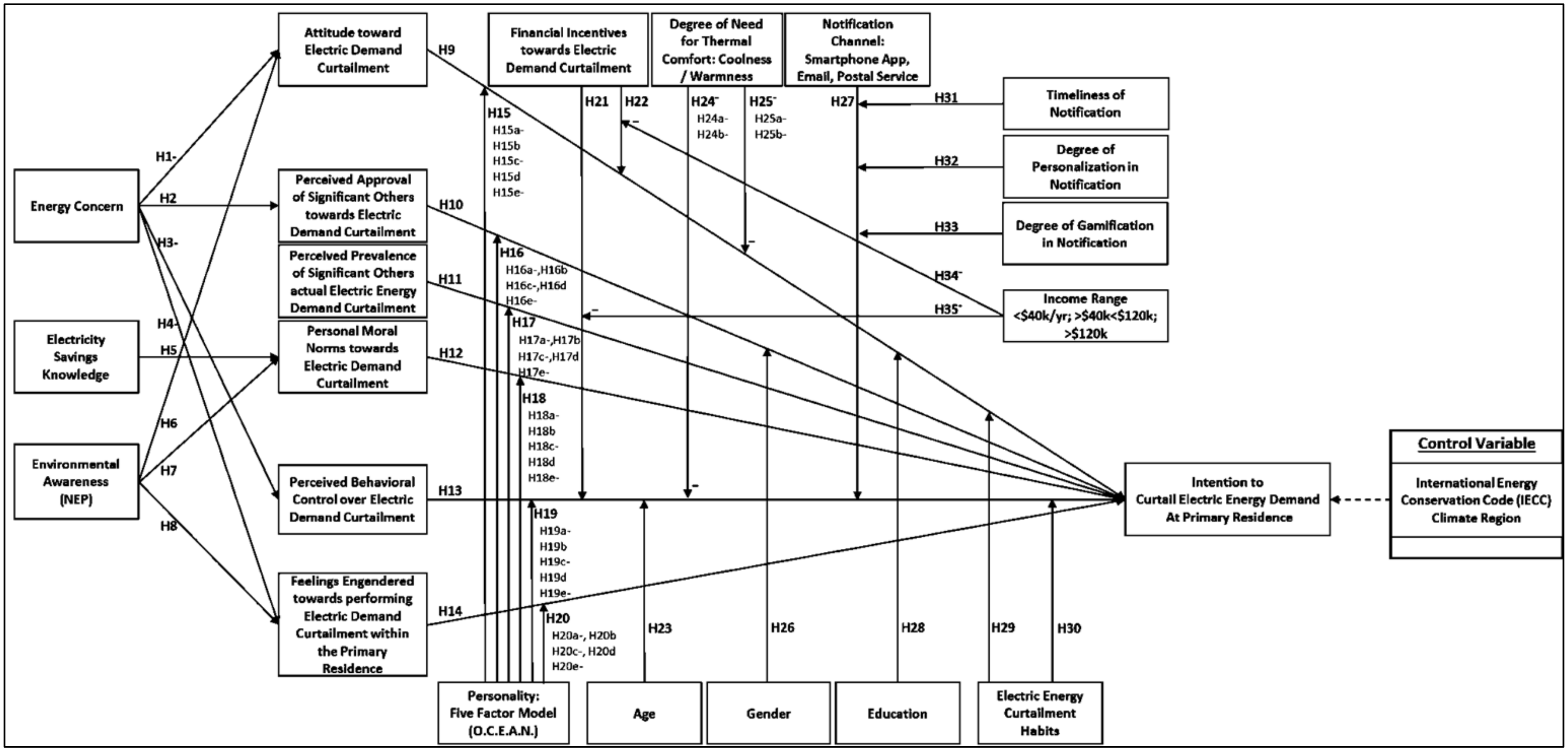

Figure 22: Research Model

The Research Model in Figure 22 has some modifications compared to the conceptualizations proposed by Triandis and includes additional constructs that this researcher believes are appropriate for the residential context of Electric Energy Demand Curtailment in the United States. TIB conceptualizes that Habits and Facilitating Conditions are a moderation on the relationship between Intention to perform a Behavior and Performing the Behavior. In the context of this research, this researcher conceptualizes that Habits moderates two of the causal relationships between the antecedents of intention and Intention to Curtail Electric Energy Demand. Similarly with Facilitating Conditions, we are theorizing that Extrinsic Reward (Financial Incentives) could act as the Level of Arousal that Triandis theorized is part of Facilitating Conditions (Triandis, 1977, p. 195), and that Degree of Need for Thermal Comfort and Notification Channel could also act as the Facilitating Conditions "*environmental factors that increase the probability of the act*" (Triandis, 1977, p. 195). We suggest that the Notification Channel moderates one of the causal relationships that lead to Intention to Curtail Electric Energy Demand. We also suggest that Extrinsic Reward (Financial Incentives) and Degree of Need for Thermal Comfort moderates two of the causal relationships. The additional control variable and constructs that are added to the model are aspects of the research context and are not necessarily conceptualized to be specific replacements or additions to the underlying theories.

Constructs

Dependent Variable

An individual's Intention to Curtail Electric Energy Demand at their Primary Residence (during electric utility peak demand time periods) is the Dependent Variable

(DV) in the Research Model. For this research, Intention to Curtail Electric Energy Demand at Primary Residence is defined as "An individual's behavioral intention to voluntarily curtail their primary residences' electric energy demand." This specific definition is context specific to this research and is based on the definitions of Behavior Intention found in both Ajzen (1991) and Triandis (1977).

Control Variable

International Energy Conservation Code (IECC) Climate Region

In addition to the variables of interest, the research includes a control variable to limit the influence on the dependent variable in the multiple regression analysis (Agresti,

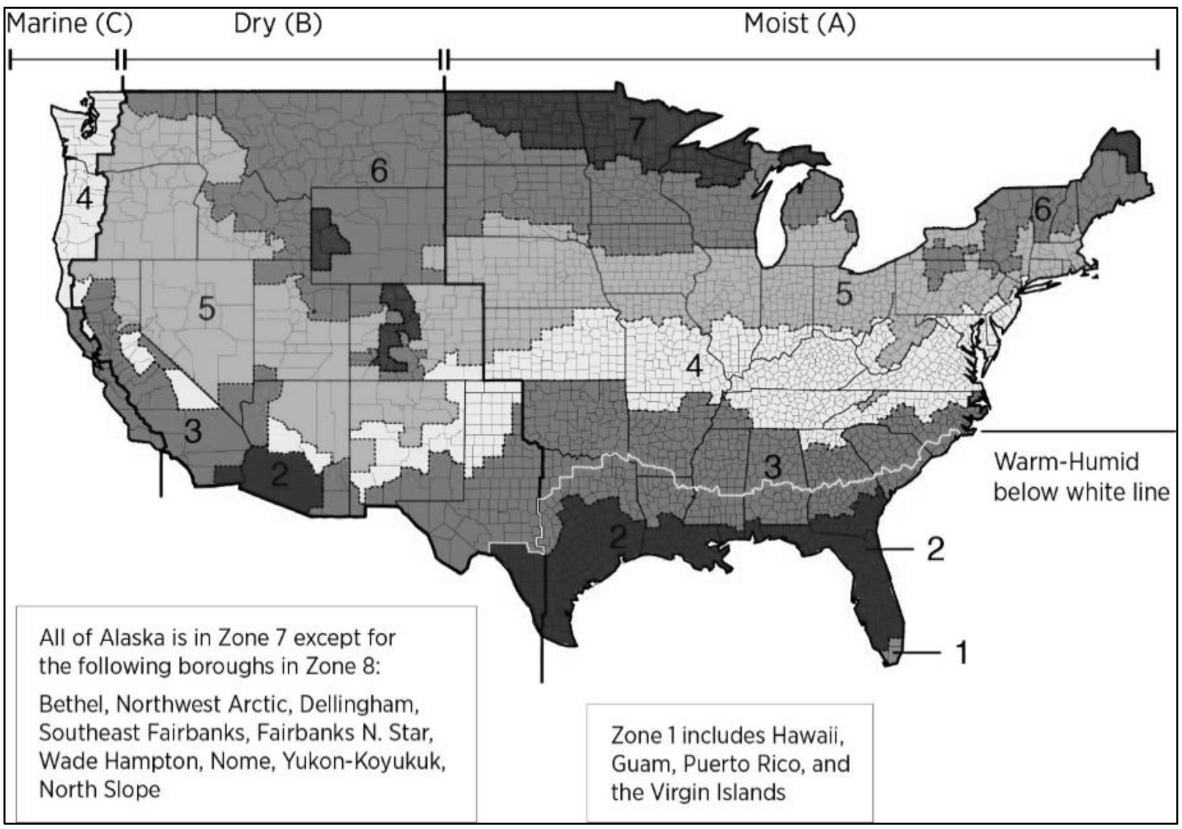

Figure 23: International Energy Conservation Code (IECC) Climate Regions

2018). The International Energy Conservation Code (IECC) Climate Regions (Baechler et al., 2010), noted in Figure 23, is the Control Variable (CV) for this research. A climate region is a defined geographic area with a distinct climate. Climate involves temperature, moisture, wind, and sun, and also includes both daily and seasonal patterns of variations of the parameters. There are eight (8) Climate Regions, or Zones, in the United States. Depending on participant distribution at the time of main survey data collection, IECC climate regions may be logically merged to ensure even distributions (Table 37) for the control variable (e.g., IECC Zone 1 and Zone 2 may be merged into a recoded IECC Zone#).

Independent Variables, Mediators, and Moderators

Energy Concern is an Independent Variable and is defined as an individual's affect associated with perceived importance of energy issues and conservation behaviors. For example, if an individual is worried, or concerned, that there is not enough electricity available for their household, they would have a high Energy Concern and less likely to conserve.

Electricity Savings Knowledge is an Independent Variable and is defined as an individual's possession of information regarding electricity savings.

Environmental Awareness is an Independent Variable and is defined as an individual's possession of an ecological worldview. This construct is based on the New Ecological Paradigm Scale (NEP), initially called the '*new environmental paradigm*' developed by Dunlap and VanLere in (1978) and subsequently modified by Dunlap et al., (2000) into its present form.

The theoretical construct of Injunctive Norms, an aspect of Social Factors, is conceptualized in this research as a Mediator labeled Perceived Approval of Significant Others towards Electric Energy Demand Curtailment. We define this as an individual's perceived approval or disapproval of the behavior of electricity demand curtailment by significant others (e.g., relatives or friends). The work done by Cialdini et al., (1990), Gao et al., (2017), and Wang et al., (2018) influenced this construct. Gao et al., (2017), and Wang et al., (2018) refer to this as Subjective Norm and, upon review of their instruments, their construct is clearly an example of an Injunctive Social Norm.

The theoretical construct of Descriptive Norms, another aspect of Social Factors, is conceptualized in this research as a Mediating Variable labeled Perceived Prevalence of Significant Others actual Electric Energy Demand Curtailment. We define this as an individual's perceived prevalence of significant others' actual electric energy demand curtailment. The inspiration to include this aspect, and breakdown of the Social Norm construct, was inspired by the research conducted by Cialdini et al., (1990), Rivis & Sheeran, (2003), and Gao et al., (2017). The construct has been modified for our context.

The third construct grouped within Social Factors and conceptualized in this research is Personal Moral Norms. We theorized that Personal Moral Norms acts as a Mediator, we've labeled the construct Personal Moral Norms towards Electric Demand Curtailment, and we defined it as an individual's desire to curtail electricity demand in ways consistent with their moral values. This construct was used by Gao et al., (2017) and also by Du & Pan (2021) and has been included here although slightly modified for our research context.

The theoretical construct of Attitude is conceptualized in this research as a Mediator and is labeled Attitude toward Electric Energy Curtailment. We defined this as an individual's favorable evaluation towards electric energy demand curtailment. For example, an individual with a positive attitude with using less electricity in their home during a period of peak demand would have a high score. The construct of Attitude comes from the underlying theories of TPB (1991) and TIB (1977) and the definition was tailored for our research context.

The theoretical construct of Perceived Behavioral Control is conceptualized in this research as a Mediator and is labeled Perceived Behavioral Control over Electric Demand Curtailment. We defined this construct as an individual's perceived ease or difficulty of performing Electric Demand Curtailment at their Primary Residence. The construct of Perceived Behavioral Control comes from the underlying Theory of Planned Behavior (Ajzen, 1991) and the definition was tailored for our research context.

The theoretical construct of Affect is conceptualized in this research as a Mediator and is labeled Feelings Engendered towards Electric Demand Curtailment. We defined this construct as an individual's emotional responses and feelings engendered by the thought of performing Electric Energy Demand Curtailment within their Primary Residence. For example, an individual that feels the emotion of displeasure, when thinking about using less electricity in their home during peak demand periods, would have a low score. The construct of Affect comes from the underlying Theory of Interpersonal Behavior (Triandis, 1977) and the definition was tailored for our research context.

Personality is an omnibus construct that represents an individual's personality. We have conceptualized this omnibus construct acting as a Moderator. For this research we utilized the comprehensive model of general personality traits, the Five-Factor Model (FFM; Digman (1990)). Subconstructs are divided into the Five-Factor Model of Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (O.C.E.A.N.) and are determined by applying the NEO Personality Inventory – Revised series of questions (NEO-PI-R & NEO-PI-3; (Costa Jr. & McCrae, 1997; Costa & McCrae, 1992, 2008; McCrae et al., 2005; McCrae & John, 1992; Piedmont, 1998)). The inclusion of this construct was inspired by the research noted in the Literature Review of Personality.

The construct Extrinsic Reward is included in our model as a Moderator. An extrinsic reward is "*a reward for behavior that is not a natural consequence of that behavior*" (VandenBos, 2007). In the context of this study, the extrinsic reward will be Financial Incentives offered to an individual for performing an Electric Energy Demand Curtailment action at their Primary Residence. We are theorizing that Extrinsic Reward (Financial Incentives) could act as an aspect of Facilitating Conditions, perhaps similar to Level of Arousal, that Triandis theorized is part of Facilitating Conditions (Triandis, 1977, p. 195).

The construct Degree of Need for Thermal Comfort (NTC) is an omnibus construct that represents an individual's cognitive state when a person expresses satisfaction or contentment with his/her surrounding thermal environment and is assessed by subjective evaluation (Ramspeck, 2004). Subconstructs are divided between the need for coolness and the need for warmth depending on the season and Climate Zone (see Figure 23). This construct was inspired by the supporting literature (see: Thermal Comfort) and has been included as part of our research as a Moderator. We are theorizing that Degree of Need for Thermal Comfort could, in addition to Notification Channel, act as an aspect of Facilitating

Conditions "*environmental factors that increase the probability of the act*" (Triandis, 1977, p. 195).

The construct Age is "*the amount of time that has passed since an organism's birth; that is, an individual's chronological age*" (VandenBos, 2007). This will be determined by asking the respondent to select which age range they belong to. In this research, we are considering Age as a Moderator.

The construct Gender is "*the psychological, behavioral, social, and cultural aspects of being male or female (i.e., masculinity or femininity)*" (VandenBos, 2007). This will be determined by asking the respondent their Biological Gender. In this research, we are considering Biological Gender as a Moderator.

The construct Education is the level of completed formal education. This will be determined by asking the respondent what is the highest level of education that they have completed. In this research, we are considering Education as a Moderator.

The theoretical construct of Habits is conceptualized in this research as a Moderator and is labeled Electric Energy Curtailment Habits. We define this construct as an individual's self-reported Electric Energy Demand Curtailment behavior sequences that are, or have become, automatic so that they occur without self-instruction. The construct of Habits comes from the underlying Theory of Interpersonal Behavior (Triandis, 1977) and the definition was tailored for our research context.

Notification Channel is the mechanism that facilitates making an individual aware, or providing feedback, of an Energy Demand Curtailment opportunity, past or present, for their residence. We are researching if Notification Channel acts as a Moderator Variable. Notification Channels considered in this study are via a Smartphone Application (App) notification, an e-mail, and a paper report sent via a postal service such as a home energy report. As noted above, we are theorizing that Notification Channel could, in addition to Degree of Thermal Comfort, act as an aspect of Facilitating Conditions "*environmental factors that increase the probability of the act"* (Triandis, 1977, p. 195).

Related to the Notification Channel, are a few three-way moderations (3MD). Two of these are included as a result of the Literature Review on Feedback / Notification Channel and one is included as a result of the literature reviews of both Feedback / Notification Channel and Gamification Theory.

Timeliness of the Notification is conceptualized as a three-way moderation and is defined as the frequency an individual is made aware of an Electric Demand Curtailment event. This can range from near real-time, within hours, the next day, or monthly (such as with their electric energy bill).

Degree of Personalization in the Notification is conceptualized as a three-way moderation and is a measure of how generalized to individualized the notification is crafted to the individual's specific energy demand curtailment opportunity. A generalized notification would be "you should turn off your lights when you leave a room" whereas an individualized notification would include more specifics tailored to the individual's behaviors. An example of an individualized notification would be "the data seems to indicate you run a dishwasher around 530pm on most weeknights. If you run that dishwasher at 9pm instead you'd benefit by….".

Degree of Gamification in the Notification is conceptualized as a three-way moderation. Gamification refers to the use of design element characteristics for games in non-game contexts (Deterding et al., 2011). The degree of gamification contained within the notification is a measure of how many gamification elements are presented in the notification. Several gamification elements would be considered high, one (1) would be considered medium, and no gamification would be considered low. Gamification design elements examples are Leaderboards, Badges, Points, Performance Status, and Social Connection.

These Notification Channel constructs and associated three-way moderations have been added based on the review of the academic literature on Feedback / Notification Channel and "best practices".

Income Range, defined as the household's total annual income, is proposed as a three-way moderation with Extrinsic Reward (Financial Incentives).

Hypotheses

Given the research model in Figure 22, there are a total of thirty-five (35) main hypotheses. These are expanded upon below.

H1- – H4-

As discussed in the Literature review of Influencers of Energy Behavior, Energy Concern has been studied in a similar, but not identical, context of our research and has supported a mediating relationship structure (Bamberg, 2003; Chen et al., 2017; Chen & Knight, 2014; De Groot & Steg, 2007). For example, Chen & Knight (2014) found that within the work environment, at nine Chinese electric power companies, energy concern directly influenced the TPB constructs of attitude, perceived behavioral control, and injunctive norms but not behavioral intentions. However, in the context of our research, it's possible that the average American household might feel different than employees that work for an electric company in China. As a result, and within the merged model, we did hypothesize that Energy Concern will act similarly as an antecedent on TPB & TIB antecedents. However, we are hypothesizing that the directionality will differ between Perceived Approval of Significant Others and Attitude, Perceived Behavioral Control, and Affect. As noted earlier, if an individual is worried, or concerned, that there is not enough electricity available for their household, they would have a high Energy Concern and we hypothesize are less likely to conserve. We hypothesize if someone has high Energy Concern, they will not have a positive attitude on curtailment. However, we do not believe these Energy Concerns will act in the same manner on their perceived approval of significant others. As a result, this dissertation considered the following four hypotheses:

H1-: As an individual's Energy Concern increases, their Attitude towards Electric Demand Curtailment decreases.

H2: As an individual's Energy Concern increases their Perceived Approval of Significant Others towards Electric Demand Curtailment increases.

H3-: As an individual's Energy Concern increases, their Perceived Behavioral Control over Electric Demand Curtailment decreases.

H4-: As an individual's Energy Concern increases, their favorable feelings engendered towards Electric Demand Curtailment decreases.

H5

As discussed in the Literature review of Influencers of Energy Behavior, Electricity Savings Knowledge has been studied in a similar context of our research and researchers have found that an increase in knowledge, particularly in the field of pro-environmental behavior, is an important cognitive precondition for developing personal moral norms

(Bamberg & Möser, 2007; Teksoz et al., 2012). As a result, we researched the following hypothesis:

H5: As an individual's Electricity Savings Knowledge increases so will their feelings of Personal Moral obligations towards Electric Demand Curtailment increase.

H6 – H8

As discussed in the Literature review of Influencers of Energy Behavior, Environmental Awareness is an individual's possession of an ecological worldview and provides an essential cognitive basis that shapes attitudes, personal moral norms, and feelings of guilt; which we consider similar to the Theory of Interpersonal Behavior construct of Affect. We propose that individuals that are more environmentally aware will have an increase across those same constructs in our context. As a result, we researched the following three hypotheses:

H6: As an individual's Environmental Awareness increases so will their favorable Attitude towards Electric Demand Curtailment increase.

H7: As an individual's Environmental Awareness increases so will their feelings of Personal Moral obligations towards Electric Demand Curtailment increase.

H8: As an individual's Environmental Awareness increases so will their favorable feelings engendered towards Electric Demand Curtailment increase.

H9 – H12

The next several hypotheses are based upon our Literature Review of Theory of Planned Behavior and Theory of Interpersonal Behavior. Following the well-established model of Theory of Planned Behavior and the several studies that have applied Theory of Interpersonal Behavior, we hypothesized that in our context the underlying theories will act the same. As a result, the constructs that have overlap between these two theories form the next several hypotheses. Namely, Attitude and the three components of Social Factors - Injunctive Norms, Descriptive Norms, and Personal Moral Norms, discussed in the Constructs section above:

H9: As an individual's Attitude towards Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.

H10: As an individual's Perceived Approval of Important Others towards Electric Demand Curtailment increases so will the individual's Intention to Curtail their Electric Energy Demand at their Primary Residence increase.

H11: As an individual's Perceived Prevalence of Significant Others actual Electric Energy Demand Curtailment increases so will the individual's Intention to Curtail their Electric Energy Demand at their Primary Residence increase.

H12: As an individual's feelings of Personal Moral obligations towards Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.

H13

The next hypothesis is based upon our Literature Review of the Theory of Planned Behavior. Following the well-established model of Theory of Planned Behavior, we hypothesized that in our context the underlying theory will act the same. The unique construct that Theory of Planned Behavior brings to our research model is Perceived Behavioral Control. We propose:

H13: As an individual's Perceived Behavioral Control over Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.

H14

The next hypothesis is based on our Literature Review of the Theory of Interpersonal Behavior and the several studies that have applied TIB. We proposed that in our context the underlying theory will act the same. The first unique construct that Theory of Interpersonal Behavior brings to the research model is Affect. We researched:

H14: As an individual's Feelings Engendered towards Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.

H15 – H20

As discussed in the Literature review of Influencers of Energy Behavior, Personality has been studied in a similar context of our research and researchers have found that personality does come into play when individuals are either consciously or unconsciously making their intention to behave determination. Q.C.Wang et al., (2021) said it best that electric energy interventions, which is very similar with our research on individual's intention to curtail electric energy, "*should incorporate individual difference, especially personality traits, to find out who needs assistance or who has the potential to change behaviors"* (Q.-C. Wang et al., 2021, p. 11). As reviewed by Q.C. Wang et al, (2021) each of the individual five personality traits of Openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N) have been applied towards several different pro-environmental situations. Some found that the individual personality traits had a significant positive relationship while other studies found the same personality trait, in their context, to be significantly negative. This research is considering the Personality omnibus construct to be a Moderator. Conscientiousness and Agreeableness are theorized to be a positive relationship whereas Openness, Extraversion, and Neuroticism are theorized to be a negative relationship. Where we differ from Q.C. Wang et al, (2021) is our treatment of the relationship. Q.C. Wang et al, (2021) has the FFM personality traits as causal to the TPB constructs citing the recommendations of Brick & Lewis (2016) and Pavalache-Ilie & Cazan (2018) that "*investigations on personality-to environmental protection relationship should consider more immediate antecedents of pro-environmental behavior*." This research, however, will be following the approach taken by Yu & Yu (2017) where environmental attitudes were moderated by personality traits. As a result, the following omnibus Personality hypotheses were researched:

H15: Personality will moderate the relationship between Attitude and Intention.

H15a-: As an individual's Openness (O) increases, the relationship between Attitude and Intention decreases.

H15b: As an individual's Conscientiousness (C) increases, the relationship between Attitude and Intention increases.

H15c-: As an individual's Extraversion (E) increases, the relationship between Attitude and Intention decreases.

H15d: As an individual's Agreeableness (A) increases, the relationship between Attitude and Intention increases.

H15e-: As an individual's Neuroticism (N) increases, the relationship between Attitude and Intention decreases.

H16: Personality will moderate the relationship between Perceived Approval (Injunctive Norms) and Intention.

H16a-: As an individual's Openness (O) increases, the relationship between Perceived Approval (Injunctive Norms) and Intention decreases.

H16b: As an individual's Conscientiousness (C) increases, the relationship between Perceived Approval (Injunctive Norms) and Intention increases.

H16c-: As an individual's Extraversion (E) increases, the relationship between Perceived Approval (Injunctive Norms) and Intention decreases.

H16d: As an individual's Agreeableness (A) increases, the relationship between Perceived Approval (Injunctive Norms) and Intention increases.

H16e-: As an individual's Neuroticism (N) increases, the relationship between Perceived Approval (Injunctive Norms) and Intention decreases.

H17: Personality will moderate the relationship between Perceived Prevalence of Significant Others (Descriptive Norms) and Intention.

H17a-: As an individual's Openness (O) increases, the relationship between Perceived Prevalence of Significant Others (Descriptive Norms) and Intention decreases.

H17b: As an individual's Conscientiousness (C) increases, the relationship between Perceived Prevalence of Significant Others (Descriptive Norms) and Intention increases.

H17c-: As an individual's Extraversion (E) increases, the relationship between Perceived Prevalence of Significant Others (Descriptive Norms) and Intention decreases.

H17d: As an individual's Agreeableness (A) increases, the relationship between Perceived Prevalence of Significant Others (Descriptive Norms) and Intention increases.

H17e-: As an individual's Neuroticism (N) increases, the relationship between Perceived Prevalence of Significant Others (Descriptive Norms) and Intention decreases.

H18: Personality will moderate the relationship between Personal Moral Norms and Intention.

H18a-: As an individual's Openness (O) increases, the relationship between Personal Moral Norms and Intention decreases.

H18b: As an individual's Conscientiousness (C) increases, the relationship between Personal Moral Norms and Intention increases.

H18c-: As an individual's Extraversion (E) increases, the relationship between Personal Moral Norms and Intention decreases.

H18d: As an individual's Agreeableness (A) increases, the relationship between Personal Moral Norms and Intention increases.

H18e-: As an individual's Neuroticism (N) increases, the relationship between Personal Moral Norms and Intention decreases.

H19: Personality will moderate the relationship between Perceived Behavioral Control and Intention.

H19a-: As an individual's Openness (O) increases, the relationship between Perceived Behavioral Control and Intention decreases.

H19b: As an individual’s Conscientiousness (C) increases, the relationship between Perceived Behavioral Control and Intention increases.

H19c-: As an individual’s Extraversion (E) increases, the relationship between Perceived Behavioral Control and Intention decreases.

H19d: As an individual’s Agreeableness (A) increases, the relationship between Perceived Behavioral Control and Intention increases.

H19e-: As an individual’s Neuroticism (N) increases, the relationship between Perceived Behavioral Control and Intention decreases.

H20: Personality will moderate the relationship between Affect and Intention.

H20a-: As an individual’s Openness (O) increases, the relationship between Affect and Intention decreases.

H20b: As an individual's Conscientiousness (C) increases, the relationship between Affect and Intention increases.

H20c-: As an individual's Extraversion (E) increases, the relationship between Affect and Intention decreases.

H20d: As an individual's Agreeableness (A) increases, the relationship between Affect and Intention increases.

H20e-: As an individual's Neuroticism (N) increases, the relationship between Affect and Intention decreases.

H21 – H22

The next hypotheses are based upon our synthesis of what has been discussed in the Literature Review of Rational Inattention, Behavioral Reasoning Theory, Self-Determination Theory & Organismic Integration Theory (namely intrinsic and extrinsic motivation), and additional synthesis of several other academic studies in our context but didn't fit nicely within the formal literature review subsections. "*Research has shown that curiosity and the desire for information can lead people to act*" (Hsee & Ruan, 2016; Kruger & Evans, 2009). However, it's not just curiosity that might lead people to act in our context. We hypothesized that aspects of intrinsic and extrinsic motivations come into the equation. When studying a group of students, Petersen et al., (2007) show that "*a combination of immediate feedback about actual consumption levels and* ***economic incentives*** *can lead to significant reductions in electricity*" (Ek & Söderholm, 2010). "*Brandon and Lewis (1999) stress that both economic motives as well as attitudes and values need to be addressed in the analysis of electricity saving behavior, and that much of the previous research carried out by consumer scientists have focused too narrowly on attitudes, beliefs and values but* ***neglected the importance of energy costs*** *and therefore underestimated the potential for change for individual households*" (Ek & Söderholm, 2010). Recall that Sexton et al., (1987), found that when individuals were made aware of an upcoming price change in the use of energy, there was significant shifting of electricity use from on-peak to off-peak time periods. Earlier real world experiment work done by Winette et al., (1978) found that monetary rebates (high monetary rebates equaling 240% price change in electricity versus a low monetary rebate of 50% price change), combined with weekly written feedback, resulted in only the high rebate participants curtailing 12% (on average) of their weekly electricity use across the 13-week experiment period. The reviews of energy conservation intervention studies performed by Abrahamse et al., (2005) additionally concluded that extrinsic rewards appear to have a significant effect on energy savings whereby all of the studies in their review reported significant differences between households that received a monetary incentive versus those who had not. However, they also note that the effect of the incentive is short-lived. In the context of our study regarding intermittent peak demand time-periods, that observation is both pertinent and welcomed.

Synthesizing these literatures with the aforementioned theories, we conjectured that the existence of an extrinsic reward, that individuals are made aware of as part of the curtailment need during a peak demand time period, will act as a moderator on the Attitude and Perceived Behavioral Control causal relationships leading to Intention to Curtail Electric Energy Demand at the Primary Residence such that:

H21: As Financial Incentives increase, the relationship between Attitude and Intention increases.

H22: As Financial Incentives increase, the relationship between Perceived Behavioral Control and Intention increases.

H23

The next hypothesis was based on the moderating behavior of age and is supported by past research performed by Lee (2009), Moon (2021), Morris et al.,(2005), Morris & Venkatesh (2000), Venkatesh et al., (2012, 2003) , and B.E. White et al., (2007). Each of these researchers have found age to perform as a moderator along several of the construct relationships that lead directly to the intention creation construct. Notably in the list is the well-researched theories of UTAUT (Venkatesh et al., 2003) and the consumer decision focused UTAUT2 (Venkatesh et al., 2012). While these are related to technology adoption and use, there are similar cognitive processes that individuals experience that are the same as a behavior change cognitive process. In the creation of UTAUT & UTAUT2, Venkatest et al., (2012, 2003) compared and leveraged these same cognitive theories and aspects of them such as Theory of Reasoned Action (Attitude towards behavior, Subjective Norm), Motivational Model (Intrinsic/Extrinsic motivations), Theory of Planned Behavior (Subjective Norm, Perceived Behavioral Control), and Social Cognitive Theory (Affect). Leveraging TPB, Morris & Venkatesh (2000) found that age moderations on Attitude were stronger for younger individuals, Perceived Behavioral Control was stronger for older individuals, and Subjective Norm (i.e., Injunctive Norms) were stronger for older women (i.e., a three-way interaction). In our context of curtailed behavior change, technology is used to aid in the behavior. We've seen recently that 'smart' connected devices, such as thermostats and fully-integrated smartphone apps (i.e., IOT devices passing and smartphone apps leveraging data between applications), are being used to enhance the daily lives of consumers of all ages across the United States (Silverglate & Arbanas, 2022). As a result of this past research, this research has synthesized all these findings. While many age-related moderation hypotheses could be put forth in our context, for now we researched the following single age moderation hypothesis:

H23: As Age increases, the relationship between Perceived Behavioral Control and Intention increases.

H24- – H25-

As discussed in the Literature review of Influencers of Energy Behavior, Thermal Comfort, which includes the need for both warmth and coolness (Chen et al., 2017), has been studied in the context of energy conservation behaviors. Research has found that thermal comfort itself, even more than energy prices, was an important determinant (Becker et al., 1981; Chen et al., 2017). Thermal comfort concern was also found to be a significant reason for low-income homes to not engage in energy conservation (Chen et al., 2017; Langevin et al., 2013). While energy savings and power savings are different electrical measures (see: Foundational Understandings), most consumers perceive them as the same. Synthesizing the above consumer cognitive and psychological realities, with respect to our context of electric energy demand curtailment, we researched the following negative hypotheses:

H24-: The Degree of Need for Thermal Comfort will negatively moderate the relationship between Attitude and Intention.

H24a-: As an individual's need for coolness increases (in the summer/warm climates), the relationship between Attitude and Intention decreases.

H24b-: As an individual's need for warmness increases (in the winter/cold climates), the relationship between Attitude and Intention decreases.

H25-: The Degree of Need for Thermal Comfort will negatively moderate the relationship between Perceived Behavioral Control and Intention.

H25a-: As an individual's need for coolness increases (in the summer/warm climates), the relationship between Perceived Behavioral Control and Intention decreases.

H25b-: As an individual's need for warmness increases (in the winter/cold climates), the relationship between Perceived Behavioral Control and Intention decreases.

H26

The next hypothesis is based on the moderating behavior of gender on intention and is supported by past research performed across many contexts, including energy behavior, by Beldad & Hegner (2018), Blanchard et al., (2009), Du & Pan (2022), Hashim et al., (2014), Morris et al, (2005), Morris & Venkatesh (2000), Ruizalba Robledo et al, (2015), Shin et al., (2020), Venkatesh et al., (2012, 2000, 2003), Venkatesh & Morris (2000), Waktu Saptu et al., (2020), and B.E. White et al., (2007). Very similar to the discussion and justification above for hypothesis H23, several of these researchers found significant moderations as a result of gender on several of the construct relationships that lead directly to intention creation; while others did not. Leveraging TPB, Venkatesh et al., (2000) found that gender moderations on the Attitude to Intention relationship were stronger for men and that stronger moderations existed for women in early stages of experience (i.e., a three-way interaction) on both the Perceived Behavioral Control to Intention relationship and the Subjective Norm (i.e., Injunctive Norms) to Intention relationship. The latter gender moderation on Subjective Norm to Intention was similarly found by Venkatesh and Morris (2000). In the context of energy-savings behaviors, Du & Pan (2022) were inspired by their acknowledgement that there is insufficient research on energy-savings behavioral mechanisms of young people and the gender effect on their perceptions and practices. Their results do show that "*gender differences existed evidently in energy-saving perceptions and practices of university students in favor of females.*" (Du & Pan, 2022) While energy savings and power savings are electrical measures (see: Foundational Understandings), most consumers perceive them as the same. Synthesizing the above consumer cognitive and psychological realities, with respect to our context of electric energy demand curtailment, while many gender-related moderation hypotheses could be put forth in our context, including three-way moderations, for now we researched the following single gender moderation hypothesis:

H26: The relationship between Perceived Approval of Significant Others and Intention will be stronger for Women than Men.

H27

As discussed in the Literature review of Influencers of Energy Behavior (Feedback / Notification Channel), the invisibility of energy resources is a challenge and has an impact on feedback provided to consumers. A critical insight found by Ehrhardt-Martinez & Donnely (2010) was that the design of the feedback matters. Design of feedback includes the mechanism by which the information is delivered; operationalized by this research as Notification Channels. Those Notification Channels are characterized well by EPRI (2009), and are summarized in Figure 21. However, it should be acknowledged, technology has advanced and the cost to implement more real-time disaggregated information may not be as costly as it was circa early 2009. Indeed, Rhode Island Energy (RIE) plans to offer this real-time disaggregated information, via a commercially available Home Area Networking (HAN) APP solution, free to customers as part of their upcoming RF Mesh Automated Metering installation deployment plans slated for 2024/2025 (*RIE - Record Request No.11*, 2023, p. 12). Either way, we've seen that customers will shift their demand (kW) when notified of an upcoming price change (Sexton et al., 1987). If we consider that Sexton et al., (1987) started their 2 year study in 1979, the monitoring device and Notification Channel they used in the households acted like a very rudimentary smartphone app providing near real-time awareness. Today, customers have their monthly bill, and many utilities offer a webpage where customers can login and see their energy use, though often delayed by a day or longer. However, most residential customers are trapped in the 'direct debit' dilemma - they only receive a monthly notification (bill) on their energy use for which payment goes directly from their bank account, hence not even having to open their bills (Brandon & Lewis, 1999; Darby, 2006; Roberts & Baker, 2003). This is essentially no notification and only when the debit is more than usual do consumers take note. If electricity bills are indeed opened, they include information which is not always clearly presented and can be confusing to the customer. It is beyond the scope of this dissertation research but perhaps both of these items may be inadvertently contributing to reinforcing residential customers Rational Inattention towards energy use.

Progressive utilities, with permission from the respective State's regulatory bodies, are working towards increasing customer energy use awareness by leveraging this advanced and available technology. However, what is not known is if these Notification Channels matter in the context of curtailment intention during peak demand episodes. Synthesizing the above, our research sought to understand if the Notification Channel matters to residential customer's intention to curtail electric energy demand at their primary residence. While many exploratory moderation hypotheses could be put forth in this context, for now we propose the following single Notification Channel moderation hypothesis:

H27: Notification Channel moderates the relationship between Perceived Behavioral Control and Intention.

H28

The next hypothesis is based on the moderating behavior of formal education level on intention. This is supported by past research performed by Bai et al., (2020), Holdsworth et al., (2019), Hu & Zhang (2016), Kotchen et al., (2013), McKinsey & Company (2014), Schüz et al., (2020), Sovacool et al., (2018), Vassileva & Campillo

(2017), C.Wang et al., (2022), Wibowo et al., (2022), and Y.Wu (2022). Each of these has the Theory of Planned Behavior as the base theoretical model and spans a vast universe of contexts including pro-environmental behavior. Very similar to the discussion and justifications above for hypotheses H23 & H26, several of these researchers found significant moderations as a result of formal education on several of the construct relationships that lead directly to intention creation; while others did not. Sovacool et al., (2018) found that men with high education and below middle age (30-45) were more likely to make a pro-environmental intention decision towards electric mobility and vehicle-to-grid systems. In a different context, Schüz et al., (2020) found that education significantly moderated the intention to behavior and attitude to intention relationships, with more educated individuals having a stronger positive moderation. Synthesizing the above, while many education-related moderation hypotheses could be put forth, including three-way moderations, for now we considered the following single education moderation hypothesis:

H28: For individuals with a higher degree of formal Education, the relationship between Attitude and Intention increases.

H29 – H30

The next hypotheses are based on our Literature Review of the Theory of Interpersonal Behavior and the several studies that have applied TIB. The second unique construct that Theory of Interpersonal Behavior brings to the research model is Habits. We researched that, within our context, the underlying theory will act the same. Recall that Energy Consumption behaviors are theorized to be under the unconscious control of habit (Martiskainen, 2007). As noted in the Energy Consumption Summary, energy consumption by itself is not a behavior but is a consequence of many behaviors (Becker et al., 1981; Becker & Seligman, 1978). The use of these energy consuming devices and appliances are based on routine and habit (Pierce et al., 2010) in order for individuals to perform routine tasks (Shove, 2003, 2004). S.Wang et al., (2018) included saving electricity as a habit in their research and found a significant relationship with intention to save electricity as well as reported electricity savings behavior of residential customers in one of the fastest growing cities in China. Triandis (1977) did theorize that habits and intention work together, are moderated by facilitating conditions, and this determines the probability of an act occurring (referencing his equation 1, (Triandis, 1977, pp. 9, 11, 194, and 195)). However, we also acknowledged that Triandis provides flexibility in this application by noting "*while this is current thinking, it does not prevent future research from suggesting other ways of conceiving the problem*" (Triandis, 1977, p. 195) of how to best apply his added theorized constructs for the respective context. As a result of past research noted both above and in the Literature Review, and the theoretical flexibility afforded us, we hypothesized and researched:

H29: For individuals who possess a high degree of Electric Energy Curtailment Habits, the relationship between Attitude and Intention increases.

H30: For individuals who possess a high degree of Electric Energy Curtailment Habits, the relationship between Perceived Behavioral Control and Intention increases.

H31 – H33

The next several hypotheses are conceptualized to be three-way interactions based on our synthesis of the information discussed in the Literature Review of Behavioral Change theories and Influencers of Energy Behavior, namely Feedback / Notification Channel. Notification Channel matters, as discussed above with Hypothesis H27.

Therefore, equally important are the characteristics of the notification itself. Recall that Fisher (2008) summarizes the characteristics of the successful notifications (which she conceptualized as feedback best practices) that satisfies the households and stimulates energy conservation (see Feedback / Notification Channel for details). Of importance to our research are the following from Fisher's summary: frequency of notification, interaction & choice, appliance-specific breakdown, understandable & appealing, and normative comparisons. Our research groups and operationalizes Fisher's feedback best practices thusly - frequency of notifications is our construct Timeliness of Notification; interaction & choice, appliance-specific breakdown, and being understandable are conceptualized as part of our construct Degree of Personalization in Notification; appealing and normative comparisons are conceptualized as part of our construct Degree of Gamification in Notification. Synthesizing all the above as noted, we researched the following three positive three-way moderations:

H31: The timelier the Notification Channel notification, the Notification Channel moderation between Perceived Behavioral Control and Intention will increase.

H32: The higher the Degree of Personalization in the notification, the Notification Channel moderation between Perceived Behavioral Control and Intention will increase.

H33: The higher the Degree of Gamification in the notification, the Notification Channel moderation between Perceived Behavioral Control and Intention will increase.

H34- – H35-

The last two hypotheses are conceptualized to be three-way interactions and are based on the premise that the more income an individual has, the less likely they are to be motivated by a financial incentive. Our research therefore investigated the following two negative three-way moderations:

H34-: As an individual's Income increases, the Financial Incentives moderation between Attitude and Intention will decrease.

H35-: As an individual's Income increases, the Financial Incentives moderation between Perceived Behavioral Control and Intention will decrease.

IV. METHODOLOGY

Introduction

Chapter IV provides details on the research design, processes followed across phases, and the instruments and measurements used to test the hypotheses. Data Analysis and Results of each phase are explored in Chapter V.

The Stakeholder Engagement section details how this research engaged with industry experts. The Research Design section covers the overall philosophical assumption, design justification and reasoning, overall approach, timeline summary, and discusses how the research design methodology addresses participants privacy and confidentiality. The Unit of Analysis and Observation, Population of Interest, and Sample Size sections cover those respective topics and, where applicable, calls out the differences within each of the four phases described herein. Instrumentation and Measurements explains the instrument used and provides details on the measures for each construct. Instrument Validation details why and how the survey instrument was validated ahead of and within the full-scale data collection. Finally in this methodology chapter, the Threats to Validity of this research and methodology approach will be acknowledged with implemented remedies to limit unintended validity impacts.

Stakeholder Engagement

Big research questions tend to reside in a buzzing, blooming, confusing world (Van de Ven, 2007, p. 18). Given the complexity of many issues facing business today, it is impossible, and arrogant, for an individual researcher to believe that in isolation they could properly capture the complexity and nuanced contextual experience many practitioners have cultivated over the years. *In the absence of unambiguous foundational truth in the* *social sciences, the only sensible way forward can be conscious pluralism* (Pettigrew, 2001, p. P62). To incorporate this acknowledged pluralism requires the researcher to seek and value the involvement from stakeholders with varying backgrounds and different roles such that stakeholders contribute their rich, unique, and varied perspectives. Anderson et al., (2001) and Hodgkinson et al., (2001) argue that stakeholder involvement in the research increases the impartiality of the research by incorporating the diverse perspectives of multiple stakeholders. Research collaborations that incorporate such diversity spur novelty and creativity through exposure to diverse assumptions, objectives, and ways of viewing phenomena (Rynes et al., 1999), and through the motivational effects of working on real-world problems (Lawler, 1985). As such, this researcher will not go it alone and stakeholder feedback will be sought and scheduled. Aside from the assigned dissertation chair, a few individuals from industry with significant experience gained through employment at large, well-established, and well-respected electric utility companies volunteered for the early phases of the research. This volunteer effort is outside of their formal roles and will occur during their personal non-working time. The researcher explained the time commitment these engagements will require to the volunteers.

Touchpoints with the dissertation chair acted as opportunities for status and feedback every week. These meetings were primarily for the benefit of the researcher. During these meetings feedback and guidance was sought. Separately, at the onset of the research, a series of meetings were held with the industry volunteers. These stakeholders provided feedback on where they see the challenges in the industry with Peak Demand and how they've been addressing it. These individuals also participated in the Informed Pilot, provided direct feedback on the survey instrument, and have provided pragmatic suggestions for additional hypotheses to be considered and preliminarily investigated during a Post Ad-Hoc Analysis.

Research Design

Philosophical Framework

As noted in this dissertation's title, there are multidimensional behavioral and technological determinants when exploring individuals' perspectives in our context. As a result, this research is designed to understand and unravel these aspects. Our interpretive framework and philosophy are primarily positivism with aspects of pragmatism. Ontologically we contend that an objective physical and social world exists and the nature of which can be characterized and measured. Our epistemological beliefs result in a deductive approach, and this research was equally concerned if our proposed hypotheses can be either verified or falsified. We equally contend that reality is what is useful, is practical, and "works" however acknowledge that a single reality exists beyond ourselves, but we may not be able to understand it fully.

Design

The researcher studied the factors that contribute to U.S. residential electric utility customers intention to voluntarily curtail electric energy demand at their primary residence during an electric utility peak demand time period. Using surveys as a data collection method was most appropriate for this study as it enables a broader set of data collection from the individual unit of analysis. Using a survey questionnaire, this dissertation measured the constructs of interest. These constructs are proposed to have causal relationships, as noted in Figure 22, such that one construct influences another. A quantitative research approach is best suited for this so that we can quantify the constructs and evaluate how they support the model and hypotheses. This is a contextual design where we sampled enough cases within our population of interest to appropriately measure our constructs. The research adopted a quantitative exploratory methodology by administering a cross-sectional and contextual survey design. This survey method was suitable to "*capture the experiences and determine the meaning the participants hold about the problem*" (Creswell, 2014). *Quantitative research methods are concerned with collecting and analyzing data that is structured and can be represented numerically* (Goertzen, 2017). Our survey questions are closed-ended where participants select from either a Likert style grid of choices, a Rank Order list, or a Slider scale. All our constructs in this study are measures with at least three item measures. Past studies indicate that multiple item measures help improve validity, reliability, and construct validity (DeVellis & Thorpe, 2021; Diamantopoulos et al., 2012; Singleton & Straits, 2018).

Approach

This research followed the processes as described and demonstrated within Straub (1989). The phases in the process demonstrated by Straub (1989) are Phase 1: Pretest, Phase 2: Technical Validation, Phase 3: Pilot Test, and concludes with the final formal study - Phase 4: Full-Scale Execution. We will be referring to our Phase 1 as the Informed Pilot and Phase 4 as the Dissertation Research Study or sometimes just "Main Study". Upon completing Phases 1 through 3, Phase 4 began with the validated instrument being administered online, and participants were sought via Connect™ powered by CloudResearch.com. The initial Phases 1 and 2 were conducted via an Informed Pilot (Phase 1) and a small sample of data collected online via the survey instrument (Phase 2). The goal of the Informed Pilot and Technical Validation was to revise the survey instrument to a point where a meaningful survey instrument can be validated with a Pilot test (Phase 3). The goal of the Pilot Test was to validate the survey instrument. The goal of the Dissertation Research Study, if not self-evident, is to utilize the validated survey instrument and collect data for statistical interpretation, re-verify items aggregated to their respective constructs, Research Model hypothesis analysis, translation into meaningful theoretical and practical industry implications, and document the results into this very dissertation document for final submission. The Instrument Validation section details the research and work that was performed within each Phase.

Timeline Summary

While the IRB approval was granted May 5th, 2023, and the Dissertation Proposal was approved September 20, 2023. Phase 1 began in earnest October 7th, 2023, with invitations being emailed to Informed Pilot participants. Phase 4 data collection concluded November 11, 2023, data analysis concluded March 15th, 2024, and the final dissertation document was submitted to the researcher's full Dissertation Committee in April 2024. The Dissertation Defense occurred on May 23, 2024.

Privacy and Confidentiality

Privacy is the ability of an individual or group to seclude themselves or information about themselves and thereby reveal themselves selectively. Privacy refers to people and their interest in controlling the access of others to themselves. Each subject, in Phases 3 & 4, will automatically be assigned both a Participant ID and an Assignment ID via Connect™ powered by CloudResearch.com. These unique IDs are indirect identifiers. This research will not reveal the identity of the enrolled subjects however, as described, subjects will be linked via the unique IDs with each digital consent form to facilitate payment, outlier removal, or a subsequent request via the CloudResearch.com portal from the participant to be removed from the dataset. Since subjects will be provided with a unique Participant ID and Assignment ID via Connect™ powered by CloudResearch.com, they will have the ability to have their responses removed from the dataset thereby secluding themselves, if they desire, at a future date. By following this research design approach, management of privacy of the subjects was possible. There have been no requests by participants to be removed from the dissertation dataset as of the final dissertation document submission.

Confidentiality has been defined by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) in ISO/IEC 27000:2018-02, clause 3.10, as ensuring that "*information is not made available or disclosed to unauthorized individuals, entities, or processes*" (International Organization for Standardization, 2018). With respect to our research, confidentiality refers to the researcher's agreement with the participant about how the participant's identifiable private information will be handled, managed, and disseminated. This research is **not** collecting names, birthdates, social security numbers, medical record numbers, or mailing addresses. This research will be asking the participants for their zip code and, to link consent documents, facilitate payment, and adhere to our privacy approach noted above, each subject will be automatically assigned both a Participant ID and an Assignment ID via Connect™ powered by CloudResearch.com. To protect the confidentiality of the participants, the master key was stored separately from the data on a password protected laptop, stored in a locked office, within a locked file cabinet in FIU Mango 373. Survey data was stored separately from the master key on a password protected laptop in a locked office, within a locked file cabinet in FIU Mango 373. Per FIU IRB procedures, coded linked data will be permanently removed and de-identified at the conclusion of the study. If the data needs to be transported, data will be transported on an encrypted USB drive that will be in the researcher's possession during transport. By following this research design approach, management of confidentiality of the subjects was possible. This researcher is unaware of any break in confidentiality that would have exposed a participant's zip code, linked to their unique Participant ID or Assignment ID, such that the individual could be personally identified.

Unit of Analysis and Observation

This research studied the factors that contribute towards U.S. residential electric utility customers' intention to voluntarily curtail their electric energy demand at their primary residence. The unit of analysis for this research is the individual. For this research, individuals were both the unit of analysis and unit of observation. While the individual does belong to a group – a group of people who can curtail electric demand at their primary residence – this researcher is conscious to not make any additional ecological fallacies as it pertains to the individuals.

Population of Interest

The population of interest for this study are individuals who have electric service for their primary residence and can contribute to electricity demand curtailment behaviors within the primary residence. If the individual cannot contribute to electricity demand curtailment behaviors, they were not eligible to participate in the study. Additionally, characteristics of the individual include if they have Wi-Fi at their primary residence, own a smartphone with permission to install applications, and are generally aware of how much electricity their residence uses monthly. These additional characteristics, however, were not reasons for disqualification but were collected and evaluated for any outliers. This population is inclusive of all generational representations provided they meet the above noted curtailment characteristic for their primary residence, even if said residence is a rental property. For example, an 18-year-old who is renting an apartment while attending college, has no idea how much energy they use monthly, owns a smartphone, can install apps on their smartphone, has permission to connect devices to the apartment Wi-Fi, and can contribute to using less energy in their apartment would meet the requirements and could participate in the study. Whereas if the same 18-year-old, for some reason, could not contribute to curtailment behaviors, they would not meet the requirements and could not participate in the study. In all cases, eligibility questions will be used to determine if the participants meet the population of interest criteria.

Sample Size

This research required four separate sample sizes – one for each phase.

Phase	Name	Sample Size Target	Sample Size Achieved
1	Informed Pilot	5	12
2	Technical Validation	10	16
3	Pilot Test	75	80
4	Dissertation Research Study	385	427

Table 1: Sample Size per Research Design Phase

Phase 1: Informed Pilot had a target of meeting with a total of 5 people at one time over a video conference call. Invitations went to 14 individuals. A total of twelve people provided feedback - 5 people participated in feedback via zoom meetings and 7 individuals filled out the online survey and provided written qualitative feedback within each section. In preparation for the zoom meetings, 3 of the 5 zoom participants also filled out the online survey ahead of the zoom meeting.

Phase 2: Technical Validation had a target of collecting data from 10 people. An invitation email, which contained a link to the initial survey instrument, was distributed to five participants on October 15th, 2023, and to fourteen participants on November 4th, 2023. The October 15th technical validation participants data was used for initial average timing estimates for the pilot study. The November 4th technical validation participants experienced the EFA reduced online survey, which included informed pilot and dissertation chair feedback adjustments. A total of sixteen responses were collected – 4 from the October 15th invitation and 12 from the November 4th invitation.

Phase 3: Pilot Study had a target of collecting data from 75 people. The online survey was launched on October 17th, 2023 at 730am and collected 105 responses. After data quality validations occurred (detailed in Phase 3: Pilot Study - Process Steps), 80 responses remained as usable.

Phase 4: Dissertation Research Study had a target of collecting valid responses from no less than 385 fully randomized participants. This quantity of participants was required due to the number of hypotheses being tested, the large population size, the target confidence level, and the target margin of error, and confidence intervals. The minimum sample size of 385 was determined by using the Qualtrics Sample Size calculator (Qualtrics, 2022b) with the following parameters: Confidence Level: 95%; Margin of Error/Confidence Interval: 5%; Population Size: 136.7M (target population: # of residential Electric customers in the United States (US Department Of Energy & US Energy Information Administration, 2021)). Ideally the researcher desired to collect between 500-600 valid randomized survey responses with representation distribution across the United States. 519 responses were collected between November 8th and 11th,

2023. After applying the same data quality validation technique as Phase 3: Pilot Study - Process Steps, 427 valid responses remained for analysis.

Instrumentation and Measurements

Instrumentation

The primary instrument for all four phases of the research was a questionnaire constructed and administered online via Qualtrics. Upon review of the other data collection approaches, this researcher believed that an online questionnaire was the best instrumentation approach for this research. Qualtrics was selected primarily due to its popularity, usability, researcher familiarity, and FIU provided access for students.

Additional software programs were used to gather, quality check, validate, analyze, and ultimately report and present the results from the completed online survey questionnaire. The software programs that were used included IBM SPSS v.28, Microsoft Excel, Microsoft Word, Microsoft PowerPoint, and Google Maps. Exploratory Factor Analysis, Reliability, and a confirmatory analysis was conducted via SPSS primarily because of the tools statistical power and the researcher's familiarity and comfort with SPSS. As applicable, SPSS's ability to export result graphs and charts was used. Excel was used for quality checking the raw data from the completed Qualtrics questionnaires. Excel was also leveraged to create visual presentations of the data. Microsoft Word was used to document the research and Microsoft PowerPoint was used to present the findings as part of the final dissertation defense. Google Maps was used to determine the International Energy Conservation Code (IECC) Climate Region (Baechler et al., 2010), noted in Figure 23, based on the zip code provided by the survey respondent. Lastly, post ad-hoc analysis was performed and visualized within IBM SPSS v.28 leveraging the Process v4.2 Macro; interactions Model #1 (Hayes, 2022, 2023).

Instrument Design

The survey instrument was divided into three main sections. The initial section verified the respondent was human, presented the screening questions, presented the FIU consent form, and then verified the respondent understood the purpose of the survey. Provided the participant met the Population of Interest characteristics (BOT check and screening question), gave consent, and answered the Purpose question correctly, they proceeded to the 2nd section. Otherwise, they were routed to either a customized Voluntary Exit or customized Screening Failed end of the survey message and did not receive remuneration in either case. The second section presented the research construct items starting with the dependent variable, Intention, then followed with the constructs of Habits, Energy Concern, Electricity Savings Knowledge, Environmental Awareness, Attitude, Subjective Norms, Personal Moral Norms, Perceived Behavioral Control, Thermal Comfort, Affect, Notification Channel, Timeliness of Notification, Degree of Personalization, Degree of Gamification, and finally Personality (Five-Factor Model). The third and final section were the demographic questions around the participant's Zip code, Age, Biological Gender, Education, Income and Residential Ownership. Upon finishing the last question, the subjects were automatically re-directed to Connect™ by CloudResearch.com where they could voluntarily provide feedback and rate the survey on a scale of 1 to 5 stars. Please see the Appendices for some of these feedback reviews and metrics (e.g., Table D. 2, Pilot_1 Participant Feedback)

Participants were informed that their participation in this research is voluntary, and they will not be penalized if they refuse to participate or decide to stop. If they felt uncomfortable for any reason, the participants may exit the survey at any point in time.

Measurements

Definitions of the below constructs have been provided above in the Research Model Constructs section and are not repeated. All items presented below were used in Phases 1 through 3. Results of the EFA performed in Phase 3, and the resultant reduction in construct items and numbering, are discussed within the Phase 3: Pilot Study subsection of V. Data Analysis and Results. Unless noted differently below, all construct measurements used a 5-point Likert scale (5 = Strongly Agree, 1 = Strongly Disagree). Reverse coded items were used as an intervention to avoid automatic or same response patterns as recommended by Podsakoff et al., (2003). If an item was reverse coded, it is noted and each have an asterisk beside the Item# within the respective table (e.g., ATT4*)[1]. Use of a 5-point Likert was based on prior operationalizations, noted for each construct, and statistical findings and recommendations from Dawes (2008).

Since prior research items were focused on energy savings (i.e., kWh) associated with monthly usage or billing, our items were modified to reflect our research interest of electrical demand (i.e., kW) reduction during common peak demand episodes faced by electric utilities (i.e., 6am-9am and 4pm-7pm). Please see Energy Consumption - Foundational Understandings for a review of the difference between kWh and kW.

[1] The use of an asterisk beside an Item# is only used within the table to note the reverse coded item.

Dependent Variable

Intention to Curtail Electric Energy Demand at Primary Residence

An individual's "Intention to Voluntarily Curtail Electric Energy Demand at their Primary Residence during an Electric Utility Peak Demand Time Period" is the Dependent Variable (DV) in this dissertation research. A total of eight questions were posed and are based on the Behavior Intention question structure, suggested in both Ajzen (1991) and

Construct	Item#	Item
Intention to Curtail Electric Energy Demand at Primary Residence (INT)	INT1	I intent to engage in electric energy demand curtailment actions at home
	INT2	I will endeavor to curtail electric energy demand in my home
	INT3	I intend to unplug easily assessable electronics when they are not being used
	INT4	I intend to turn off lights when they are not being used
	INT5	I intend to adjust my cooling/heating thermostat settings to save electricity
	INT6	I intend to turn off electronics when they are not being used (TVs, computers, laptops, etc)
	INT7	Before we leave our home, I intend to turn up/down my cooling/heating equipment to use less electricity
	INT8	I am willing to follow electric demand curtailment suggestions for my primary residence

Table 2: Intention Construct Items

Triandis (1977), as well as prior operationalization of this construct in the context of energy savings intention (Chen & Knight, 2014; Du & Pan, 2022; Gao et al., 2017; Hien & Chi, 2020; Milfont & Sibley, 2012; Qalati et al., 2022; S. Wang et al., 2018).

Independent Variables

Energy Concern

A total of eight questions were posed and are based on the support noted in the Literature Review of this construct. Our operationalization of Energy Concern leveraged the operationalization of this construct from Chen & Knight (2014) and Li et al., (2020).

Construct	**Item#**	**Item**
Energy Concern (ECN)	ECN1	I am concerned about the availability of energy resources
	ECN2	I am concerned about an electricity shortage
	ECN3	I am concerned about a lack of electricity for my
	ECN4	I am concerned about wasting electricity at home
	ECN5	I am concerned about electricity consumption
	ECN6	I am concerned about the state of the U.S. electrical grid's ability to provide electricity when called upon
	ECN7	I am concerned about my utility's electrical grid's ability to provide electricity when I want to use it
	ECN8	I am concerned about the availability of electricity for my home

Table 3: Energy Concern Construct Items

Electricity Savings Knowledge

A total of eight questions were posed and are based on the support noted in the Literature Review of this construct. One item (ESK6) was reverse coded. Our

Construct	Item#	Item
Electricity Savings Knowledge (ESK)	ESK1	I know which home appliances waste more electricity.
	ESK2	I am a person with more electricity-saving knowledge in comparison with other people.
	ESK3	I know the meaning of the energy usage labels affixed to my home's appliances
	ESK4	Electricity can be saved if I switch off the lights when not in use.
	ESK5	Electricity can be saved if I switch off phone chargers when not in use.
	ESK6*	Electricity can be saved if I leave a television on
	ESK7	Electricity can be saved if I switch off the computer when not in use.
	ESK8	Depended on the season, electricity can be saved if I adjust my home's thermostat setting

Table 4: Electricity Savings Knowledge Construct Items

operationalization of Electricity Savings Knowledge leveraged the operationalization of this construct from Z.Wang et al.,(2014), Lai et al., (2016), and Mahat et al., (2019).

Environmental Awareness

A total of fifteen (15) questions were used and are taken directly from the New Ecological Paradigm Scale (NEP) (Dunlap et al., 2000). No modifications were made to

Construct	Item#	Item
Environmental Awareness (NEP)	NEP1	We are approaching the limit of the number of people the Earth can support.
	NEP2*	Humans have the right to modify the natural environment to suit their needs.
	NEP3	When humans interfere with nature it often produces disastrous consequences
	NEP4*	Human ingenuity will insure that we do not make the Earth unlivable
	NEP5	Humans are seriously abusing the environment
	NEP6*	The Earth has plenty of natural resources if we just learn how to develop them
	NEP7	Plants and animals have as much right as humans to exist
	NEP9*	The balance of nature is strong enough to cope with the impacts of modern industrial nations
	NEP10	Despite our special abilities, humans are still subject to the laws of nature
	NEP11*	The so-called "ecological crisis" facing humankind has been greatly exaggerated
	NEP12	The Earth is like a spaceship with very limited room and resources
	NEP13*	Humans were meant to rule over the rest of nature
	NEP14	The balance of nature is very delicate and easily upset
	NEP15*	Humans will eventually learn enough about how nature works to be able to control it
	NEP16	If things continue on their present course, we will soon experience a major ecological catastrophe

Table 5: Environmental Awareness Construct Items

the items. The NEP uses a 5-point Likert scale (5 = Strongly Agree, 1 = Strongly Disagree), and seven items (NEP2, NEP4, NEP6, NEP9, NEP11, NEP13, and NEP15) are reverse coded. Within the survey instrument during Phases 1 through 3, we placed an attention check question in place of NEP8.

Mediator Variables

Attitude toward Electric Demand Curtailment

A total of eight questions were posed for this construct. These are based on the Attitude question structure suggested by both Ajzen (1991) and Triandis (1977) and prior operationalization of this construct in the context of energy savings (Abrahamse & Steg, 2009; Chen et al., 2017; Chen & Knight, 2014; Du & Pan, 2022; Gao et al., 2017; Hien & Chi, 2020; Li et al., 2020; Nie et al., 2019; Qalati et al., 2022; Q.-C. Wang et al., 2021; S. Wang et al., 2018). Each question was presented starting with the phrase "Using less electricity in my home between the hours of 6am-9am and 4pm-7pm ...” and was followed by a phrase to which the respondent indicated their level of agreement (e.g., Figure E. 4, Figure E. 11). Seven items (ATT1, ATT2, ATT3, ATT4, ATT5, ATT7, and ATT8) were reverse coded.

Construct	Item#	Item
	Using less electricity in my home between the hours of 6am-9am and 4pm-7pm ...	
Attitude toward Electric Demand Curtailment (ATT)	ATT1*	….is a waste of my time
	ATT2*	….is too much of a hastle
	ATT3*	….takes up too much of my time
	ATT4*	….is a waste of my money
	ATT5*	….is troublesome
	ATT6	….is valuable
	ATT7*	….means I will live less comfortably
	ATT8*	….means my quality of life will decrease

Table 6: Attitude Construct Items

Perceived Approval of Significant Others towards Electric Demand Curtailment

“Perceived Approval of Significant Others towards Electric Energy Demand Curtailment” is an operationalization of Injunctive Norms (INM), an aspect of Social

Construct	Item#	Item
Perceived Approval of Significant Others towards Electric Demand Curtailment (INM)	INM1	I think that many people who mean a lot to me expect me to use less electricity at home.
	INM2	Most of my family members expect me use less electricity at home.
	INM3	Most of my close friends expect me to use less electricity at home.
	INM4	My relatives think that I should use less electricity at home.
	INM5	My family thinks that I should use less electricity at home.
	INM6	My friends think I should use less electricity at home.
	INM7	My neighbors think that I should use less electricity at home.
	INM8	Other people who are important to me think I should use less electricity at home.

Table 7: Injunctive Norms Construct Items

Factors. A total of eight questions were posed and are based on the Subjective Norms (SNM) question structure suggested by Ajzen (1991) and Norms/Social Factors by Triandis (1977). We used prior operationalization of this construct where the prior researchers were using the Theory of Planned Behavior in the context of energy savings (Chen et al., 2017; Chen & Knight, 2014; Du & Pan, 2022; Gao et al., 2017; Hien & Chi, 2020; Li et al., 2020; Nie et al., 2019; Qalati et al., 2022; Q.-C. Wang et al., 2021; S. Wang et al., 2018).

Perceived Prevalence of Significant Others actual Electric Energy Demand Curtailment

"Perceived Prevalence of Significant Others actual Electric Energy Demand Curtailment" is an operationalization of Descriptive Norms (DNM), an aspect of Social Factors. A total of eight questions were posed and are based on the Norms question structure suggested by Ajzen (1991) and Triandis (1977). We used prior operationalization

Construct	Item#	Item
	Between the hours of 6am-9am and 4pm-7pm ...	
Perceived Prevalence of Significant Others actual Electric Energy Demand Curtailment (DNM)	DNM1	…people around me have curtailed their electric energy demand..during peak demand time periods
	DNM2	…most people who are important to me do curtail their electric energy demand..during peak demand time periods
	DNM3	…people important to me have curtailed their electric energy demand..during peak demand time periods
	DNM4	…my friends have curtailed their electric energy demand..during peak demand time periods
	DNM5	…my relatives have curtailed their electric energy demand..during peak demand time periods
	DNM6	…my parents have taken actions to curtail their electric energy demand..during peak demand time periods
	DNM8	…my colleagues have taken actions to curtail their electric energy demand
	DNM9	…others who are important to me have participated in electric energy demand curtailment behaviors

Table 8: Descriptive Norms Construct Items

of this construct where the prior researchers were using Descriptive Norms (not Injunctive Norms) as an extension to the Theory of Planned Behavior in the context of energy savings (Gao et al., 2017; Qalati et al., 2022; Tang et al., 2019). Each question started with the phrase “Between the hours of 6am-9am and 4pm-7pm ...” and was followed by a phrase to which the respondent was to indicate their level of agreement. Within the survey instrument during Phases 1 through 3, we placed an attention check question in place of DNM7.

Personal Moral Norms towards Electric Demand Curtailment

A total of eight questions were posed to measure the construct of Personal Moral Norms (PMN). Questions were based on the Norms question structure suggested by Ajzen (1991) and Triandis (1977). We used prior operationalization of this construct where the prior researchers were using Personal Moral Norms as an extension to the Theory of

Construct	Item#	Item
Personal Moral Norms towards Electric Demand Curtailment (PMN)	PMN1	I feel morally obliged to curtail my electric energy demand, regardless of what other people do
	PMN2*	I do not feel guilty when I use a lot of electricity all at once
	PMN3	I use electricity sparingly even though people around me do not
	PMN4	Wasting electricity in my home would go against my principles
	PMN5	I would feel guilty if I did not practice electric energy demand curtailment behaviors in my home
	PMN6	I believe that I have a moral obligation to curtail the electricity use in my home
	PMN7	It is my moral obligation to power off electrical appliances when not in use
	PMN8	I think I have a moral responsibility to curtail the electricity use in my home

Table 9: Personal Moral Norms Construct Items

Planned Behavior in the context of energy savings (Du & Pan, 2022; Gao et al., 2017; Hien & Chi, 2020; Kácha & Van Der Linden, 2021; Li et al., 2020; Lopes et al., 2019; Qalati et al., 2022; Sia & Jose, 2019; S. Wang et al., 2018). One item (PMN2) was reverse coded.

Perceived Behavioral Control over Electric Demand Curtailment

To measure “Perceived Behavioral Control over Electric Demand Curtailment”, a total of eight questions were utilized. The items were based on the Perceived Behavioral Control (PBC) question structure suggested by Ajzen (1991). We used prior operationalization of this construct where the prior researchers were using either the Theory of Planned Behavior or an extension TPB in the context of energy savings (Chen et al., 2017; Chen & Knight, 2014; Du & Pan, 2022; Gao et al., 2017; Hien & Chi, 2020;

Construct	Item#	Item
Perceived Behavioral Control over Electric Demand Curtailment within the Primary Residence (PBC)	PBC1	I am certain that I am able to use less electricity at home.
	PBC2*	I don't know when I should use less electricity at home.
	PBC3*	I think it's too difficult to reduce electricity use at my home.
	PBC4	I can control whether my household saves electricity or not.
	PBC5	I believe that I am capable of using less electricity at my
	PBC6	I know how to use less electricity at my home.
	PBC7*	I don't have enough time to perform electricity use saving actions at my home.
	PBC8*	I don't have enough money to spend on what I think it would take to perform electricity saving actions in my home.

Table 10: Perceived Behavioral Control Construct Items

Li et al., 2020; Lopes et al., 2019; Nie et al., 2019; Qalati et al., 2022; Q.-C. Wang et al., 2021; S. Wang et al., 2018). Ajzen (1985) discussed aspects of time, money, skills, and cooperation of others being additional relevant aspects. We observed that no prior research in our context operationalized aspects of time or money. As a result, this researcher created and added items PBC7 and PBC8 to account for these relevant aspects in our context. Four items (PBC2, PBC3, PBC7, and PBC8) were reverse coded.

Feelings Engendered towards performing Electric Demand Curtailment within the Primary Residence

"Feelings Engendered towards Electric Demand Curtailment" is an operationalization of the theoretical construct Affect (AFF) from Triandis (1977, 1979). Eight questions/words were presented based on the prior operationalizations in different applications (Bamberg & Schmidt, 2003; Boyd & Wandersman, 1991; Godin et al., 1996; Valois et al., 1988) with Bamberg & Schmidt (2003) being the closest in context because it dealt with pro-environmental behaviors. Each question was presented starting with "Imagine that you are actively reducing the electricity used in your home. When you think about this, which of the following words best describes the emotions or moods that you feel?" and was followed by a single word to which the respondent indicated the degree to which that word described their feeling engendered. Measurements used a 5-point Likert scale (5 = Completely describes, 1 = Does not describe) via a slider scale (Figure E. 5). Five items were created for this dissertation research (AFF3, AFF4, AFF5, AFF6, and AFF7) and four of these were reverse coded as noted in Table 11.

Construct	**Item#**	**Item**
Feelings Engendered towards performing Electric Demand Curtailment within the Primary Residence (AFF)		Imagine that you are actively reducing the electricity used in your home. When you think about this, which of the follwing words best describes the emotions or moods that you feel?
	AFF1	Excited
	AFF2	Delighted
	AFF3*	Displeased
	AFF4*	Insecure
	AFF5*	Frustrated
	AFF6*	Perplexed
	AFF7	Relieved
	AFF8	Proud

Table 11: Affect Construct Items

Moderator Variables

Personality: Five-Factor Model (FFM)

Personality is an omnibus construct that represents an individual's personality. To measure an individual's personality we employed the NEO Personality Inventory - Revised series of questions NEO-PI-R & NEO-PI-3; (Costa Jr. & McCrae, 1997; Costa & McCrae, 1992, 2008; McCrae et al., 2005; McCrae & John, 1992; Piedmont, 1998). Both the 60 item and 240 item versions of the NEO Five-Factor Inventory (Form S) are provided in the Appendices. Modifications were made to our dissertation items to incorporate the NEO-PI-3 modifications (McCrae et al., 2005, pp. 269–270) with the 60 item NEO inventory because *NEO-PI-3 scales appear to offer a slight improvement* (McCrae et al., 2005, p.

Construct	Item#	Item
Personality - Openness (PO)	PO1*	I don't like to waste my time daydreaming.
	PO2*	I like the old-fashioned methods I'm used to.
	PO3	I am intrigued by the patterns I find in art and nature.
	PO4*	I believe letting students hear controversial speakers can only confuse and mislead them.
	PO5*	Poetry has little or no effect on me.
	PO6	I often try new and foreign foods.
	PO7*	I seldom notice the moods or feelings that different environments produce.
	PO8*	I believe we should look to our religious authorities for decisions on moral issues.
	PO9	Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.
	PO10*	I have little interest in speculating on the nature of the universe or the human condition.
	PO11	I have a lot of intellectual curiosity.
	PO12	I often enjoy playing with theories or abstract ideas.

Table 12: Personality - Openness Construct Items

264) and *the NEO-PI-3 was designed chiefly for individuals with limited vocabularies* (McCrae et al., 2005, p. 266). Given our Population of Interest encompasses the entire US general population, a more readable instrument is desired and *NEO-PI-3 can appropriately be used for* ages 14 and up (McCrae et al., 2005, p. 268). The NEO-PI-R and NEO-PI-3 both use a 5-point Likert scale (5 = Strongly Agree, 1 = Strongly Disagree). A total of twenty-seven items are reverse coded in our research as noted by an asterisk beside the Item# in Table 12, Table 13, Table 14, Table 15, and Table 16.

Construct	Item#	Item
Personality - Conscientiousness (PC)	PC1	I keep my belongings clean and neat.
	PC2	I'm pretty good about pacing myself so as to get things done on time.
	PC3*	I'm not a very orderly or methodical person
	PC4	I try to perform all the tasks assigned to me conscientiously.
	PC5	I have a clear set of goals and work toward them in an orderly fashion.
	PC6*	I waste a lot of time before settling down to work.
	PC7	I work hard to accomplish my goals.
	PC8	When I make a commitment, I can always be counted on to follow through.
	PC9*	Sometimes I'm not as dependable or reliable as I should be.
	PC10	I am a productive person who always gets the job done.
	PC11*	I never seem to be able to get organized
	PC12	I strive for excellence in everything I do.

Table 13: Personality - Conscientiousness Construct Items

Construct	Item#	Item
Personality - Extraversion (PE)	PE1	I like to have a lot of people around me.
	PE2	I laugh easily.
	PE3*	I'm not happy-go-lucky
	PE4	I really enjoy-talking to people.
	PE5	I like to be where the action is.
	PE6*	I usually prefer to do things alone.
	PE7	I often feel as if I'm bursting with energy.
	PE8	I am a cheerful, high-spirited person.
	PE9*	I am not a cheerful optimist.
	PE10	My life is fast-paced.
	PE11	I am a very active person.
	PE12*	I would rather go my own way than be a leader of others.

Table 14: Personality - Extraversion Construct Items

Construct	Item#	Item
Personality - Agreeableness (PA)	PA1	I try to be courteous to everyone I meet.
	PA2*	I sometimes get into arguments.
	PA3*	Some people think I'm selfish and egotistical.
	PA4	I would rather cooperate with others than compete with them.
	PA5*	Often, people aren't as nice as they seem to be
	PA6*	I believe that most people will take advantage of you if you let them
	PA7	Most people I know like me.
	PA8*	Some people think of me as cold and calculating.
	PA9*	I don't worry much about the homeless
	PA10	I generally try to be thoughtful and considerate.
	PA11*	If I don't like people, I let them know it.
	PA12*	If necessary, I am willing to manipulate people to get what I want.

Table 15: Personality - Agreeableness Construct Items

Construct	Item#	Item
Personality - Neuroticism (PN)	PN1*	I am not a worrier.
	PN2	I often feel that I am not as good as others
	PN3	When I'm under a great deal of stress, sometimes I feel like I'm going to pieces
	PN4*	I rarely feel lonely or blue.
	PN5	I often feel tense and jittery.
	PN6	Sometimes I feel completely worthless.
	PN7*	I rarely feel fearful or anxious.
	PN8	I often get angry at the way people treat me.
	PN9	Too often, when things go wrong, I get discouraged and feel like giving up.
	PN10*	I am seldom sad or depressed.
	PN11	I often feel helpless and want someone else to solve my problems.
	PN12	At times I have been so ashamed I just wanted to hide.

Table 16: Personality - Neuroticism Construct Items

Financial Incentives towards Electric Demand Curtailment

"Financial Incentives towards Electric Demand Curtailment" is an operationalization of the Extrinsic Reward construct. To our knowledge, this is the first time that financial incentives towards electricity demand curtailment has been operationalized in this manner for academic research in our context. A total of eight questions were created by the researcher and posed as part of Phases 1 through 3. The eight questions were based on 1) the theories in the Literature Review section that discuss extrinsic motivation and 2) a member of the Stakeholder Engagement provided examples of Financial Incentives that are offered today towards energy savings and demand curtailment. The measure was presented with the following scenario for the respondent to read:

Imagine that your electric utility has notified you that this coming Thursday, between 4pm and 7pm only, you have the opportunity to participate in a voluntary reward program where you will get a discount on your upcoming bill depending on how much electricity you voluntarily save during that time. On Thursday, between 4pm and 7pm, you voluntarily use less electricity by turning off lights, unplugging a few unused electronics, adjusting your home's temperature setting (just till 7pm), and a few other electricity saving tasks you consider easy to perform.

Respondents in Phase 4 were randomly assigned to either get a 20% reward (FIN20) or a 5% reward (FIN05). The instrument was setup to attain an even distribution between FIN20 and FIN05. Depending on their random assignment, respondents were presented with the following to read:

<u>FIN20</u>

> *Based on your electricity saving actions from that day, your electric utility determines you qualified for a 20% reward discount off your utility bill that month. Let's assume your electricity bill for the month would have normally been $300. You receive a $60 reward discount credit, and your electric utility bill is now $240.*

<u>FIN05</u>

> *Based on your electricity saving actions from that day, your electric utility determines you qualified for a 5% reward discount off your utility bill that month. Let's assume your electricity bill for the month would have normally been $300. You receive a $15 reward discount credit, and your electric utility bill is now $285.*

In Phase 1 through 3, participants were only presented FIN20. Respondents were then asked to indicate their level of agreement with the items. One item (FIN20_9 or

Construct	Item#	Item
Financial Incentives towards Electric Demand Curtailment (FIN20 & FIN05)	FIN20_1 & FIN05_1	I think the financial reward would provide me with clarity on when I could use less electricity.
	FIN20_2 & FIN05_2	I think the financial reward would help cover the cost of our electricity bill
	FIN20_3 & FIN05_3	Being provided with the financial reward might make it worth my while to temporarily reduce our home's electricity use
	FIN20_4 & FIN05_4	I believe the financial reward would make it easier for me to perform electricity reduction tasks at home
	FIN20_6 & FIN05_6	The financial reward is meaningful to me
	FIN20_7 & FIN05_7	The financial reward has an impact on our electricity bill
	FIN20_8 & FIN05_8	Because of the financial reward I would use less electricity during the reward time period
	FIN20_9* & FIN05_9*	No matter the percentage of the financial reward, I would not change my electricity use during the reward time period

Table 17: Extrinsic Reward Construct Items

FIN05_9) was reverse coded. An attention check question was placed in FIN20_5 (e.g.,

Figure E. 6) or FIN05_5. If the moderation is found to be significant, the individual components (FIN20 & FIN05) will be further evaluated.

Age

Age was determined by asking the respondent "How old are you?" and were presented with seven different age ranges to select from.

Demographic	Option #	
Age	1	Under 18
	2	18-24 years old
	3	25-34 years old
	4	35-44 years old
	5	45-54 years old
	6	55-64 years old
	7	65+ years old

Table 18: Age Demographic Options

Degree of Need for Thermal Comfort

The construct Degree of Need for Thermal Comfort is an omnibus construct that is an operationalization of Thermal Comfort (TC) that this researcher has termed Need for Thermal Comfort (NTC). A total of twelve questions were posed as part of Phases 1

Construct	Item#	Item
Thermal Comfort - Coolness (TCC)	TCC1	I find I cannot relax or work well unless the house is air conditioned in the
	TCC2	I have trouble falling asleep at night without an air conditioner on
	TCC3	While others might turn off their air conditioners in the summer, my need for being cool is high
	TCC4	It's not worth having the house warm in the summer just to try to save a little money
	TCC5	I would be very uncomfortable in the summer if I turned my usual daytime thermostat setting up three degrees
	TCC6	It is just too uncomfortable to have my indoor temperature more than 75∘F (23∘C) in summer months

Table 19: Thermal Comfort - Coolness Construct Items

through 3, six for coolness (TCC) and six for warmth (TCW). Our operationalization of

Degree of Need for Thermal Comfort leveraged the operationalization from Chen et al.,

Construct	Item#	Item
Thermal Comfort - Warmth (TCW)	TCW1	I find I cannot relax or work well unless the house is warm in the winter
	TCW2*	I am willing to wear heavier clothes indoors this winter so that I can set my thermostat lower than I otherwise could
	TCW3	While others might tolerate lowering their thermostat settings in the winter, my need for being warm is high
	TCW4	It's not worth having the house a little chilly in the winter just to try to save a little money
	TCW5	I would be very uncomfortable in the winter if I turned my usual daytime thermostat setting down three degrees
	TCW6	It is just too uncomfortable to have my indoor temperature less than 70◦F (21◦C) in winter months

Table 20: Thermal Comfort - Warmth Construct Items

(2017) whose base theory was the Theory of Planned Behavior. However, Chen et al., (2017) only had 2 items for TCW and 3 items for TCC. As a result, additional items were added for this dissertation research with inspiration from the ten TC items found within Becker et al., (1981). One TCW item (TCW2) was reverse coded. Since this is being treated as an omnibus construct, if the moderation is found to be significant, the individual components (TCC & TCW) will be further evaluated.

Gender

Gender of the survey respondent was determined by an item that asked, "What is your gender (biological)?" with possible replies: Male, Female.

Notification Channel

To our knowledge, this is the first time that notification channel has been operationalized in this manner for academic research in our context. A total of eight questions were created by the researcher and posed in all Phases. The eight questions were based on 1) the theories and industry best practices in the Literature Review section that discuss Feedback / Notification Channel and 2) members of the Stakeholder Engagement provided examples of notification channel options their customers are provided. Notification Channels considered in this study are via a Smartphone Application (App) notification, an e-mail, and a letter sent via the postal service. While the Stakeholder Engagement members noted they also provide a text messaging notification option to their customers, this research considered receiving a text message like receiving a notification via a smartphone app. As a result, we limited our notification channel options to three channels. The respondent was asked to:

> *Imagine that you want to be alerted by your electric utility of upcoming voluntary electricity savings opportunities with suggestions about how you could reduce electricity during those times.*

They were then required to order a list, via a Qualtrics drag and drop rank order question, on how they *would most like to receive the notifications*. The list contained three items presented in the following order: 1) A letter mailed to me at home, 2) An app on my smartphone, 3) My preferred email address (Figure E. 7). After they ordered the list, they were then presented the eight researcher developed items with a custom prompt based on their top preferred notification channel. The eight notification channel items were identical between channels. If their preferred method was a smartphone App the items were coded NCA#, NCE# for email, and NCL# for letter. Table 21 reflects the items and manner in which the custom prompt with eight items were presented to a respondent who had selected a smartphone App as their preferred notification channel. The only difference between what was presented between respondents was the custom prompt based on their preferred notification channel. The custom prompt was in bold, had their preferred method underlined, and the full custom prompt read either "I believe receiving notifications via an app on my smartphone would ….", "I believe receiving notifications via my preferred email address would ….", or "I believe receiving notifications via a letter mailed to me at

Construct	Item#	Item
		"I believe receiving notifications via an app on my smartphone would ….
Notification Channel via an App (NCA)	NCA1	… allow me to better manage using less electricity at home.
	NCA2	… be my preferred manner of notifications regarding upcoming opportunities to use less electricity.
	NCA3	… allow me to plan for using less electricity.
	NCA4	… provide me with greater awareness about the times when I could use less
	NCA5	… give me greater control over my electricity use.
	NCA6	… make it easy for me to participate in electricity savings tasks at home.
	NCA7	… give me greater knowledge about upcoming electricity savings opportunities.
	NCA8	… be my preferred manner of notifications regarding how I can save electricity during specific times of the day.

Table 21: Notification Channel Construct Items – Smartphone APP

home would ….". For the moderation calculation, we will treat Notification as an omnibus construct. If the moderation is found to be significant, the individual components will be further evaluated.

Education

The education of the survey respondent was determined by an item that asked, "What is the highest level of school you have completed or the highest degree you have received" (Qualtrics, 2022a) with possible replies: Less than a high school degree, High school graduate (high school diploma or equivalent including GED), Some college but no degree, Associate degree in college (2-year), Bachelor's degree in college or university (4-year), Master's degree, Doctoral degree.

Electric Energy Curtailment Habits

"Electric Energy Curtailment Habits" is an operationalization of the theoretical construct Habits (HAB) from Triandis (1977, 1979). Twelve questions were asked of the respondents as part of Phases 1 through 3. The twelve items are based on examples where past researchers have either worked with the Theory of Interpersonal Behavior or have added a Habits construct to an extension of the Theory of Planned Behavior. Our operationalization of Electric Energy Curtailment Habits took inspiration and leveraged operationalizations previously done by Li et al., (2020), S.Wang et al., (2018), Verplanken & Orbell (2003). Additional inspiration came from past research that used the Theory of Planned Behavior in the context of energy savings behaviors (Hien & Chi, 2020; Jaciow et al., 2022; Qalati et al., 2022) or operationalized Habits for their unique contexts (Ouellette & Wood, 1998; Venkatesh et al., 2012; Verplanken et al., 1998; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). The habits measure was presented with the following setup for the respondent to read:

> *Turning off lights, closing curtains, running your dishwasher before bed, adjusting your thermostat, and turning off electronics when not in use may have become part of your normal routine. It may have become so routine that you might do many other electricity reducing actions around your home without even thinking about it.*
> *With that in mind, please indicate your level of agreement with the following statements:*

Each question started with the phrase "Using less electricity at home is something …" and was followed by a phrase to which the respondent was to indicate their level of agreement.

Construct	Item#	Item
	Using less electricity at home is something …	
Electric Energy Curtailment Habits (HAB)	HAB1	... I do frequently.
	HAB2	... I do automatically.
	HAB3	... I do without having to consciously remember.
	HAB4	... that makes me feel weird if I do not do it.
	HAB5	... I do without thinking.
	HAB6	... that would require effort not to do it.
	HAB7	... that belongs to my (daily, weekly, monthly)
	HAB8	... I start doing before I realize I'm doing it.
	HAB9	... I would find hard not to do.
	HAB10	... I have no need to think about doing.
	HAB11	... that's typically "me."
	HAB12	... I have been doing for a long time.

Table 22: Habits Construct Items

Three-way Moderation Variables

Timeliness of Notification

To our knowledge, this is the first time that timeliness of notification has been operationalized in this manner for academic research in our context. A total of eight

Construct	Item#	Item
Timeliness of Notification (TON)	TON1	I need to be notified about voluntary electricity saving opportunities in a very timely manner.
	TON2	If I'm going to participate in voluntarily using less electricity, I need to alerted as close to the time as possible (i.e., near real-time).
	TON3	Making me aware of electricity savings opportunities needs to be at the right time.
	TON4	Alerting me about specific electricity savings times a month ahead of time doesn't help me use less electricity during those times.
	TON5	If I was informed in a timely manner I would have enough time to act on using less electricity.
	TON6	By informing me timely, it makes it easier for me to use less electricity in my home during those time periods.
	TON7	The timeliness of the electricity savings notification is important to
	TON8	A timely notification gives me greater control over using less electricity at home.

Table 23: Timeliness of Notification Construct Items

questions were created by the researcher to measure timeliness of notifications (TON). The eight questions were based on 1) the theories and industry best practices in the Literature Review section that discuss Feedback / Notification Channel. Namely, the best practices noted in the Influencers of Energy Behavior, Feedback / Notification Channel where Fisher (2008) summarizes that the most successful feedback *–is given frequently (ideally daily or more)*. Within the survey instrument, the TON section followed the Notification Channel section. At the onset of the TON section the respondent was asked to:

> *Imagine that you are now receiving notifications about these upcoming voluntary electricity savings opportunities with suggestions about how you could reduce electricity during those times.*

Respondents were then asked to indicate their level of agreement with the items.

Degree of Personalization in Notification

To our knowledge, this is the first time that degree of personalization in

Construct	Item#	Item
Degree of Personalization in Notification (DPN)	DPN1	Personalization of the notification is important to me.
	DPN2	A personalized recommendation is more valuable to me than a basic recommendation.
	DPN3	I would prefer the notification message to be personalized.
	DPN4	Personalization of the notification message provides me with better insights into how I can use less electricity.
	DPN5	I believe that if the notification was personalized I would consider trying the electricity saving recommendation.
	DPN6	Personalization of the message would help me reduce electricity use in my home.
	DPN7	By personalizing the notification message it makes it easier for me to participate in electricity savings at my home.
	DPN8	A personalized notification provides me with greater clarity into how I can manage my electricity use at home.

Table 24: Degree of Personalization in Notification Construct Items

notifications (DPN) has been operationalized in this manner for academic research in our context. A total of eight questions were created by the researcher to measure DPN. The eight questions were based on 1) the theories and industry best practices in the Literature Review section that discuss Feedback / Notification Channel. Namely, the best practices noted in the Influencers of Energy Behavior, Feedback / Notification Channel where Fisher (2008) summarizes that the most successful feedback has actual consumption, appliance-specific breakdown, involves interaction, and is understandable. Within the survey instrument, the DPN section followed the TON section. At the onset of the DPN section the respondent was asked to:

Continue to imagine that you are now receiving the notifications from your electric utility.

A couple basic notification examples could be:
** you may want to consider turning off lights and other electronics when you leave an empty room.*
** you may want to consider adjusting your home's temperature by 5 degrees when you leave your home for a few hours.*

A personalized notification would be specific to your home. A couple personalized notification examples could be:
** the data seems to indicate you use a dishwasher around 630pm most nights. If you can delay your dishwasher to run at 9pm instead you'd save...*
** the data seems to indicate that your furnace is using more electricity than normal when starting up. You may want to consider a routine service appointment, or changing the filters, to see if that helps reduce the electricity being used.*

Respondents were then asked to indicate their level of agreement with the items.

Degree of Gamification in Notification

To our knowledge, this is the first time that degree of gamification in notifications

Construct	Item#	Item
Degree of Gamification in Notification (DGN)		**"I believe that if my electric utility included game-like elements in the notifications to me, it would …**
	DGN1	… be more fun to manage my electricity use at home.
	DGN2	… make it a more pleasurable engagement regarding upcoming voluntary electricity savings opportunities.
	DGN3	… allow me to enjoy using less electricity
	DGN4	… provide me with motivation to participate during upcoming voluntary electricity saving events.
	DGN5	… challenge me to control my electricity use.
	DGN6	... make it enjoyable for me to participate in electricity saving actions.
	DGN7	… make awareness about upcoming electricity saving opportunities more entertaining.
	DGN8	... be more gratifying to participate in using less electricity at home.

Table 25: Degree of Gamification in Notification Construct Items

(DGN) has been operationalized in this manner for academic research in our context. A total of eight questions were created by the researcher to measure DGN (Table 25). The eight questions were based on 1) the best practices noted in the Influencers of Energy Behavior, Feedback / Notification Channel as well as 2) a synthesis of the gamification elements previously discussed within Gamification Theory. Within the survey instrument, the DGN section followed the DPN section. At the onset of the DGN section the respondent was asked to read the following:

> *Challenging your friends, earning badges, seeing your ranking on a leaderboard, or receiving an in-game reward after completing a task are examples of game-like elements that have been used for activities such as weight loss, learning a new language, saving money, and walking.*
>
> *Continue to imagine that you are receiving the notifications from your electric utility. Your electric utility is considering including game-like elements such as badges, challenges, and leaderboards in the notifications. A couple examples could be:*
> ** Congratulations! You have achieved the 'Kilowatt Warrior' badge by saving electricity on Thursday's challenge!*
> ** You have been challenged by <<your friend's name>> to participate in a "1 watt a day keeps the bills at bay" challenge this Tuesday.*

Each question started with the phrase "I believe that if my electric utility included game-like elements in the notifications to me, it would …" and was followed by a phrase to which the respondent was to indicate their level of agreement (Figure E. 8).

Income

The income of the survey respondent was determined by an item that asked them to select an option that represented their entire household income in 2023 before taxes. The seven possible replies were: Less than $32k, $32k to $53k, $53,000 to $99k, $99,001 to $125k, $125,001 to $170k, $170,001 to $237k, More than $237,001.

Control Variable

International Energy Conservation Code (IECC) Climate Region

The IECC of the survey respondent was determined by an item that directed the participant to, "Kindly enter the ZIP code of your primary residence." Based on the zip code information provided, the data was plotted on Google Maps, correlated with the IECC Climate Region (Baechler et al., 2010), noted in Figure 23, and recorded within the dataset for that response.

Screening Question

To ensure the participants meet Population of Interest parameters and were paying attention, the survey instrument included screening items and attention check questions.

	Item#	Item
Screening Questions (SCRN)	SCRN1	Do you have WiFi at your Primary Residence?
	SCRN2	Do you have a smartphone?
	SCRN3	Do you use your smartphone daily?
	SCRN4	Do you have permission to install apps on your smartphone?
	SCRN5	At your home, can you contribute to using less electricity (examples are turning off lights, adjusting the temperature in the home, unplugging easy to access appliances (cell phone chargers, toaster, hairdryer, etc.)?
	SCRN6	Do you pay the electricity utility bill for your home?
	SCRN7	On your home WiFi network, do you have permission to connect new WiFi devices to it?

Table 26: Screening Questions

Prior to presenting the consent form, participants were asked seven yes/no question. If the individual answered “No” to SCRN5 they were routed to the end of survey and not compensated. Based on feedback from the Stakeholder Engagement team, SCRN6 was changed for Phase 4 to read “Are you aware of how much electricity your home uses on a monthly basis?” (Figure E. 1).

Attention Checks

Purpose Check

The purpose of the study was the 3rd sentence on the consent form, was in bold text, and was presented as "**The purpose of this study is to understand an electric utility customer's intention to use less electricity** ('curtailment') **during certain times of the day** and the items that contribute to those curtailment intentions." After reading the consent form and giving consent, the participant was advanced to the next page and was asked "What is the purpose of this study". They were presented with seven options. If the participant did not select PURP5 (Table 27) they were routed to the end of survey and not compensated (Figure E. 2 & Figure E. 10).

	Item#	Item
Purpose Check	**To understand an electric utility customer's intention to ....**	
	PURP1	install an electric vehicle charging station at their home
	PURP2	use wind or geothermal energy for their home
	PURP3	purchase an electric vehicle
	PURP4	use electricity all day long
	PURP5	use less electricity during certain times of the day
	PURP6	install energy efficient windows in the next 6-9 months
	PURP7	participate in a time of use electric rate for mining bitcoin at home

Table 27: Purpose Check Question

Attention Checks

Three attention check questions were placed throughout in the survey instrument in all phases as noted in Table 28 (e.gs., Figure E. 6, Figure E. 8).

		Item#	**Item**
Attention Check Questions	**Phase 1 through 3**	NEP8	Select Strongly disagree for the answer to this question
		DNM7	... select somewhat agree as the answer to this question.
		FIN20_5 FIN05_5	Select Somewhat disagree as the answer to this question.
	Phase 4	NEP3	Select Strongly disagree for the answer to this question
		FIN20_3 FIN05_3	Select Strongly disagree as the answer to this question.
		DGN4	Select Strongly agree as the answer to this question.

Table 28: Attention Check Questions and Placement

Instrument Validation

Although the survey instrument uses existing measures, they are from a diverse source of peer-reviewed research whose contexts, and theoretical models, were slightly different than this research. As a result, our survey instrument required validation. As noted by past research, instrument validation should occur before any other core empirical validations (Cook & Campbell, 1979). To determine and establish face validity, content validity, construct validity, reliability, instrument validity, internal validity, and ultimately statistical conclusion validity this research followed the processes as described and demonstrated within the Straub (1989) paper titled Validating Instruments in MIS Research.

Phase 1: Informed Pilot

Phase 1 was an engaging exchange between the participants where the qualitative data collected further enriched the survey instrument. This approach was significantly beneficial versus simply asking the participants to conduct the survey and provide text commentary. Though several did elect to forgo the zoom meetings, described below, those that completed the informed pilot instrument provided meaningful online comments, item by item, which included points at which they were experiencing fatigue. The additional goal of Phase 1 was to implement the findings such that the scenarios and questions are easy to understand for the population of interest. The informed pilot focused on each item in the survey instrument with focus on construct and content validity. An invitation email, which contained a link to the initial survey instrument, was distributed to each informed pilot participant on October 7th, 2023. These materials are included in the Appendix Informed Pilot Materials subsection. The informed pilot participants were a mixture of fellow researchers, individuals from this researcher's immediate professional and personal network, in line with the Stakeholder Engagement. Participants were equally split between electric utility industry experts and fellow doctoral students, equally trained in survey design and quantitative methodologies. However, one (1) participant, from the researcher's personal network, holds a Ph.D. in higher education and is currently a lecturer emeritus at the University of Pennsylvania. While not a formal participant in Phase 1, feedback from the dissertation chair was received weekly during regularly scheduled meetings. Each participant individually reviewed the instrument and was subsequently invited to participate in 1 of 3 one-hour long recorded Zoom meetings to discuss and critique the survey instrument. To accommodate varying schedules, 1-hr recorded informed pilot Zoom meetings were held on October 24th, 26th, and 28th, 2023. Participants were not compensated during this phase.

Phase 2: Technical Validation

Phase 2 was a technical validation and was quantitative in nature. The goal of the technical validation was threefold. First, from a mechanical standpoint, the technical validation allowed the researcher to exercise the processes of the data processing cycle - 1) collecting data via the survey instrument, 2) data encoding, 3) data review and preparation, 4) data input into the statistical software packages, 4) processing, and 5) storage and organization. Second, with the pretested instrument from Phase 1, the technical validation allowed the researcher to validate construct reliability. Third, the technical validation allowed the researcher to establish an average timing, from a cross-section of participants, at two different points in time, who had no prior knowledge of the research nor survey instrument items. Technical validation was fully administered online via the internet based Qualtrics survey data collection software. The respondents did not have contact with the researcher while responding to the items, had no prior knowledge of the survey items, and responded to the online pretested instrument on their own without aid. Like the informed pilot, the technical validation participants were a mixture of individuals from this researcher's immediate professional and personal network. An invitation email, which contained a link to the initial survey instrument, was distributed to five participants on October 15th, 2023, and to fourteen participants on November 4th, 2023. The October 15th technical validation participants data was used for initial average timing estimates for the pilot study. The November 4th technical validation participants experienced the EFA reduced model, which included the informed pilot and dissertation chair feedback adjustments. Data from the November 4th technical validations was to allow for a timing estimate of the Phase 4: Dissertation Research Study. These materials are included in the

Appendix Technical Validation Materials subsection and results are discussed in Chapter V. Data Analysis and Results subsection titled Phase 2. All participants met the population of interest. Participants were not compensated during this phase.

Phase 3: Pilot Study

Florida International University ("FIU") Institutional Review Board ("IRB") approval had been granted in May 2023, prior to formally being assigned a dissertation chair. Upon completion of Phases 1 and 2, we proceeded to conduct the quantitative Pilot Study on October 17th, 2023. The goal of the pilot study was to further test 1) the survey instrument reliability via Cronbach alphas 2) construct validity via factor analysis of the construct with a much larger fully randomized population of interest, and 3) re-exercise, with a larger dataset, the end-to-end processes of the data processing cycle established in Phase 2. The pilot study was a self-reported online survey questionnaire fully administered online via Qualtrics survey data collection software. Survey participants were sought via Connect™ powered by CloudResearch.com. Based on the average per participant completion timings from Phase 2 (October 15th), we estimated the Pilot Study instrument would take 25 minutes to complete. Phase 3 participants were offered $6.25 USD for participation, a compensation equivalent to $15 USD per hour of productive work. The respondents did not have contact with the researcher while responding to the items and had no prior knowledge of the survey items. Each participant was required to consent to the study prior to progressing to the first items, which are further designed to determine appropriateness of the respondent. All surveys had one (1) purpose verification check (Table 27), to ensure they read the consent form, and three (3) attention check questions (Table 28). Completed surveys were assigned a unique survey completion ID to aid in compensation verifications once quality checks were completed. These additional process steps were not required in Phases 1 & 2 but were required in Phase 3 to facilitate compensation and closely mirror the experiences and end-to-end processes that the researcher and the participants will encounter within Phase 4.

The principal data analysis techniques that were used during Phase 3 were Exploratory Factor Analysis (Finch, 2021; Yong & Pearce, 2013), Reliability Analysis, and Descriptive Statistics. The data analysis and results are reported upon within the Phase 3: Pilot Study subsection of Data Analysis and Results.

Process Steps

The following systematic process was performed in both Phase 3 and Phase 4 to validate the instrument, understand the data, explore the respondent makeup, improve factor loading, address potential multicollinearity and excessive residuals, and ultimately improve the survey instrument ahead of Phase 4.

Once the survey data was collected, the raw data from Qualtrics was downloaded and loaded into MS Excel. Data quality verification took place and respondents were removed if they did not give consent, failed the screening question, failed the purpose question, or got 2 of the 3 attention check questions wrong. This data was also used as evidence to reject payment. Any surveys that were completed too quickly (top 5%) or took too long (bottom 5%) were also removed. While these fast & slow replies were removed from the dataset, participants were compensated, and the researcher flagged them within the Connect™ by CloudResearch tool. Once these data quality validations were completed within MS Excel, the resultant base dataset was loaded into SPSS. Once imported, measures were corrected to be either Ordinal, Nominal, or Scale. Data labels and values were also added at this stage (i.e., Biological Gender: 1=female; 2=male; 3=did not disclose) and all survey items that required reverse coding were performed. Dataset demographics and item by item descriptive statistics were generated and explored. Please see Appendices - Phase 3: Pilot Study for the item-by-item details (Table D. 5 & Table D. 6).

Next, in Phase 3, the exploratory factor analysis ("EFA") followed the following systematic process to improve factor loading and address potential multicollinearity and excessive residual issues. All items that needed to be reverse coded were adjusted at the onset of this step. An initial evaluation of the orthogonal rotation (varimax) occurred and any items that are either loading on factors with coefficient values less than .5 (factors coefficient values less than .5 will be suppressed in SPSS and therefore appeared blank across the row), were cross loaded on 3 or more factors, then items that are loaded on 2 factors will be sequentially removed (remove one item, rerun the analysis, then remove another, and so forth). Once we had a clean pattern matrix, an evaluation of the individual Kaiser-Meyer-Olkin ("KMO") (H. F. Kaiser & Rice, 1974) values on the anti-image correlation matrix, as well as an examination of the off-diagonal individual KMO values, will occur. If there are any values that warrant concern, they will be noted but not yet removed at this stage. The next step in the process was to review the determinant of the correlation matrix. If we see a multicollinearity issue, such as a determinant with 3.418 X 10^{-5}, items were evaluated for removal to address and improve the multicollinearity score. If this proves unsuccessful, the items will be re-added, and multicollinearity will be noted and evaluated. A review of the residuals greater than 0.05, via the reproduced correlations residual table, occurred next and if any additional factors need to be added at this stage it will be evaluated. Bartlett's Test of Sphericity (BTS) will be used to determine whether the factor modelling was appropriate. Bartlett's Test of Sphericity tells us whether the correlation matrix is significantly different from an identity matrix. If it is significant then it means that the correlations between variables are significantly different from zero. The Bartlett's Test of Sphericity needs to be significant at a $p<0.05$ level in order to confirm that the correlations between variables within each factor will be adequate (Shrestha, 2021). A quick evaluation of both the total variance explained and the scree plot occurred at this next step. As a final step in this process, the pattern matrix was reviewed again and any items that warrant removal per above criteria were removed. Items that cluster on the same factor will be paired up with their constructs, will undergo a Reliability Analysis, and Cronbach alpha values will be evaluated and documented.

Once the EFA and Reliability Analysis were concluded, items from the survey were aggregated into their respective scales and the descriptive statistics of quantity, means, standard deviations, min, max, and averages will begin to be explored. Boxplots will be created for each aggregated item to evaluate for outliers. Histograms with normal overlays will be created and reviewed. A correlation chart will initially be looked at with the acknowledgement that the prior step EFA had greater detail. Normality tests on the aggregated variables as well as P-P plots will be explored, in Phase 3, and interpreted, in Phase 4.

Once Phase 3 has been completed and results reviewed, changes may be required to the survey instrument. If so, adjustments will be made, and the Phase 3 results will be documented in the Data Analysis section. Once the above is completed during Phase 3, we can be confident we have a well validated instrument and view of the relationships before proceeding with Phase 4.

Phase 4: Dissertation Research Study

Phase 4 forwent a formal EFA, since the survey instrument being leveraged was validated as part of Phase 3. However, the EFA process steps were performed on the dissertation research full dataset and results were evaluated to confirm items once again aggregate into their respective scales. As a result of this identical execution and analysis process carried out in Phase 4, we do not repeat the descriptive steps here.

Performing, analyzing, implementing, and documenting Phases 1 through 4, per above, concludes the instrument validation phase of this dissertation. The Data Analysis and Results for all Phases, as well as the post instrument validation Data Analysis Procedure for Phase 4, are detailed within Chapter V.

Threats to Validity

Further to the validation discussion within Instrument Validation, any researcher has to successfully measure what they have set out to measure and the research itself has to draw the correct conclusions from the research data, hence construct validity is a prerequisite to developing and accurately testing theories (Doty & Glick, 1998; P. M. Podsakoff et al., 2003).

Non-Response Bias

Non-response is a significant problem for survey research (T. Yan & Curtin, 2010). Non-response bias occurs when some respondents included in the sample do not respond and is generally broken into two categories – Unit non-response and Item non-response. Unit non-response is when a potential respondent, who meets all the criteria, did not participate in the survey. Whereas item nonresponse occurs when someone does not answer all the questions on the survey instrument. As a result, depending on which items were not answered, the sample size might need to be reduced. Reasons for non-response stem from issues with the survey instrument being poorly constructed, confusing, and the target audience being misaligned. While *unit nonresponse is considered to pose a greater threat* (T. Yan & Curtin, 2010) this research took steps to address both. Our focus was on ensuring an easy to access, no pressure, comprehendible survey, written at a junior high school reading level. To achieve this and reduce the possibility of non-response bias in our research, several techniques were implemented. First, expectations were set at the onset by making respondents aware of the amount of time the survey would take. As noted in the above Instrument Validation section, several time studies were done to determine this. Second, via the consent form, participants were assured that they would remain anonymous, records would be kept private, and that their participation was voluntary and that they will not be penalized if they refuse to participate or decide to stop. Third, an incentive in the form of a financial compensation to participate in the study was set to be equivalent to the minimum wage hourly rate. For example, our Phase 3 Pilot study was estimated to take 25 minutes and participants were compensated \$6.25 – equivalent to \$15 per hour (Per Table 29, Phase 3 actual average duration was 27 minutes, medium duration was 23 minutes and 35 seconds, and we experience a 3.85% bounce rate per the Connect™ by CloudResearch portal). Fourth, our questions were closed-ended where participants select from either a Likert style grid of choices (e.g., Figure E. 3), a Rank Order list (Figure E. 7), or a Slider scale (Figure E. 5). Lastly, the Qualtrics survey was structured for mobile (e.g., Figure E. 9, Figure E. 10, Figure E. 11), tablet, and PC usage to account for individuals that prefer any of these data entry methods.

Common Method Bias

"*Common method biases arise from having a common rater, a common measurement context, a common item context, or from the characteristics of the items themselves. Obviously, in any given study, it is possible for several of these factors to be operative*" (P. M. Podsakoff et al., 2003, p. 885). There is empirical evidence that common methods variance introduce the biases to the relationship between two constructs; when variance is introduced by the measurement method rather than the constructs true relationships, thus confounds the true relationship between the constructs by either inflating or deflating the observed relationship which can introduce Type I and Type II errors (Doty & Glick, 1998; P. M. Podsakoff et al., 2003). While it has been noted that it is difficult, if not impossible, to control for all sources of common method bias (P. M. Podsakoff et al., 2024, p. 18) our research implemented three of the four procedural remedies for dealing with Common Method Bias (CMB) highlighted in Podsakoff et al., (2024). First, we placed psychological and temporal separation between the measures of the focal variables. Given our research context, this approach *may prove particularly useful when examining the relationships between internal states (e.g., attitudes, beliefs, moods, values, perceptions, intentions)* (P. M. Podsakoff et al., 2024, p. 37). Second, and noted as a potential remedy to Non-Response Bias above, we ensured and informed participants about their anonymity. *The purpose of this technique is to reduce the evaluation apprehension that respondents might experience in providing their responses by not asking for personal information that identifies them* (P. M. Podsakoff et al., 2024,

p. 39). These last two procedural remedies do not account for CMB resulting from the survey items themselves. Podsakoff et al., (2013) argue that *similarity of item characteristics across scales results in an increased possibility of Common Method Variance (CMV) biases because this condition decreases the motivation for raters to process the information as deeply as when these item characteristics are dissimilar across scales*. Therefore, we implemented a third procedural remedy, also noted as a potential remedy to Non-Response Bias, by minimizing common scale formats and properties by using Likert scales (e.g., Figure E. 3), a Rank Order list (Figure E. 7), and a Slider scale (Figure E. 5). Additionally, as part of this third remedy, we cautiously implemented reverse-coded items (e.g., Figure E. 11) designed to introduce a cognitive speed bump.

The fourth procedural remedy for dealing with Common Method Bias is obtaining measures from different sources. *It is difficult to use this procedure when focal variables represent an individual's internal states (e.g., attitudes, beliefs, values, intentions) because obtaining valid measures of a person's internal states by others requires them to accurately infer these events from the person's behavior* (P. M. Podsakoff et al., 2024, p. 36). In our dissertation context, this procedural remedy was not feasible to implement. As a result, we have a common rater for all items in the survey instrument.

External Validity / Generalizability

Given the electric utility industry context, population of interest, and cross-sectional quantitative exploratory survey design methodology, lack of generalizability is recognized as a threat to external validity. Equally, the population of individuals within the contiguous United States are generally considered living within a 1st world country and, as such, expectations and experiences with energy availability will differ from country to country. However, this researcher feels that the findings will allow for electric utilities to test and pilot in their natural settings. The academic methodological nature this dissertation sought in pursuit of these significant, or insignificant, factors will provide those very insights to allow for industry to further explore.

V. DATA ANALYSIS AND RESULTS

Phases 1 & 2: Informed Pilot & Technical Validations

Phase 1

Phase 1 was an Informed Pilot that helped evaluate the feasibility of the survey instrument. This was the first official pretest of the survey instrument. An invitation email was distributed to 14 informed pilot participants on October 7th, 2023. The email contained a link to the survey and attached was a document that outlined the research, model, and constructs. The online informed pilot also had a video introduction that the researcher recorded to provide information for the informed pilot participants who might prefer that medium to absorb data or might not make the zoom calls. One participant noted "*I liked and appreciated the video explaining the purpose of the study and purpose of the informed pilot participant*". A total of 12 people provided feedback - 5 people participated in feedback via zoom meetings and 7 individuals filled out the online survey and provided written qualitative feedback within each section. In preparation for the zoom meetings, 3 of the 5 zoom participants also filled out the online survey ahead of the zoom meeting. To accommodate varying schedules, 1-hr recorded informed pilot Zoom meetings were held on October 24th, 26th, and 28th, 2023. The informed pilot participants were a mixture of fellow researchers, individuals from this researcher's immediate professional and personal network.

The feedback was overall incredibly positive with comments like "*These questions are very important to your study! Great job!*", "*Pretty easy to understand*;" "*good short format questions here--well done!*", "*Excellent!*", "*well done pilot--it will be interesting to know which of the items you retain from the ecological awareness and personality* *inventory scales*", and "*Overall, this survey was very comprehensive*.". However, not all comments were positive and nearly all participant noted the length of the survey as an issue. Examples of this type of feedback include "*I had difficulty remaining focused. By the time I got to the big 5 questions, I just blasted through them*", "*Questions are mostly negative. Important because the questions could lead to a bias in the responses*.", "*Drag & drop could present accessibility issues…Given my physical disability, just ensure that you give appropriate consideration to respondents with those challenges*", "*It might be above the middle school grade level of comprehension*", "*This series is almost akin to framing something as a double negative. I think respondents will stumble here and have to go over it a couple of times*.", and "*As a side note, this is the point in your survey where I am starting to become fatigued.*"

Interestingly, one participant noted, "*As I am going through this, I can't tell which of these questions are tied to which hypothesis*". This comment verified to the researcher that the sections as presented did not allow some of the informed participants to guess the construct they were answering. We attribute this to the instrument design and our approach to address common method bias. We provided clear instructions at the beginning of each section. This technique reduces the potential common method bias (CMB) effect by introducing methodological separation of the measurements, reducing the salience of previous answers. This separation was necessary since the collection of the dependent variable and independent variables are in the same instrument being answered from the same individual (P. M. Podsakoff et al., 2003).

"*Very well-designed survey, but too long. I believe it's better to reduce number of questions for measuring each construct*", was a comment received by one of the participants and nicely summarizes the overall consensus of the participants who participated online. No questions were removed due to length of time concerns because an EFA was going to be performed during Phase 3 that would result in dimension reduction.

As a result of the zoom meetings, several items in the survey instrument were modified. Phrases that had been used throughout the survey like “curtailing electric energy” and “curtail my electric demand” were changed to something more readable and comprehensible like “using less energy”. While this change is not technically nor electrically correct (i.e., kW vs. kWh), upon discussion with the informed pilot participants, their comments supported the literature where the general residential consumer of electricity doesn’t really understand the difference. We felt using the phrase ‘using less electricity / energy’ was still in line with the intent of the research and dependent variable, so the change was made. As well, the informed pilot presented several questions with the preface “*During the hours of 6am-9am and 4pm-7pm, please indicate your level of agreement with the following statements*”. One participant started a dialogue questioning if this presentation was like a double-barrel question. When providing feedback in the Attitude construct, one of the online participants also noted “*What if we do it in the morning but not the afternoon?*” As a result, we focused the research to the evening peak demand period time frame (4pm-7pm) and removed references to (6am-9am). Another double-barreled condition was noted with Intention item INT7 which read “*Before we leave our home, I intend to turn up/down my cooling/heating equipment to use less electricity*”. This was split into two new Intention items “*When it's cool outside and we're not at home, I intend to turn down the thermostat before we leave our home to use less electricity while we're away*” and “*When it's warm outside and we're not at home, I intend to turn up my* *thermostat before we leave our home to use less electricity while we're away.*" We reworded INT 1 from "*I intend to engage in electric energy demand curtailment actions at home*" to "*I intend to use less electricty at home*". Embarrassingly, no one caught the spelling mistake and "electricity" was spelt '*electricty'* in the final instrument for INT1. INT2 (I <u>will endeavor</u> to <u>curtail electric energy demand</u> in my home) was removed because the recommended rewording (I intend to use less energy in my home) would be perceived by many as the same as INT1 – use less electricity vs. use less energy. A few of the informed pilot participants discussed how they might be the electricity bill payer but they <u>are not</u> the ultimate decision maker on the thermostat setting in their home nor know how much energy their household uses monthly. These sentiments were also noted by several of the online participants who commented, "*I'm wonder as the person that pays the bills the biggest influence on usage?*" and "*…you may pay, but have it tied to an autopay function and not pay any attention to the actual usage.*" Based on this, the researcher modified SCRN6 from "Do you pay the electricity utility bill for your home?" to "Are you aware of how much electricity your home uses on a monthly basis?" Finally, there was discussion among the participants if the moderation relationships were truly moderators or, perhaps, were either independent variables or antecedents to some of the constructs. Discussions revolved around the financial incentive, notification channel and the notification components, need for comfort, and habits. For example, participants began to hypothesize that habits might be the resultant of an intention. While this is certainly sound, the researcher explained that, at that point in time, the dissertation proposal was already approved by the committee and these types of causal relationship changes on the research model would not be feasible. However, the researcher did note to the participants that our research would perform some Post Ad-Hoc Analysis on several of their recommendations and note them for Future Research Considerations.

Phase 2

The technical validations performed in Phase 2 were helpful in determining the average timing that it would take our Population of Interest that would not have any prior knowledge of the research constructs or research question. The October 15th technical validation participants data was used for initial average timing estimates before any dimension reduction occurred. The average time amongst the 4 respondents was just over 38 minutes (38 minutes and 36 seconds). However, one of these 4 respondents took 71 minutes. Removing this outlier, the average time amongst the remaining three participants was 27 minutes and 42 seconds. Based on the average per participant completion timings from Phase 2 (October 15th), we estimated the Phase 3 Pilot Study instrument would take 25 minutes to complete. Connect™ by CloudResearch.com metrics, Table 29, confirm that the Phase 3 pilot took, on average, 27 minutes and 1 second.

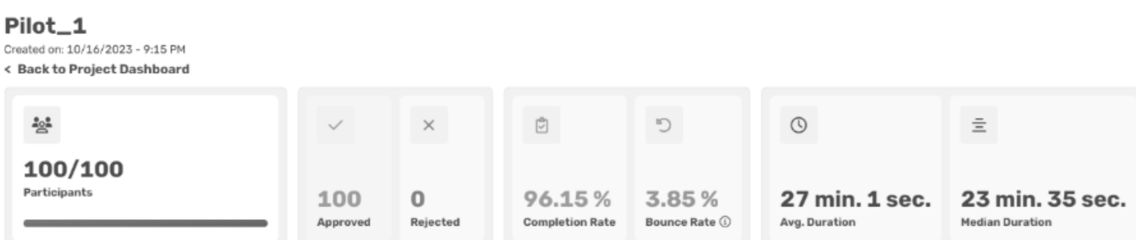

Table 29: Pilot Study - Connect™ Metrics Dashboard

Data from the November 4th technical validations was to allow for an additional timing estimate of the Phase 4: Dissertation Research Study. The November 4th technical validation participants experienced the EFA reduced online survey, 82 total items (Table 33), which included informed pilot and dissertation chair feedback adjustments. Per the

Qualtrics data, the average time amongst the 12 respondents was **26 hours**, 16 minutes, and 33 seconds per survey. After reviewing the raw data, it was clear to the researcher that something was amiss because 10 of the results were all collected on November 4^{th} and averaged 31 hours, 26 minutes, and 14 seconds per survey. However, the 2 participants that completed on November 6^{th} averaged 28 minutes (#1 - 39 minutes; #2 - 17 minutes). The research phoned each of the ten November 4^{th} participants individually and confirmed that the survey did not take them hours. Most could not remember exactly how long it took but estimated between 15 and 20 minutes. The researcher called the November 6^{th} participants and determined that respondent #1 (39 minutes) was anomalous because they were "*multi-tasking while at work*" on a Monday morning. Given the above, the researcher used respondent #2 (17 minutes and 7 seconds) as representative of a slower reader (per the verbal self-assessment of this 25-34 years old, Female, residing in zip code 19006). Based on this completion timing from Phase 2 (November 6^{th}), we estimated the Phase 4 Dissertation Research Study would take 15 minutes to complete. Connect™ by

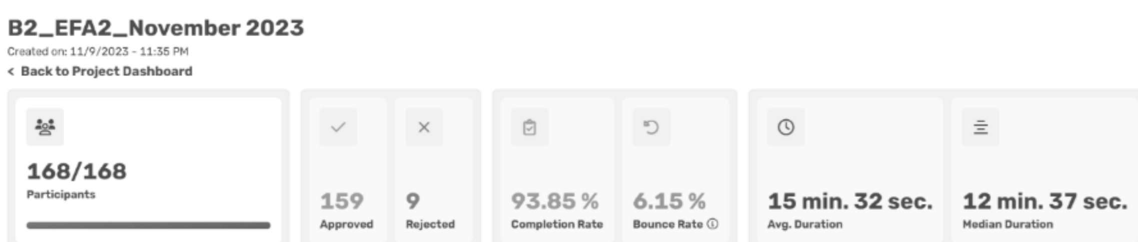

Table 30: Main Study - Data Collection B2, Connect™ Metrics Dashboard

CloudResearch.com metrics from one of our Phase 4 data collection events (Batch #2 (B2)), Table 30, confirms that data collection took an average of 15 minutes and 32 seconds. Please see the Appendices for the additional Connect™ by CloudResearch.com data collection metrics (e.g., Survey Metrics & Feedback - Connect™ by CloudResearch.com).

Phase 3: Pilot Study

Data Collection and Removal Accounting

A total of 105 responses were collected in Qualtrics on October 17th, 2023, however 25 responses were removed yielding a total of 80 valid responses from which the

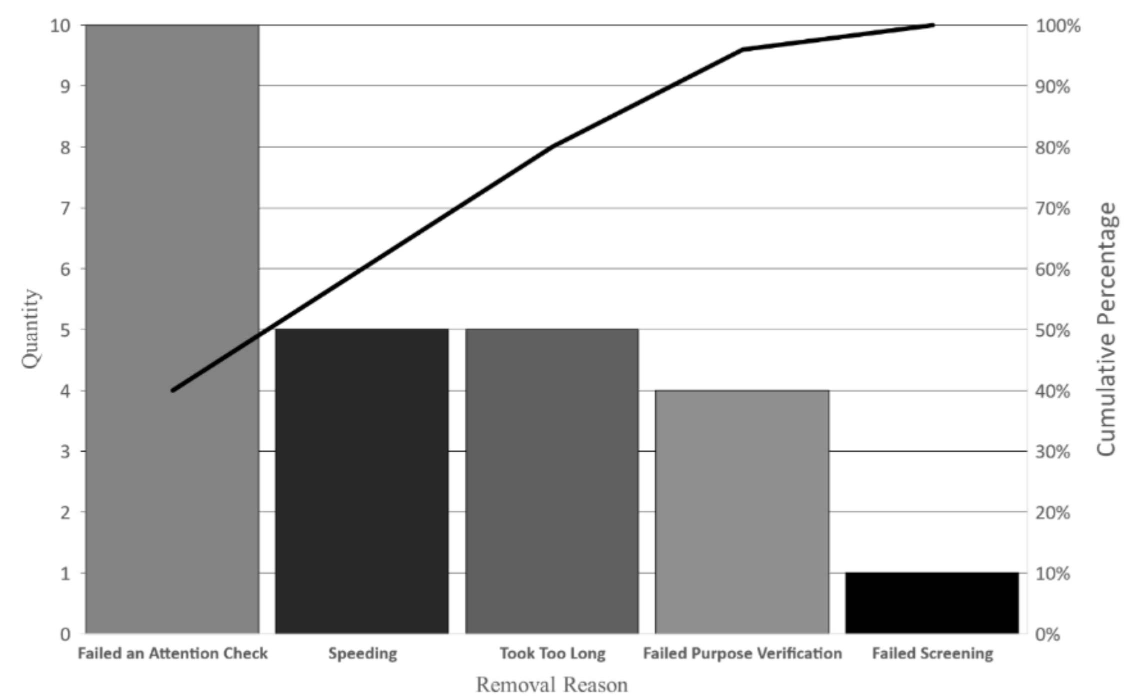

Figure 24: Pilot Study - Response Removals

subsequent data analysis took place. The researcher was content with 80 valid responses because it met the minimum sample size advised. An accounting for the 25 removed surveys is presented in Figure 24. There were no missing values.

Demographic Statistics

Geographic Distribution

Figure 25 visually depicts the percentage of the 80 responses across the United States whereas Table 31 provides the data sorted from largest to smallest State contributors.

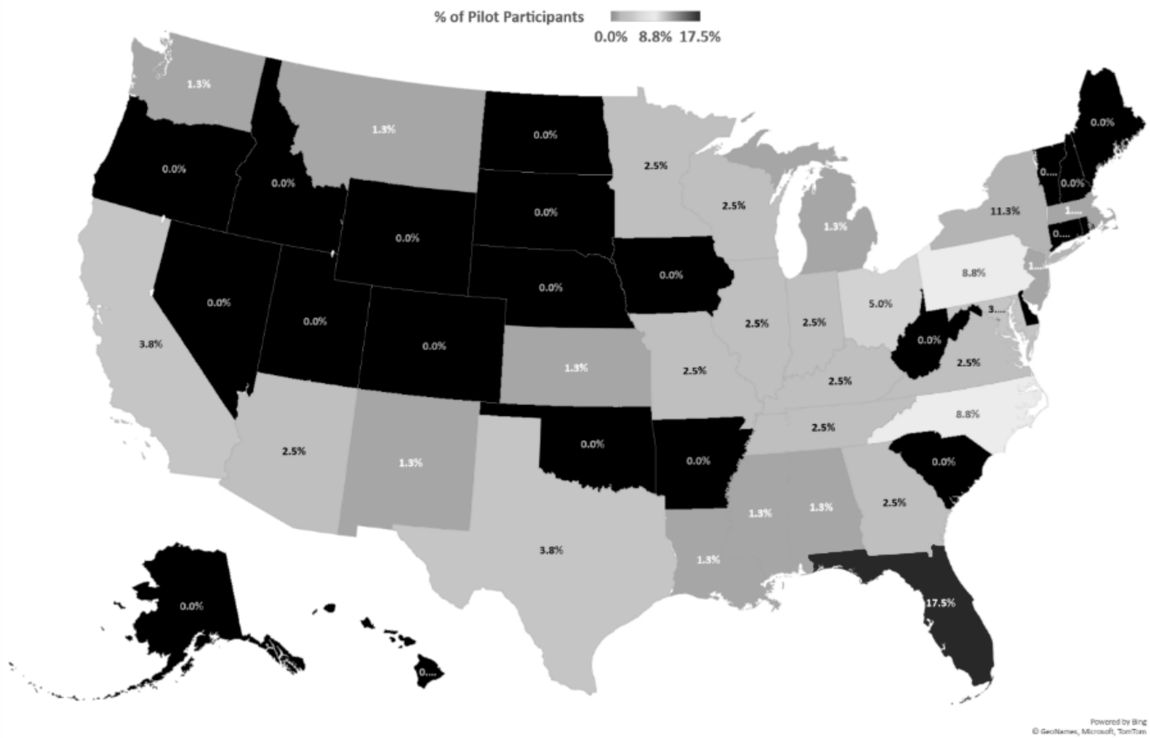

Figure 25: Percentage of Pilot Participants by State

State	Quantity	Percentage	State	Quantity	Percentage	State	Quantity	Percentage
FL	14	17.50%	WI	2	2.50%	ID	0	0%
NY	9	11.25%	AL	1	1.25%	IA	0	0%
NC	7	8.75%	KS	1	1.25%	ME	0	0%
PA	7	8.75%	LA	1	1.25%	NE	0	0%
OH	4	5.00%	MA	1	1.25%	NV	0	0%
CA	3	3.75%	MI	1	1.25%	NH	0	0%
MD	3	3.75%	MS	1	1.25%	ND	0	0%
TX	3	3.75%	MT	1	1.25%	OK	0	0%
AZ	2	2.50%	NJ	1	1.25%	OR	0	0%
GA	2	2.50%	NM	1	1.25%	RI	0	0%
IL	2	2.50%	WA	1	1.25%	SC	0	0%
IN	2	2.50%	AK	0	0%	SD	0	0%
KY	2	2.50%	AR	0	0%	UT	0	0%
MN	2	2.50%	CO	0	0%	VT	0	0%
MO	2	2.50%	CT	0	0%	DC	0	0%
TN	2	2.50%	DE	0	0%	WV	0	0%
VA	2	2.50%	HI	0	0%	WY	0	0%

Table 31: Pilot Study - Participants Sorted by State

Participant Demographics

At the end of the survey, respondents were asked to provide their Age, Biological Gender, Education, Income, and if they owned or rented their primary residence (Residential Ownership). Table 32 details the pilot study's participant demographics.

Category	Variable	Frequency	Percent	Cumulative Percent
Biological Gender	1. Female	28	35.00%	35.00%
	2. Male	52	65.00%	100.00%
	Total	80	100.00%	
Age Range	1. Under 18	0	0.00%	0.00%
	2. 18-24 years old	2	2.50%	2.50%
	3. 25-34 years old	32	40.00%	42.50%
	4. 35-44 years old	27	33.75%	76.25%
	5. 45-54 years old	10	12.50%	88.75%
	6. 55-64 years old	8	10.00%	98.75%
	7. 65+ years old	1	1.25%	100.00%
	Total	80	100.00%	
Education	1. Less than high school degree	1	1.25%	1.25%
	2. High school graduate (high school diploma or equivalent including GED)	11	13.75%	15.00%
	3. Some college but no degree	13	16.25%	31.25%
	4. Associate degree in college (2-year)	9	11.25%	42.50%
	5. Bachelor's degree in college or university (4-year)	30	37.50%	80.00%
	6. Master's degree	14	17.50%	97.50%
	7. Doctoral degree	2	2.50%	100.00%
	Total	80	100.00%	
Income Range	1. Less than $32,000	18	22.50%	22.50%
	2. $32,000 to $53.000	17	21.25%	43.75%
	3. $53,001 to $99,000	27	33.75%	77.50%
	4. $99,001 to $125,00	7	8.75%	86.25%
	5. $125,001 to $170,0	7	8.75%	95.00%
	6. $170,001 to $237,0	3	3.75%	98.75%
	7. More than $237,001	1	1.25%	100.00%
	Total	80	100.00%	
Residential Ownership	1. Own	47	58.75%	58.75%
	2. Rent	33	41.25%	100.00%
	Total	80	100.00%	

Table 32: Pilot Study - Participant Demographics

Exploratory Factor Analysis

The Process Steps described in Instrument Validation Phase 3: Pilot Study subsection Process Steps was performed. After we explored the item-by-item statistics we proceeded with an Exploratory Factor Analysis. Please find the item-by-item descriptive statistics in the Phase 3: Pilot Study section of 0. Appendices. An exploratory principal axis factor analysis was conducted on an initial 203 items with orthogonal rotation (varimax) where the underlying factors are uncorrelated. These 203 items were all the items from our pilot survey instrument for the independent variables, mediator variables, moderator variables, and three-way moderation variables. We did not include the dependent variable, control variable, demographic items, screening questions, nor attention check items in the factor analysis. An initial evaluation of the orthogonal rotation rotated factor matrix allowed the researcher to sequentially remove fifty-seven (57) that were either loading on factors with coefficient values less than .5 or were cross loaded on 3 or more factors. Once this was completed an evaluation of the individual Kaiser-Meyer-Olkin ("KMO") values on the anti-image correlation matrix as well as an examination of the off-diagonal individual KMO values occurred. No items were removed as a result. The next step in the process was to review the determinant of the correlation matrix. This revealed that there was a potential multicollinearity issue, as the determinant was less than 0.0001, however, at this stage, the researcher did not remove any additional items. This item was noted and if multicollinearity proved to be an issue in the subsequent study this could be reviewed. A review of the residuals greater than 0.05, via the reproduced correlations residual table, indicated that there are 147 (4.0%) nonredundant residuals with absolute values greater than 0.05. This did not cause concern for the researcher and, as a result, additional factors were not added nor were any items removed. A quick evaluation of both the total variance explained and the scree plot occurred at this stage. No items were removed because of this review and the final review of these are detailed below. As a final step in this process, the rotated factor matrix was reviewed again. At this stage, a total of

57 items were removed yielding 203 final items (EFA1). However, recalling feedback from the prior Phases, the researcher wanted to further reduce the instrument to a minimal number of items. The steps above were re-preformed, with a goal of reducing the instrument even further. An additional 64 items were removed yielding 82 final items (EFA2). Table 33 summarizes changes between EFA1 and EFA2. Of note is that with EFA2, Descriptive Norms was reduced to only two items, and they clustered together with

		# of Items					
			Total		(Removed)		
Construct		Pilot	EFA1	EFA2	EFA1	EFA2	Total
Habits	HAB	12	4	5	(8)	1	(7)
Energy Concern	ECN	8	6	3	(2)	(3)	(5)
Electricity Savings Knowledge	ESK	8	3	3	(5)	0	(5)
Environmental Awareness	NEP	15	4	4	(11)	0	(11)
Attitude	ATT	8	4	3	(4)	(1)	(5)
Injunctive Norms	INM	8	5	3	(3)	(2)	(5)
Descriptive Norms	DNM	8	5	2	(3)	(3)	(6)
Personal Moral Norms	PMN	8	6	4	(2)	(2)	(4)
Perceived Behavioral Control	PBC	8	5	3	(3)	(2)	(5)
Affect	AFF	8	4	3	(4)	(1)	(5)
Personality - Openness	PO	12	12	3	0	(9)	(9)
Personality - Consciousness	PC	12	12	3	0	(9)	(9)
Personality - Extraversion	PE	12	12	3	0	(9)	(9)
Personality - Agreeableness	PA	12	12	3	0	(9)	(9)
Personality - Neuroticism	PN	12	12	3	0	(9)	(9)
Extrinsic Rewards	FIN_ _	8	4	5	(4)	1	(3)
Thermal Comfort - Coolness	TCC	6	5	3	(1)	(2)	(3)
Thermal Comfort - Warmth	TCW	6	5	3	(1)	(2)	(3)
Notification Channel	NC_	8	8	8	0	0	0
Timeliness of Notification	TON	8	5	5	(3)	0	(3)
Degree of Personalization in Notification	DPN	8	6	5	(2)	(1)	(3)
Degree of Gamification in Notification	DGN	8	7	5	(1)	(2)	(3)
Totals # of items across the 22 Constructs		**203**	**146**	**82**	**(57)**	**(64)**	**(121)**

Table 33: Pilot Study - EFA item reduction summary

the three remaining Injunctive Norms items. The researcher merged the two DNM items with the three INM items and defined the merged items as a five items Subjective Norms (SNM) scale. EFA2 also improved nonredundant residuals with 80 (2.0%) having absolute values greater than 0.05. There was a negligible improvement in the determinant of the correlation matrix; it remained less than 0.0001. The rotated factor matrices for both EFA1 (Table D. 3) and EFA2 (Table D. 4) are provided in the Appendices subsection Phase 3: Pilot Study. The researcher proceeded with EFA2 because it met the goal of a significantly reduced survey instrument for the main dissertation study.

Final Principal Axis Factor Analysis

Once the above was completed, the final principal axis factor analysis was performed on 82 items with orthogonal rotation (varimax). The Kaiser-Meyer-Olkin measure of 0.295 verified we did not have sampling adequacy. Below 0.5 is 'unacceptable' according to Kaiser & Rice (1974). The researcher acknowledged this and proceeded with the 80-sample size pilot dataset and did not gather additional responses. Bartlett's Test of Sphericity (BTS) was used to determine whether the factor modelling was appropriate. Bartlett's Test of Sphericity significance was <0.001, well below the 0.05 level, as a result correlations between variables within each factor will be considered adequate.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.295
Bartlett's Test of Sphericity	Approx. Chi-Square	6175.423
	df	2701
	Sig.	<.001

Table 34: Pilot Study - KMO & BTS Results

An initial analysis was run to obtain eigenvalues for each factor in the data. Twenty factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 84.45% of the variance. The scree plot showed inflexions at 10 and 20 factors that justify retaining twenty factors. This researcher retained twenty factors because of the convergence of the scree plot and Kaiser's criterion on this value. The research proceeded with using EFA2 for the main study because it also met the goal of a significantly reduced survey instrument for the main dissertation study.

Reliability Analysis

Using the retained items, we performed Reliability Analysis for each of the factors and associated scales. Table 35 summarizes the Reliability and Scale statistics for the 20 scales as well as the three Notification Channel scales. Recalling that a minimum acceptable value of Cronbach's alpha is between 0.60 and 0.70 (Cronbach, 1951; Cronbach

Scale			Number of Items	Reliability Statistics		Scale Statistics		
				Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Mean	Variance	Standard Deviation
Habits	HAB		5	0.915	0.919	19.50	16.405	4.050
Energy Concern	ECN		3	0.949	0.949	9.57	16.045	4.006
Electricity Savings Knowledge	ESK		3	0.872	0.872	11.20	9.276	3.046
Environmental Awareness	NEP		4	0.831	0.832	11.75	16.266	4.033
Attitude	ATT		3	0.926	0.934	5.06	5.249	2.291
Injunctive Norms	INM	SNM	5	0.902	0.903	15.03	22.480	4.741
Descriptive Norms	DNM							
Personal Moral Norms	PMN		4	0.917	0.917	16.13	14.668	3.830
Perceived Behavioral Control	PBC		3	0.819	0.819	12.19	6.534	2.556
Affect	AFF		3	0.871	0.872	13.43	5.766	2.401
Personality - Openness	PO		3	0.852	0.853	11.66	8.505	2.916
Personality - Consciousness	PC		3	0.843	0.846	12.38	5.604	2.367
Personality - Extraversion	PE		3	0.851	0.851	9.21	9.815	3.133
Personality - Agreeableness	PA		3	0.701	0.790	12.95	4.200	2.049
Personality - Neuroticism	PN		3	0.830	0.832	6.78	10.379	3.222
Extrinsic Rewards	FIN		5	0.862	0.876	23.34	5.138	2.267
Thermal Comfort - Coolness	TCC		3	0.824	0.824	9.93	11.159	3.340
Thermal Comfort - Warmth	TCW		3	0.878	0.878	7.99	10.924	3.305
Timeliness of Notification	TON		5	0.880	0.882	20.89	14.835	3.852
Degree of Personalization in Notification	DPN		5	0.937	0.939	21.09	20.157	4.490
Degree of Gamification in Notification	DGN		5	0.967	0.968	18.34	36.454	6.038
Notification Channel (App)	NCA		8	0.833	0.840	37.67	6.792	2.606
Notification Channel (Email)	NCE		8	0.843	0.852	36.50	10.371	3.220
Notification Channel (Letter)	NCL		8	0.849	0.867	32.45	15.873	3.984

Table 35: Pilot Study - Reliability and Scale Statistics

& Meehl, 1955; Taber, 2018; Ursachi et al., 2015), all scales are above the minimum acceptable value with the Personality construct of Agreeableness (PA) with the lowest value of 0.701 and Degree of Gamification in Notification the highest with a value of 0.967. Item-Total statistics are provided in the Appendix (Table D. 7). In most cases, removing an additional item would not make an improvement in the scales Cronbach alpha. While there would have been a Cronbach alpha improvement from 0.701 to 0.854 for the PA scale, this would have resulted in only two items for the scale and the researcher wanted a minimum of three items per scale since multiple items for complex constructs have better psychometric properties (Peter, 1979; Sarstedt & Wilczynski, 2009). PMN, FIN, HAB, PC, and NCL scales would also see a Cronbach alpha improvement from removing an item in each however the gain would have been minimal (e.g., removing FIN20_1 would result in FIN improving from 0.862 to 0.886). The researcher did not feel the improvement was significant enough. As a result, we maintained the scales, noted PA was accepted with its value of 0.701, and proceeded with aggregating into their respective scales. Descriptive statistics of quantity, means, standard deviations, min, max, and averages were explored. Boxplots were created for each aggregated item to evaluate for outliers. Histograms with normal overlays were created and reviewed. The correlation chart was evaluated. Normality tests on the aggregated variables as well as P-P plots were explored. While there were outliers in the aggregated scales, we did not remove any responses from the pilot dataset. We maintained the scales and proceeded with the current survey design for our Phase 4: Dissertation Research Study.

Phase 4: Dissertation Research Study

Data Analysis Procedure

Phase 4 forwent a formal EFA, since the survey instrument being leveraged was validated as part of Phase 3. However, the EFA process steps were performed on the dissertation research full dataset and results were evaluated to confirm items once again aggregate into their respective scales. As a result of this identical execution and analysis process carried out in Phase 4, we do not repeat the Phase 3 EFA descriptive steps here. Phase 4, however, had additional data analysis procedural steps given the Phase 4 analysis goals. These additional Phase 4 data analysis procedural steps are described below.

After the confirmatory analysis (i.e., items once again aggregated into their respective scales), the researcher evaluated individual items descriptive statistics, boxplots, histograms with normal overlays, checked for outliers, and evaluated normality tests and Q-Q plots for each. Then, the researcher aggregated the items in their respective constructs, evaluated descriptive statistics, correlation table, boxplots, histograms with normal overlays, checked for outliers, and interpreted normality tests and Q-Q plots for each. Next began the hypothesis analysis procedure. Using multiple linear regression, each of the hypotheses were tested separately and the summary write-up of each of these are provided below which include the statistics and tests used to support or reject. For each of these regressions, we checked the multicollinearity diagnostics, plotted a histogram of the standard standardized residuals as well as a scatterplot of standardized residuals and standardized predicted values to check for any patterns indicating a violation of the linearity and/or homoscedasticity assumptions. If no discernible pattern emerged, we determined that homoscedasticity has not been violated. If there were any cases called out in the Casewise Diagnostics that lead to standardized residuals larger than three (3) Standard Deviations, these were investigated and discussed below. For hypotheses that involved interactions, we centered the continuous predictors before creating the interaction terms. If we found a moderating interaction is significant, be it a two-way interaction or a three-way interaction, an additional plot of those interactions was performed from the resources available via download at Dawson (2024), which are based on Aiken & West (1991), Dawson & Richter (2006), and Dawson (2014). If we found a moderating interaction is not significant, interpretation was performed off the reduced model (without the interaction) and reported. In the event the same non-significant moderation was hypothesized to be part of a 3-way moderation, the 3-way moderation hypothesis was not tested and has been reported as such.

Data Collection and Removal Accounting

519 total responses were collected in Qualtrics between November 8th and 11th, 2023. After applying the same data quality validation techniques as Phase 3: Pilot Study - Process Steps, 427 valid responses remained for analysis. An accounting of the 92 removed surveys is presented in Figure 26. Two participants did not disclose their

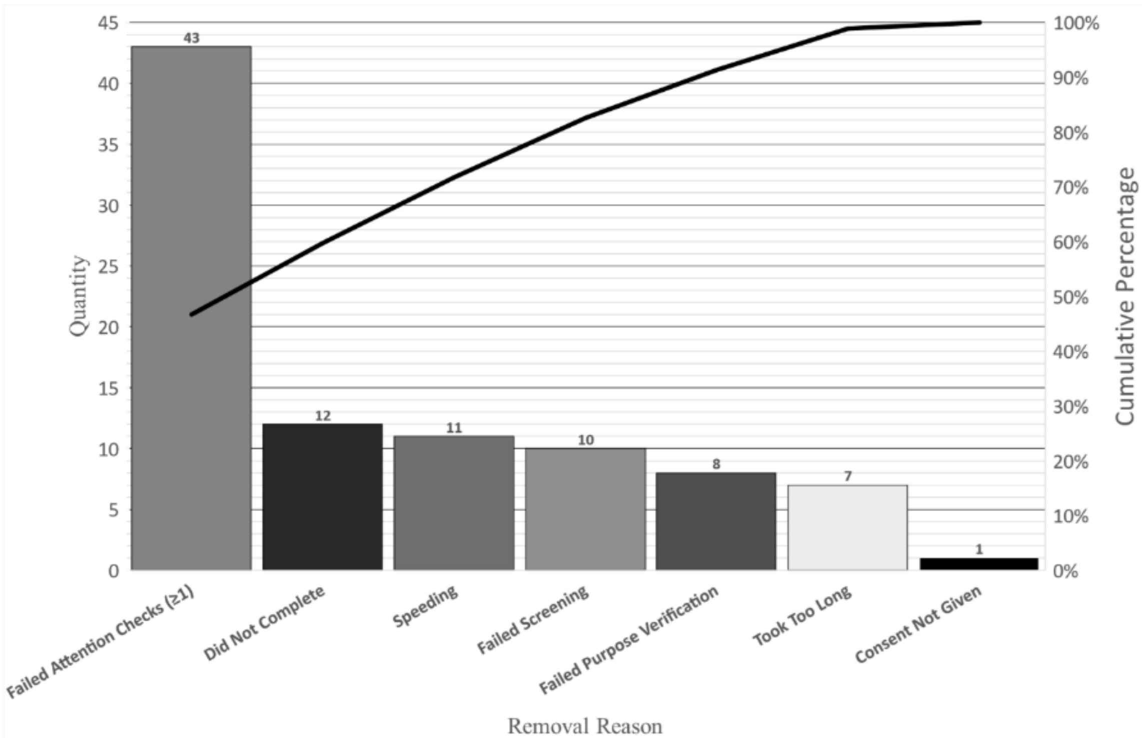

Figure 26: Main Study - Response Removals

Biological Gender, have been labelled 'Did Not Disclose' by the researcher (per our Process Steps), and remained within the 427 responses used for our analysis.

Demographic Statistics

Geographic and IECC Distribution

Figure 27 visually depicts the percentage of the 427 responses across the United States whereas Table 36 provides the data sorted from largest to smallest State contributors.

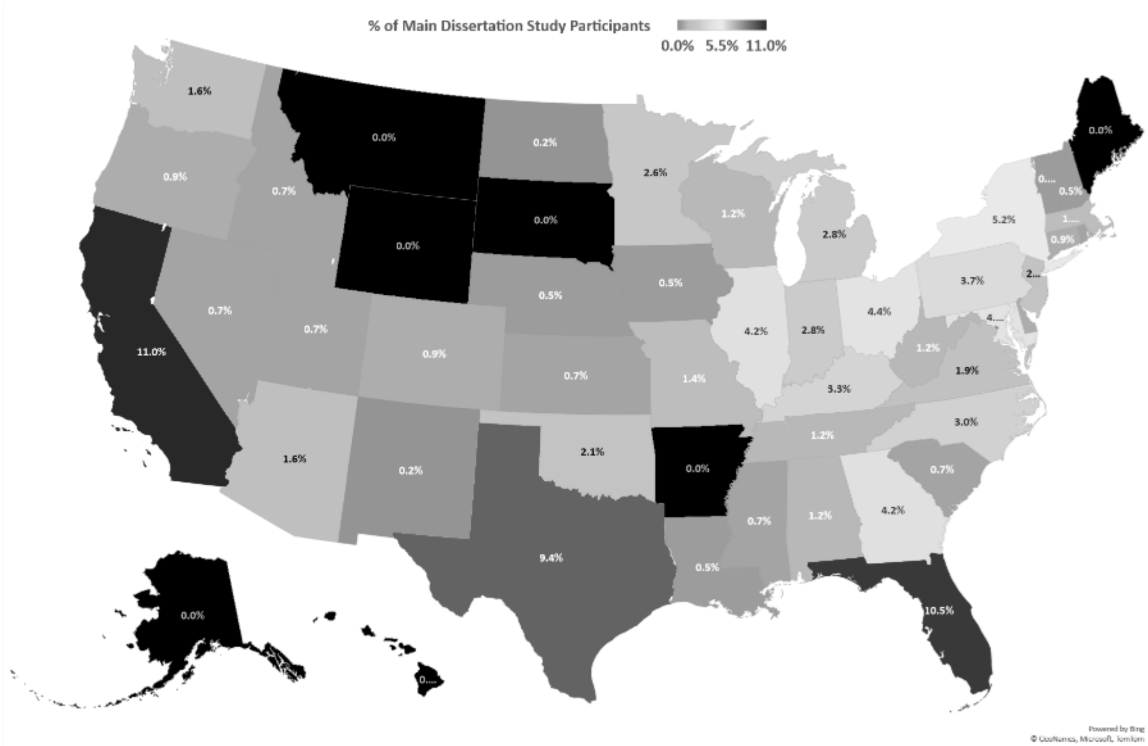

Figure 27: Percentage of Main Dissertation Study Participants by State

State	Quantity	Percentage	State	Quantity	Percentage	State	Quantity	Percentage
CA	47	11.01%	AZ	7	1.64%	SC	3	0.70%
FL	45	10.54%	WA	7	1.64%	UT	3	0.70%
TX	40	9.37%	MA	6	1.41%	IA	2	0.47%
NY	22	5.15%	MO	6	1.41%	LA	2	0.47%
MD	19	4.45%	AL	5	1.17%	NE	2	0.47%
OH	19	4.45%	TN	5	1.17%	NH	2	0.47%
GA	18	4.22%	WI	5	1.17%	VT	2	0.47%
IL	18	4.22%	WV	5	1.17%	ND	1	0.23%
PA	16	3.75%	CO	4	0.94%	NM	1	0.23%
KY	14	3.28%	CT	4	0.94%	AK	0	0%
NC	13	3.04%	DE	4	0.94%	AR	0	0%
IN	12	2.81%	OR	4	0.94%	DC	0	0%
MI	12	2.81%	ID	3	0.70%	HI	0	0%
MN	11	2.58%	KS	3	0.70%	ME	0	0%
NJ	9	2.11%	MS	3	0.70%	MT	0	0%
OK	9	2.11%	NV	3	0.70%	SD	0	0%
VA	8	1.87%	RI	3	0.70%	WY	0	0%

Table 36: Main Study - Participants Sorted by State

Recall from Figure 23: International Energy Conservation Code (IECC) Climate Regions, that the United States has eight (8) Climate Regions or Zones (note: the 8th IECC Climate Zone encompasses only several boroughs in Alaska). Our participant distribution is not evenly split across the seven (7) IECC zones found within the continental USA.

IECC_Climate_Zone		Frequency	Percent	Valid Percent	Cumulative Percent	Recoded IECC Climate Zone
Valid	1	5	1.2	1.2	1.2	A
	2	75	17.6	17.6	18.7	A
	3	109	25.5	25.5	44.3	B
	4	108	25.3	25.3	69.6	C
	5	105	24.6	24.6	94.1	D
	6	22	5.2	5.2	99.3	D
	7	3	0.7	0.7	100.0	D
	Total	427	100.0	100.0		

Table 37: Main Study - IECC Climate Zones

Table 37 details the main study's participant distribution within the IECC Climate Zones

recoded_IECC_Climate_Zone					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**A**	80	18.7	18.7	18.7
	B	109	25.5	25.5	44.3
	C	108	25.3	25.3	69.6
	D	130	30.4	30.4	100.0
	Total	427	100.0	100.0	

Table 38: Main Study - recoded IECC Climate Zones

along with our recoded and relabeled IECC Climate Zone. Table 38 summarizes the main study's participants within this research's redefined Control Variable.

Participant Demographics

Respondents provided their Biological Gender, Age Range, Education, Income Range, and if they owned or rented their primary residence (Residential Ownership). Two individuals did not provide their Biological Gender, were assigned a value of '3', have been labeled 'Did Not Disclose' by the researcher, and remain in the dataset. Table 39 details the main study's participant demographics.

Category	Variable	Frequency	Percent	Cumulative Percent
Biological Gender	1. Female	190	44.50%	44.50%
	2. Male	235	55.04%	99.53%
	3. Did Not Disclose	2	0.47%	100.00%
	Total	427	100.00%	
Age Range	1. Under 18	0	0.00%	0.00%
	2. 18-24 years old	24	5.62%	5.62%
	3. 25-34 years old	175	40.98%	46.60%
	4. 35-44 years old	123	28.81%	75.41%
	5. 45-54 years old	55	12.88%	88.29%
	6. 55-64 years old	27	6.32%	94.61%
	7. 65+ years old	23	5.39%	100.00%
	Total	427	100.00%	
Education	1. Less than high school degree	3	0.70%	0.70%
	2. High school graduate (high school diploma or equivalent including GED)	47	11.01%	11.71%
	3. Some college but no degree	84	19.67%	31.38%
	4. Associate degree in college (2-year)	49	11.48%	42.86%
	5. Bachelor's degree in college or university (4-year)	180	42.15%	85.01%
	6. Master's degree	51	11.94%	96.96%
	7. Doctoral degree	13	3.04%	100.00%
	Total	427	100.00%	
Income Range	1. Less than $32,000	74	17.33%	17.33%
	2. $32,000 to $53.000	88	20.61%	37.94%
	3. $53,001 to $99,000	160	37.47%	75.41%
	4. $99,001 to $125,000	50	11.71%	87.12%
	5. $125,001 to $170,000	39	9.13%	96.25%
	6. $170,001 to $237,000	11	2.58%	98.83%
	7. More than $237,001	5	1.17%	100.00%
	Total	427	100.00%	
Residential Ownership	1. Rent	174	40.75%	40.75%
	2. Own	253	59.25%	100.00%
	Total	427	100.00%	

Table 39: Main Study - Participant Demographics

Confirmatory Analysis

While fixing the number of factors, the EFA process steps were performed on the dissertation research full dataset for the purpose of confirming the items once again aggregate into their respective factors and the associated scales maintained their reliability. The results of this analysis are discussed below with supporting table (Table E. 7) available in the Appendices (Phase 4: Dissertation Research Study (Main Study)).

A review of the Rotated Factor Matrix (Table E. 7) found that 2 items (SNM_4 & SNM_5) in the Subjective Norms were not factoring together with the other Subjective Norms items. PA_3 was loading with the other Agreeableness (PA) items however PA_3 was only contributing 0.184. Lastly, the Attitude (ATT) and Perceived Behavior Control (PBC) constructs factored together, however when evaluated separately, with the same dataset, these two constructs factor separately (Table 40). No changes were made due to these observations however they are being noted here for completeness.

Rotated Factor Matrix[a]

	Factor 1	Factor 2
ATT_3	0.85	
ATT_1	0.83	
ATT_2	0.80	
PBC_3		0.63
PBC_1		0.58
PBC_2		0.54

Extraction Method: Principal Axis Factoring.Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Table 40: Main Study - ATT & PBC: Rotated Factor Matrix

Item & Construct Descriptive Statistics with Tests of Normality

Items

Descriptive statistics of all 111 item's quantity, means, standard deviations, variance, skewness, and kurtosis can be found in Table E. 8. The Kolmogorov-Smirnov and Shapiro-Wilk normality tests for all 111 items can be found in Table E. 9. The researcher used both the Kolmogorov-Smirnov and Shapiro-Wilk test to determine whether the individual item's responses fit a normal distribution. Kolmogorov-Smirnov and Shapiro-Wilk p-values were evaluated for reaching threshold values of .05 or greater. All 111 items indicate a significant departure from normality ($p < 0.001$) for both Kolmogorov-Smirnov and Shapiro-Wilk. Utilizing recommendations from Field (2013) and George & Mallery (2016) in addressing a failed Kolmogorov-Smirnov test, the researcher proceeded to inspect skewness and kurtosis of the data to identify the fit of the distribution. Research suggests a normal distribution may be suitable if skewness and kurtosis are within the range of -2 to +2, with a potential cutoff point as high as 7 for kurtosis (Byrne, 2006; George & Mallery, 2016; Hair et al., 2019). Table 41 summarizes that 13 items have a Skewness less

	Skewness	Kurtosis
Minimum Value	-3.859	-1.377
Maximum Value	0.933	18.374
Count Less Than -2	13	0
Count Greater Than +2	0	32
Count Greater Than +7	0	8

Table 41: Main Study Items - Skewness and Kurtosis Summary

than -2 and none are greater than 2. Kurtosis evaluation found that 8 items are greater than +7, and 24 fall between +2 and +7. Table E. 8 highlights each individual item that fell outside the suitable skewness and kurtosis range. No items were removed from the aggregation because of these however they are noted, and the dataset was considered represented within a normal distribution.

Histograms with normal overlays were created and reviewed in SPSS. Boxplots were created for each item to evaluate for outliers. While there were outliers in several of the individual items, the researcher did not remove any individual responses from the main study dataset due to them.

Constructs

Descriptive statistics of all 29 constructs means, standard deviations, variance, skewness, kurtosis, and tests of normality can be found in Appendix 0 (Table E. 10, Table E. 11, and Table E. 12). Of importance to understanding the data in Table E. 10 and Table 43 is the distinction of high numerical values associated to high evaluated responses. For example, a score of 5 represents a response of strong agreement. Conversely, a score of 1 represents strong disagreement.

As with the 111 survey items, the researcher used both the Kolmogorov-Smirnov and Shapiro-Wilk test to determine whether the constructs fit a normal distribution and utilized recommendations from Field (2013) and George & Mallery (2016) in addressing failed Kolmogorov-Smirnov tests. All 29 constructs indicate a significant departure from normality ($p < 0.001$) for both Kolmogorov-Smirnov and Shapiro-Wilk (Table E. 12). Research suggests a normal distribution may be suitable if skewness and kurtosis are within the range of -2 to +2, with a potential cutoff point as high as 7 for kurtosis (Byrne, 2006; George & Mallery, 2016; Hair et al., 2019).

	Skewness	Kurtosis
Minimum Value	-3.526	-1.153
Maximum Value	0.680	17.615
Count Less Than -2	2	0
Count Greater Than +2	0	8
Count Greater Than +7	0	2

Table 42: Main Study Constructs - Skewness and Kurtosis Summary

Table 42 summarizes that 2 constructs have a Skewness less than -2 and none are greater than 2. Kurtosis evaluation found that 2 constructs are greater than +7, and 6 fall between +2 and +7. Table E. 11 highlights each individual construct that fell outside the suitable skewness and kurtosis range. No constructs were removed from the study due to this; however, these have been noted and the constructs were considered represented within a normal distribution.

Table 43 summarizes all the constructs means, standard deviations, and number of potential outliers based on their respective boxplots. While each of these potential outliers merits a follow-up, to make a determination if it necessitates re-running the analysis without them, this researcher did not remove individual responses based on boxplots and proceeded with hypothesis analysis via multiple linear regression analysis.

Construct	N Statistic	Mean Statistic	Std. Deviation Statistic	Number of Boxplot Outliers
INT	427	4.2623	0.77610	13
ECN	427	2.3372	1.18116	0
ESK	427	3.4996	0.99277	0
NEP	427	3.0515	0.93289	0
ATT	427	4.1249	0.92409	7
SNM	427	2.5457	0.82783	5
PMN	427	3.9052	0.93640	9
PBC	427	4.1038	0.75984	4
AFF	427	4.3911	0.76762	11
FFM	427	3.6056	0.40996	8
PO	427	4.1405	0.79745	10
PC	427	3.9563	0.85560	1
PE	427	2.8017	1.10895	0
PA	427	4.4020	0.59905	3
PN	427	2.7276	1.25491	0
FIN	427	4.3883	0.78540	14
FIN05	214	4.0981	0.86708	9
FIN20	213	4.6798	0.56017	10
HAB	427	3.8628	0.96764	7
NTC	427	2.9364	0.89596	0
TCC	427	3.4614	1.19718	0
TCW	427	2.4114	1.11711	0
NCN	427	4.4666	0.59609	11
NCA	167	4.6115	0.48003	2
NCE	198	4.4160	0.60084	7
NCL	62	4.2379	0.75467	1
TON	427	4.0169	0.87848	9
DPN	427	4.1265	1.05016	8
DGN	427	3.4014	1.28439	0

Table 43: Main Study Constructs - Means and Boxplot Outliers Summary

Multiple Linear Regression Analysis

Hypothesis	Path	Tolerance	VIF	F statistics Regression df	Residual df	value	p	% Varience Explained
H1-	ECN ---> ATT	1.000	1.000	1	425	13.447	<0.001	3.1%
H2	ECN ---> SNM	1.000	1.000	1	425	12.360	<0.001	2.8%
H3-	ECN ---> PBC	1.000	1.000	1	425	9.876	0.002	2.3%
H4-	ECN ---> AFF	1.000	1.000	1	425	14.097	<0.001	3.2%
H5	ESK ---> PMN	1.000	1.000	1	425	32.180	<0.001	7.0%
H6	NEP ---> ATT	1.000	1.000	1	425	6.358	0.012	1.5%
H7	NEP --->PMN	1.000	1.000	1	425	3.297	0.070	0.8%
H8	NEP ---> AFF	1.000	1.000	1	425	3.105	0.079	0.7%
H9	ATT ---> INT	1.000	1.000	2	424	49.908	<0.001	19.1%
H10	SNM ---> INT	0.992	1.008	2	424	7.375	<0.001	3.4%
H11	DNM ---> INT	Not Tested (merged with H10)						
H12	PMN ---> INT	0.998	1.002	2	424	47.217	<0.001	18.2%
H13	PBC ---> INT	1.000	1.000	2	424	34.253	<0.001	13.9%
H14	AFF ---> INT	0.996	1.004	2	424	19.384	<0.001	8.4%
H15	FFM X ATT ---> INT	0.981	1.019	4	422	40.381	<0.001	27.7%
H15a-	PO X ATT ---> INT	0.993	1.007	4	422	33.053	<0.001	23.9%
H15b	PC X ATT ---> INT	0.987	1.013	3*	423*	49.949*	<0.001*	26.2%*
H15c-	PE X ATT ---> INT	0.995	1.005	4	422	31.696	<0.001	23.1%
H15d	PA X ATT ---> INT	0.967	1.034	3*	423*	39.443	<0.001*	21.9%*
H15e-	PN X ATT ---> INT	0.986	1.014	3*	423*	34.508	<0.001*	19.7%*
H16	FFM X SNM ---> INT	0.963	1.039	3*	423*	18.171	<0.001*	11.4%*
H17	FFM X DNM ---> INT	Not Tested (H11 removed)						
H18	FFM X PMN ---> INT	0.984	1.017	3*	423*	41.276*	<0.001*	22.6%*
H19	FFM X PBC ---> INT	0.994	1.007	3*	423*	39.216*	<0.001*	21.8%*
H20	FFM X AFF ---> INT	0.960	1.042	4	422	22.534	<0.001	17.6%
H20a-	PO X AFF ---> INT	0.957	1.045	4	422	15.688	<0.001	12.9%
H20b	PC X AFF ---> INT	0.950	1.053	3*	423*	28.960*	<0.001*	17.0*%
H20c-	PE X AFF ---> INT	0.989	1.012	4	422	14.698	<0.001	12.2%
H20d	PA X AFF ---> INT	0.870	1.149	3*	423*	20.786*	<0.001*	12.8*%
H20e-	PN X AFF ---> INT	0.952	1.050	3*	423*	14.794*	<0.001*	9.5*%
H21	FIN X PBC ---> INT	0.995	1.005	3*	423*	35.861*	<0.001*	20.3*%
H22	FIN X ATT ---> INT	0.879	1.137	3*	423*	41.822*	<0.001*	22.9*%
H23	Age X PBC ---> INT	0.071	13.991	3*	423*	23.034*	<0.001*	14.0*%
H24-	NTC X PBC ---> INT	0.930	1.075	3*	423*	34.499*	<0.001*	19.1%*
H25-	NTC X ATT ---> INT	0.931	1.074	3*	423*	43.948*	<0.001*	23.8*%
H26	Gender X SNM ---> INT	0.087	11.499	3*	423*	5.906*	<0.001*	4.0*%
H27	NCN X PBC ---> INT	0.953	1.049	3*	423*	35.663*	<0.001*	20.2*%
H28	Education X ATT ---> INT	0.078	12.884	3*	423*	33.205*	<0.001*	19.1*%
H29	HAB X ATT ---> INT	0.979	1.022	4	422	36.849	<0.001	25.9%
H30	HAB X PBC ---> INT	0.983	1.017	4	422	28.420	<0.001	21.2%

* -reduced model values; otherwise full model values presented

Table 44: Main Study - Regression Analysis Summary

Multiple regression analyses were conducted to examine the relationships for each of the individual hypothesis. Table 44 summarizes the key results from the full model for each hypothesis. For example, reviewing H12 in Table 44, we see the relationship between Personal Moral Norms (PMN) and Intention (INT) where neither Tolerance nor VIF statistics indicated the presence of marked multicollinearity. The full model was significant [$F(2,424) = 47.217$, $p < 0.001$] and explained 18.2% of the variance in Intention.

If noted by an asterix (*), the reduced model values are presented due to the change between the reduced model and the full model not being statistically significant. For example, reviewing H27 in Table 44, we see the Notification Channel (NTC) moderation relationship between Perceived Behavioral Control (PBC) and Intention (INT) where neither Tolerance nor VIF statistics indicated the presence of marked multicollinearity. The full model was not significant. However the reduced model, without the moderation, was significant [$F(3,423) = 35.663$, $p < 0.001$] and explained 20.2% of the variance in Intention.

Neither Tolerance nor VIF statistics indicated the present of marked multicollinearity in a majority of the situations with the exceptions being three moderation hypotheses H23, H26, and H28. Several authors note that multicollinearity, with respect to a moderation relationship, may not be relevant (Chennamaneni et al., 2016; McClelland et al., 2017; Shieh, 2010) where multicollinearity has been compared to "*a red herring in the hunt for interactions in moderated multiple regression*" (McClelland et al., 2017, p. 400). Given these are moderation hypotheses, and not significant (Table 45), the researcher did not pursue additional remedies.

Hypotheses H9 through H30 controlled for the recoded IECC Climate Zone (Table 38 with additional reference to Figure 23) of the participant. These hypotheses are where Intention (INT) is the dependent variable in the regression analysis.

Due to the reduction of the Descriptive Norms (DNM) construct down to two (2) items and it's subsequent merge with Injunctive Norms (INM) to form the Subjective Norms (SNM) scale, as described in the Phase 3: Pilot Study Exploratory Factor Analysis, H11 & H17 were not tested.

H16a- through H19e- and H31 through H35- are not presented in Table 44 because either 1) their Omnibus hypothesis was not supported due to lack of significance (see Table 45; H16, H18, H19 with reference to Figure 22: Research Model), 2) the Omnibus hypothesis was not tested (i.e., H17), or 3) in the case of the three-way moderation hypotheses H31 through H35-, the relationships they moderate (Figure 22) were not found to be significant therefore not supported (see Table 45; H21, H22, H27).

Hypothesis	Beta	Residual df	t	p	# of Casewise Diagnostics Standardized Residuals (>3 SD)	Hypothesis Result
H1-	-0.137	425	-3.667	<0.001	4	Supported
H2	0.118	425	3.516	<0.001	3	Supported
H3-	-0.097	425	-3.143	0.002	2	Supported
H4-	-0.116	425	-3.755	<0.001	6	Supported
H5	0.250	425	5.673	<0.001	4	Supported
H6	0.120	425	2.521	0.012	5	Supported
H7	0.088	425	1.816	0.070	5	Supported
H8	0.070	425	1.762	0.079	7	Supported
H9	0.363	424	9.894	<0.001	9	Supported
H10	0.163	424	3.626	<0.001	7	Supported
H11	Not Tested (merged with H10)					
H12	0.351	424	9.620	<0.001	6	Supported
H13	0.376	424	8.167	<0.001	8	Supported
H14	0.287	424	6.089	<0.001	7	Supported
H15	-0.264	422	-3.074	0.002	5	Supported
H15a-	-0.165	422	-3.344	<0.001	7	Supported
H15b	-0.006	422	-0.086	0.877	6	Not Supported
H15c-	-0.077	422	-2.650	0.008	8	Supported
H15d	-0.004	422	-0.660	0.947	7	Not Supported
H15e-	-0.010	422	-0.036	0.721	9	Not Supported
H16	-0.077	422	-0.777	0.438	6	Not Supported
H17	Not Tested (H11 removed)					
H18	-0.116	422	-1.377	0.169	5	Not Supported
H19	-0.168	422	-1.526	0.128	6	Not Supported
H20	-0.327	422	-3.335	<0.001	7	Supported
H20a-	-0.165	422	-3.093	0.002	7	Supported
H20b	-0.078	422	-1.502	0.134	6	Not Supported
H20c-	-0.104	422	-2.582	0.010	7	Supported
H20d	-0.116	422	-1.494	0.136	7	Not Supported
H20e-	-0.019	422	-0.505	0.614	7	Not Supported
H21	-0.650	422	-1.101	0.271	8	Not Supported
H22	-0.005	422	-0.132	0.895	7	Not Supported
H23	0.042	422	0.930	0.353	8	Not Supported
H24-	-0.009	422	-0.191	0.849	9	Not Supported
H25-	0.057	422	1.511	0.132	8	Not Supported
H26	0.071	422	0.790	0.430	7	Not Supported
H27	-0.062	422	-0.730	0.466	6	Not Supported
H28	0.006	422	0.209	0.834	9	Not Supported
H29#	-0.118#	422	-3.268	0.001#	6	Not Supported#
H30#	-0.152#	422	-3.280	0.001#	7	Not Supported#
H31	Not Tested (H27 not significant)					
H32	Not Tested (H27 not significant)					
H33	Not Tested (H27 not significant)					
H34-	Not Tested (H22 not significant)					
H35-	Not Tested (H21 not significant)					

- significant (p < 0.001) however sign on Beta / direction of hypothesis not as hypothesized

Table 45: Main Study - Regression Analysis Summary (continued)

For all the individual hypotheses, Table 45 summarizes the full model coefficients parameters resulting from the regression analysis, the number of Casewise diagnostics with standardized residuals greater than 3 standard deviations (SD), and if the Research Model hypotheses as proposed and researched (Figure 22) were supported. Table 45 presents main effects as well as interaction hypotheses.

To aid in interpreting all the main effect hypotheses summarized in Table 45, an analysis of a main effect hypothesis of interest to H9 (ATT ---> INT) is now detailed. The unstandardized coefficient for ATT was 0.363 indicating that, while holding the participant's recoded International Energy Conservation Code (IECC) Climate Region (Table 38) constant, each unit increase in ATT leads to an increase of 0.363 units in INT, in the same direction as predicted in the Research Model, and this results is significantly different from zero [$t(424) = 9.894$, $p < 0.001$]. There are nine Cases in our data that lead to standardized residuals larger than three (3) Standard Deviations. While each of these potential outliers merits a follow-up, to investigate and decide if it necessitates re-running the analysis without them, this researcher did not remove these Cases from the data and proceeded with hypothesis support determination based on the dataset containing these Cases. These results provide support for the positive relationship between ATT and INT which was predicted in H9.

To aid in interpreting all the interaction hypotheses summarized in Table 45, an analysis of an interaction hypothesis of interest to H29 (HAB X ATT ---> INT) is now detailed. Please note that plots and evaluations of all significant moderations are detailed in the subsequent Significant Moderations section and not repeated here. A multiple regression analysis was conducted to examine the interaction between Habits (HAB) and

Attitude (ATT) as predictors of Intention to Curtail Electricity Demand (kW) at the participant's primary residence during a 6pm-9pm Peak Demand (INT). All interaction hypotheses results are reported based on mean-centered predictors as well as their product. The participant's recoded International Energy Conservation Code (IECC) Climate Region (Table 38) was controlled for and held constant. As noted in Table 44, the full model was significant [$F(4,422) = 36.849$, $p < .001$] and explained 25.9% of the variance in INT. A reduced model, not containing the interaction between HAB and INT is presented in the Appendix (Table E. 36), explained 24.0% of the variance; the change in explained variance of 1.9% between the reduced and full models was significant [$F(1,422) = 10.679$, $p <0.001$], indicating the presence of a significant interaction between HAB and ATT. Table 45 provides the details of the interaction coefficient, which was found to be -0.118, and this relationship is significantly different from zero [$t(422) = -3.268$, $p < .001$]. There are six Cases in our data that lead to standardized residuals larger than three (3) Standard Deviations. While each of these potential outliers merits a follow-up, to investigate and decide if it necessitates re-running the analysis without them, this researcher did not remove these Cases from the data and proceeded with hypothesis support determination based on the dataset containing these Cases. While H29 was found to be significant ($p<0.001$), given the negative sign on the interaction coefficient (i.e., $B = -0.118$), these results do not provide support for the positive moderation relationship that was predicted in H29.

As summarized in Table 45, each of the hypotheses have Cases (i.e., individual responses) in our data that lead to standardized residuals larger than three (3) Standard Deviations (SD). While each of these potential outliers merits a follow-up, to investigate and make a determination if it necessitates re-running the analysis without them, this researcher did not remove these Cases from the data and proceeded with hypothesis support determination based on the dataset containing these Cases.

Histograms, P-P plots of the residuals, and the scatterplots of the standardized predicted values against the standardized residuals were evaluated. Across all the hypotheses, there is some light skew in the residuals which is more than one would expect if they followed a standard normal distribution. To this researcher, the scatterplots of the standardized predicted values against the standardized residuals look random with no discernible pattern. This researcher considered this in the determination that homoscedasticity has not been violated.

Significant Moderations

Per our Research Model, moderations were hypothesized as H15 through H35-. Eight (H15, H15a-, H15c-, H20, H20a-, H20c-, H29, and H30) were found to be significant (Table 45). In Figure 28, Panels A through F display the interaction plots and moderation effect for the significant Personality moderations hypothesized (H15 – H20) and measured as part of this research. In Panel A, we see a plot of the relationship between Personality (FFM), Attitude (ATT), and Intention to Curtail (INT) indicating that the relationship between ATT and INT, which is positive in nature (H9; Table 45), takes on a steeper negative angle for higher values of FFM; conversely, the relationship is attenuated, but still negative, for lower values of FFM. This means that those individuals that score higher on their aggregated Personality (FFM) scale, and have a high Attitude (ATT), have a lower Intention to Curtail (INT) compared to those individuals with a lower aggregated

Personality (FFM) score and the same high Attitude (ATT). Interestingly, when we investigate the significant subconstructs of Personality with Attitude and Intention (Panel B H15a- (Openness) and Panel C H15c- (Extraversion)), we see for individuals with lower Openness and Extraversion scores, the positive relationship found with H9 (Table 45) is exacerbated whereas for individuals with higher Openness and Extraversion scores, with the same high Attitudes, the relationship becomes negative. This same pattern is observed in Panels D through F between Personality (FFM), Affect (AFF), and Intention to Curtail (INT). This means that those individuals that score higher on their Openness or Extraversion scales and have a high Attitude or high Affect, have a much lower Intention to Curtail compared to those individuals with a lower Openness or Extraversion scores and the same high Attitude.

The additional Personality subconstructs of Conscientiousness, Agreeableness, and Neuroticism, that were hypothesized within H15 and H20, were not found to be significant (Table 45). As a result, those interaction plots and moderation effects were not explored.

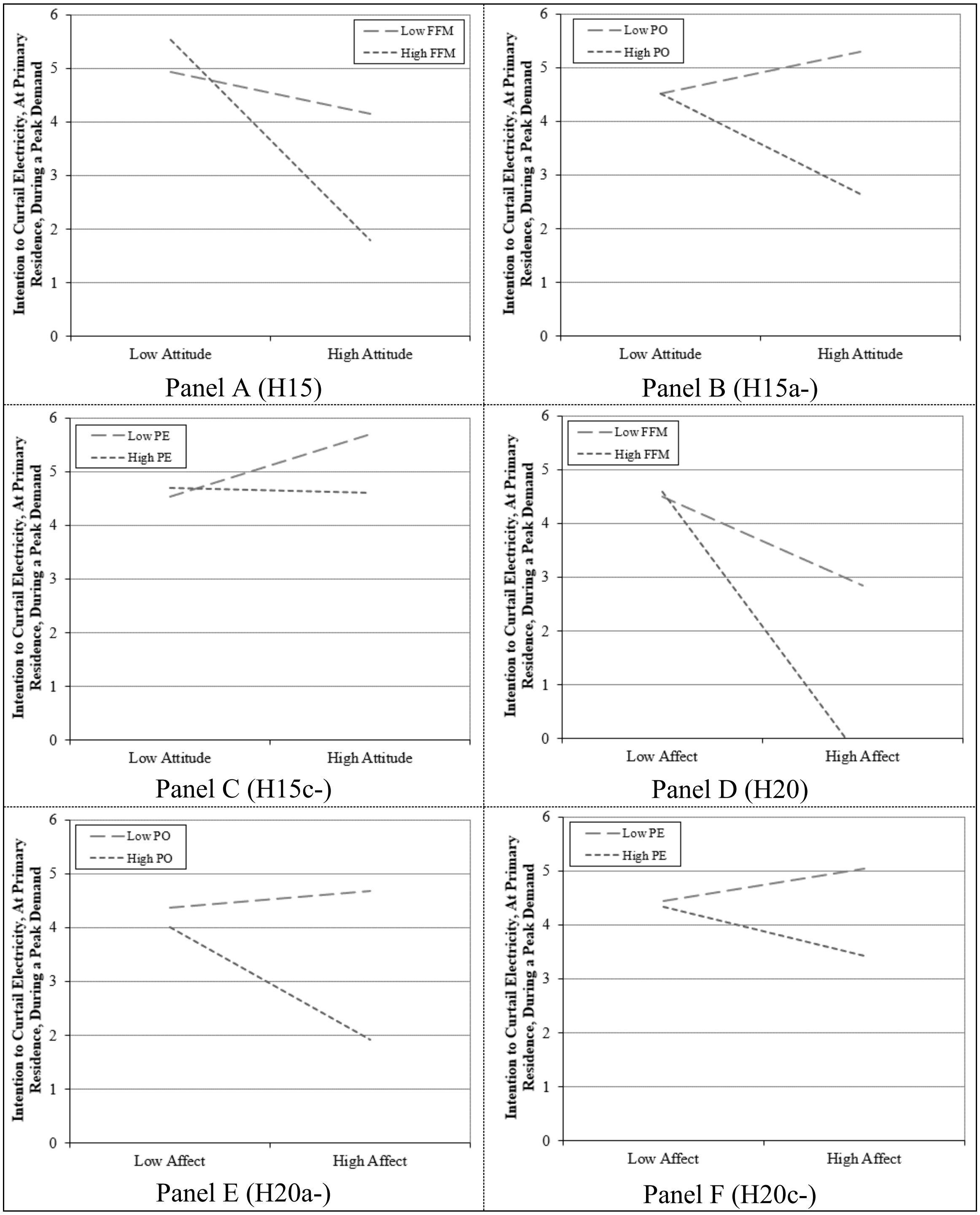

Figure 28: Significant Moderations: H15 through H20c-

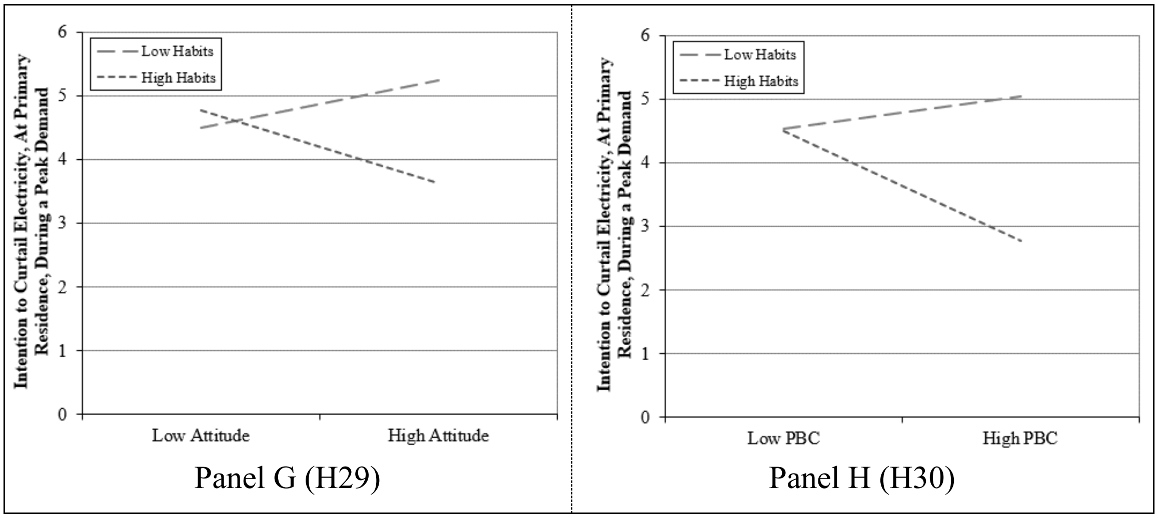

Figure 29: Significant Moderations: H29 & H30

In Figure 29, Panels G and H display the interaction plots and moderation effect for the significant Habit moderations hypothesized (H29 – H30) and measured as part of this research. In Panel G, we see a plot of the relationship between Habits (HAB), Attitude (ATT), and Intention to Curtail (INT) indicating for individuals with lower Habit scores, the positive relationship found with H9 (Table 45) is exacerbated whereas for individuals with higher Habit scores, with the same high Attitudes, the relationship becomes negative. This same pattern is observed in Panel H between Habits, Perceived Behavior Control (PBC), and Intention to Curtail (INT). This means that those individuals that score higher on their Habits scales and have a high Attitude or high Perceived Behavioral Control, have a much lower Intention to Curtail compared to those individuals with lower Habit scores and the same high Attitude score or high Perceived Behavioral Control score.

Hypotheses Summary

Hypothesis (Label | Description)		Result
H1-	As an individual's Energy Concern increases, their Attitude towards Electric Demand Curtailment decreases.	Supported***
H2	As an individual's Energy Concern increases their Perceived Approval of Significant Others towards Electric Demand Curtailment increases.	Supported***
H3-	As an individual's Energy Concern increases, their Perceived Behavioral Control over Electric Demand Curtailment decreases.	Supported**
H4-	As an individual's Energy Concern increases, their favorable feelings engendered towards Electric Demand Curtailment decreases.	Supported***
H5	As an individual's Electricity Savings Knowledge increases so will their feelings of Personal Moral obligations towards Electric Demand Curtailment increase.	Supported***
H6	As an individual's Environmental Awareness increases so will their favorable Attitude towards Electric Demand Curtailment increase.	Supported**
H7	As an individual's Environmental Awareness increases so will their feelings of Personal Moral obligations towards Electric Demand Curtailment increase.	Supported*
H8	As an individual's Environmental Awareness increases so will their favorable feelings engendered towards Electric Demand Curtailment increase.	Supported*
H9	As an individual's Attitude towards Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.	Supported***
H10	As an individual's Perceived Approval of Important Others towards Electric Demand Curtailment increases so will the individual's Intention to Curtail their Electric Energy Demand at their Primary Residence increase.	Supported***
H11	As an individual's Perceived Prevalence of Significant Others actual Electric Energy Demand Curtailment increases so will the individual's Intention to Curtail their Electric Energy Demand at their Primary Residence increase.	Not Tested

Hypothesis (Label | Description)		Result
H12	As an individual's feelings of Personal Moral obligations towards Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.	Supported***
H13	As an individual's Perceived Behavioral Control over Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.	Supported***
H14	As an individual's Feelings Engendered towards Electric Demand Curtailment increases so will their Intention to Curtail their Electric Energy Demand at their Primary Residence increase.	Supported***
H15	Personality will moderate the relationship between Attitude and Intention.	Supported**
H15a-	As an individual's Openness (O) increases, the relationship between Attitude and Intention decreases.	Supported***
H15b	As an individual's Conscientiousness (C) increases, the relationship between Attitude and Intention increases.	Not Supported
H15c-	As an individual's Extraversion (E) increases, the relationship between Attitude and Intention decreases.	Supported**
H15d	As an individual's Agreeableness (A) increases, the relationship between Attitude and Intention increases.	Not Supported
H15e-	As an individual's Neuroticism (N) increases, the relationship between Attitude and Intention decreases.	Not Supported
H16	Personality will moderate the relationship between Perceived Approval (Injunctive Norms) and Intention.	Not Supported
H17	Personality will moderate the relationship between Perceived Prevalence of Significant Others (Descriptive Norms) and Intention.	Not Tested
H18	Personality will moderate the relationship between Personal Moral Norms and Intention.	Not Supported
H19	Personality will moderate the relationship between Perceived Behavioral Control and Intention.	Not Supported
H20	Personality will moderate the relationship between Affect and Intention.	Supported***
H20a-	As an individual's Openness (O) increases, the relationship between Affect and Intention decreases.	Supported**
H20b	As an individual's Conscientiousness (C) increases, the relationship between Affect and Intention increases.	Not Supported

Hypothesis (Label | Description)		Result
H20c-	As an individual's Extraversion (E) increases, the relationship between Affect and Intention decreases.	Supported**
H20d	As an individual's Agreeableness (A) increases, the relationship between Affect and Intention increases.	Not Supported
H20e-	As an individual's Neuroticism (N) increases, the relationship between Affect and Intention decreases.	Not Supported
H21	As Financial Incentives increase, the relationship between Attitude and Intention increases.	Not Supported
H22	As Financial Incentives increase, the relationship between Perceived Behavioral Control and Intention increases.	Not Supported
H23	As Age increases, the relationship between Perceived Behavioral Control and Intention increases.	Not Supported
H24-	The Degree of Need for Thermal Comfort will negatively moderate the relationship between Attitude and Intention.	Not Supported
H25-	The Degree of Need for Thermal Comfort will negatively moderate the relationship between Perceived Behavioral Control and Intention.	Not Supported
H26	The relationship between Perceived Approval of Significant Others and Intention will be stronger for Women than Men.	Not Supported
H27	Notification Channel moderates the relationship between Perceived Behavioral Control and Intention.	Not Supported
H28	For individuals with a higher degree of formal Education, the relationship between Attitude and Intention increases.	Not Supported
H29	For individuals who possess a high degree of Electric Energy Curtailment Habits, the relationship between Attitude and Intention increases.	Not Supported[#]
H30	For individuals who possess a high degree of Electric Energy Curtailment Habits, the relationship between Perceived Behavioral Control and Intention increases.	Not Supported[#]
H31	The timelier the Notification Channel notification, the Notification Channel moderation between Perceived Behavioral Control and Intention will increase.	Not Tested
H32	The higher the Degree of Personalization in the notification, the Notification Channel moderation between Perceived Behavioral Control and Intention will increase.	Not Tested

<table>
<tr><th colspan="2">Hypothesis (Label | Description)</th><th>Result</th></tr>
<tr><td>H33</td><td>The higher the Degree of Gamification in the notification, the Notification Channel moderation between Perceived Behavioral Control and Intention will increase.</td><td>Not Tested</td></tr>
<tr><td>H34-</td><td>As an individual's Income increases, the Financial Incentives moderation between Attitude and Intention will decrease.</td><td>Not Tested</td></tr>
<tr><td>H35-</td><td>As an individual's Income increases, the Financial Incentives moderation between Perceived Behavioral Control and Intention will decrease.</td><td>Not Tested</td></tr>
<tr><td colspan="3">***p<0.001; **p<0.05; *p<0.1; # - significant (p<0.001) however sign on Beta / direction of hypothesis not as hypothesized.</td></tr>
</table>

Table 46: Main Study - Hypotheses Summary Chart

Table 46 provides a summary of all the Dissertation Research Study's main hypotheses with their result and significance if applicable. Subconstruct hypotheses, such as H24a- through H25b- and H15a- through H20e-, are only presented if the main Omnibus

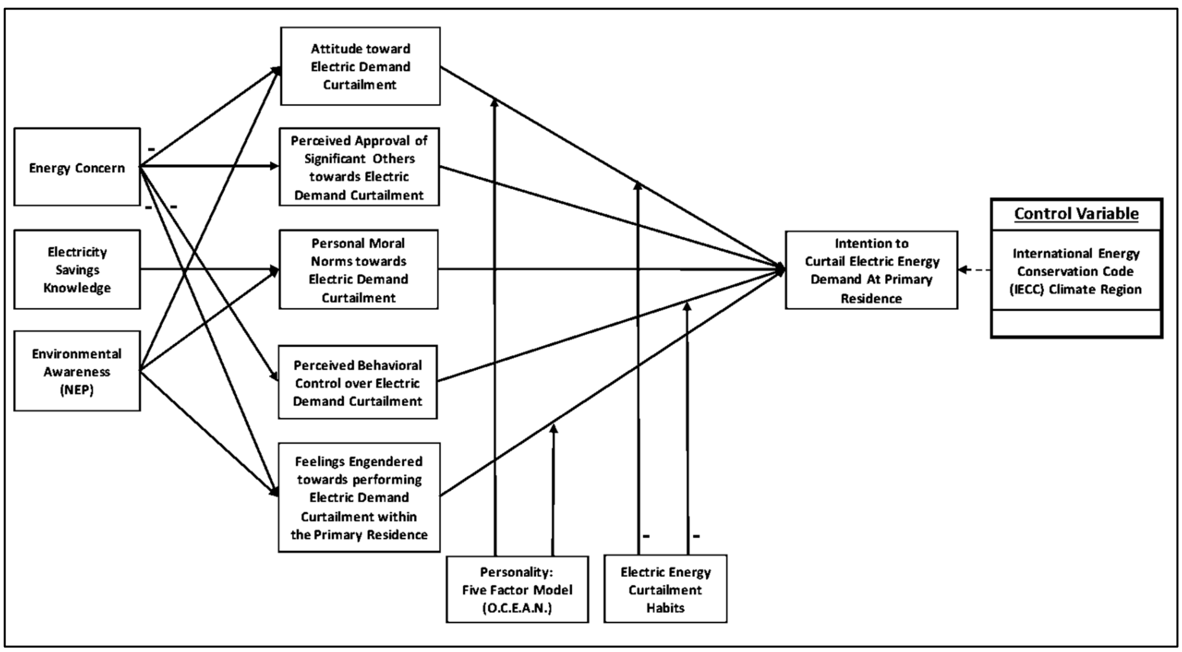

Figure 30: Resultant Dissertation Model

hypothesis (e.g., H15 & H20) was supported. Figure 30 summarizes and redraws the original research model (Figure 22) based on the significant individual hypothesis full model findings (Table 45). Regarding H7 and H8 (Table 44), Environmental Awareness to Personal Moral Norms (H7) and Affect (H8) were significant at p=.07 and p=.079 respectively. This is mentioned not to undermine the pragmatic, practical, and significant finding; however, it is noted because some may consider these findings non-significant because they are greater than p=0.05. Our research positions that p-values require context (Betensky, 2019), and this researcher is comfortable considering these two hypotheses significant.

Post Ad-Hoc Analysis

This post ad-hoc analysis section provides additional analysis on relationships found within the Phase 4 dataset (Table E. 10). Namely, we reconceptualize and explore the Financial Incentives (FIN) relationship with a moderation, the Need for Thermal Comfort (NTC) relationship with a moderation, the Notification Channel (NCN) relationship with a focus on Smartphone Notifications via an App (NCA) with moderations, and the Habits (HAB) relationship. The post ad-hoc relationships leverage this dissertation's constructs and dataset however were not hypothesized as part of this dissertation's Research Model. These reconceptualized relationships arose from our engaging Phase 1 participant dialogues, pragmatic feedback from our Stakeholder Engagement members, and materialized from several of the significant reduced models contained within our multiple linear regression results (significant reduced models are noted by an asterix in Table 44). This researcher feels this additional post ad-hoc analysis is appropriate given our interpretive framework and philosophy being primarily positivism with aspects of pragmatism. This researcher contends that reality is what is useful, is practical, and "works". For example, if a dissertation hypothesized moderation was not found to be significant however the reduced model, without the interaction, indicates that a significant relationship exists; this finding has pragmatic value to industry. These pragmatic reconceptualized relationships are explored below and noted again in Future Research Considerations. Post ad-hoc analysis is performed and visualized within SPSS leveraging the Process v4.2 Macro, moderation Model#1 (Hayes, 2022, 2023). Detailed outputs resulting from SPSS and the Process Macro are provided in the Appendices Ad-Hoc Analysis - SPSS Outputs.

Financial Incentives

Financial Incentives (FIN) were reconceptualized as an independent variable with Intention to Curtail Electric Energy Demand at Primary Residence (INT) as the dependent variable. Electric Energy Curtailment Habits were added as a Moderation on the FIN to

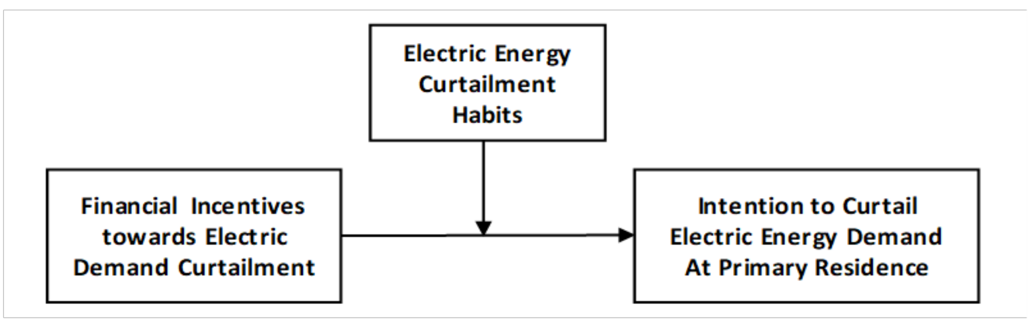

Figure 31: Ad-Hoc Analysis - Financial Incentives

INT relationship (Figure 31). The overall model was significant [$F(3,423) = 31.43$, $p<0.001$] and explained 18.2% of the variance due to these three predictors of Financial Incentives, Habits, and their interaction. Financial Incentives is positively associated with Intention to Curtail [$b=0.26$, $t(423)=6.02$, $p<0.001$] as is Habits [$b=0.23$, $t(423)=6.56$, $p<0.001$]. With respect to the interaction, the change in explained variance of 1.04% was significant [F(1,423)=5.39, p=0.021], indicating the presence of a significant interaction between Financial Incentives and Habits, with the interaction coefficient being -0.09

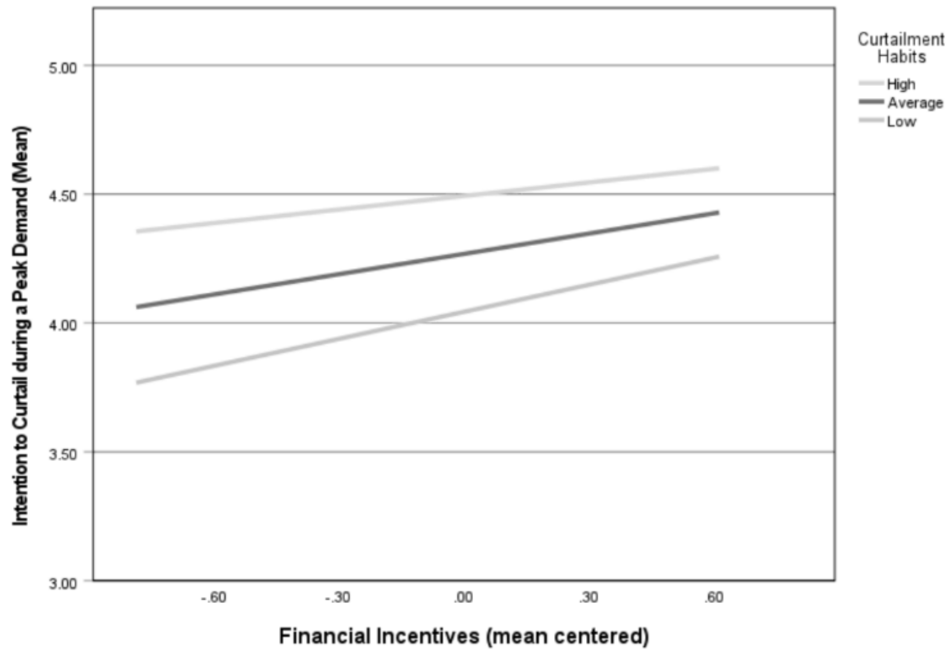

Figure 32: Moderating Effect of Habits on Financial Incentives

[t(423)=-2.32, p=0.021]. Figure 32 is presented to better understand the nature of the moderating effects. We see that the lines are converging but do not yet cross. As Habits increases, the relationship becomes less positive. When Habits are high [+1SD, b=0.18, t(423)=3.01, p=0.003], average [0 SD, b=0.26, t(423)=6.02, p<0.001], and low [-1SD, b=0.35, t(423)=6.16, p<0.001], Financial Incentives are associated with lower levels of Intention. Therefore, Habits appear to weaken the impact of Financial Incentives on Intention to Curtail Electric Energy Demand at the Primary Residence. This is certainly an interesting and significant post ad-hoc observation that has value for electric utility companies. However, as will be noted in the limitations and future research considerations section, additional research with field trials, comparisons without Financial Incentives, and customer demand curtailment behavior results (i.e. actual curtailment or not) is recommended.

Need for Thermal Comfort

Degree of Need for Thermal Comfort (NTC) was reconceptualized as an independent variable with Intention to Curtail Electric Energy Demand at Primary Residence (INT) as the dependent variable. Personality (FFM) was added as a positive Moderation on the negative NTC to INT relationship (Figure 33). The overall model was

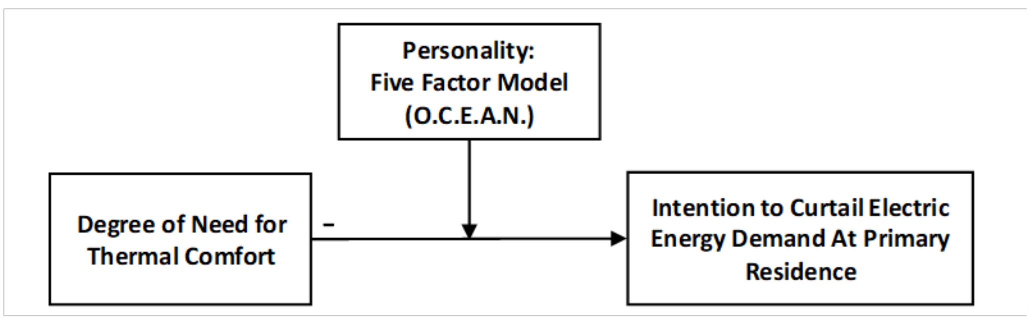

Figure 33: Ad-Hoc Analysis - Need for Thermal Comfort

significant [$F(3,423) = 40.04$, $p<0.001$] and explained 22.1% of the variance due to these three predictors of Degree of Need for Thermal Comfort, Personality, and their interaction. Degree of Need for Thermal Comfort is negatively associated with Intention to Curtail [$b=-0.30$, $t(423) = -8.10$, $p<0.001$] whereas Personality is positively associated with Intention to Curtail [$b=0.60$, $t(423)=7.33$, $p<0.001$]. With respect to the interaction, the change in explained variance of 0.7%, albeit small, was significant [$F(1,423)=3.71$, $p=0.05$]. This indicates the presence of a significant interaction between Degree of Need for Thermal Comfort and Personality, with the interaction coefficient being 0.172 [$t(423)=1.93$, $p=0.05$]. Figure 34 is presented to better understand the nature of the moderating effects.

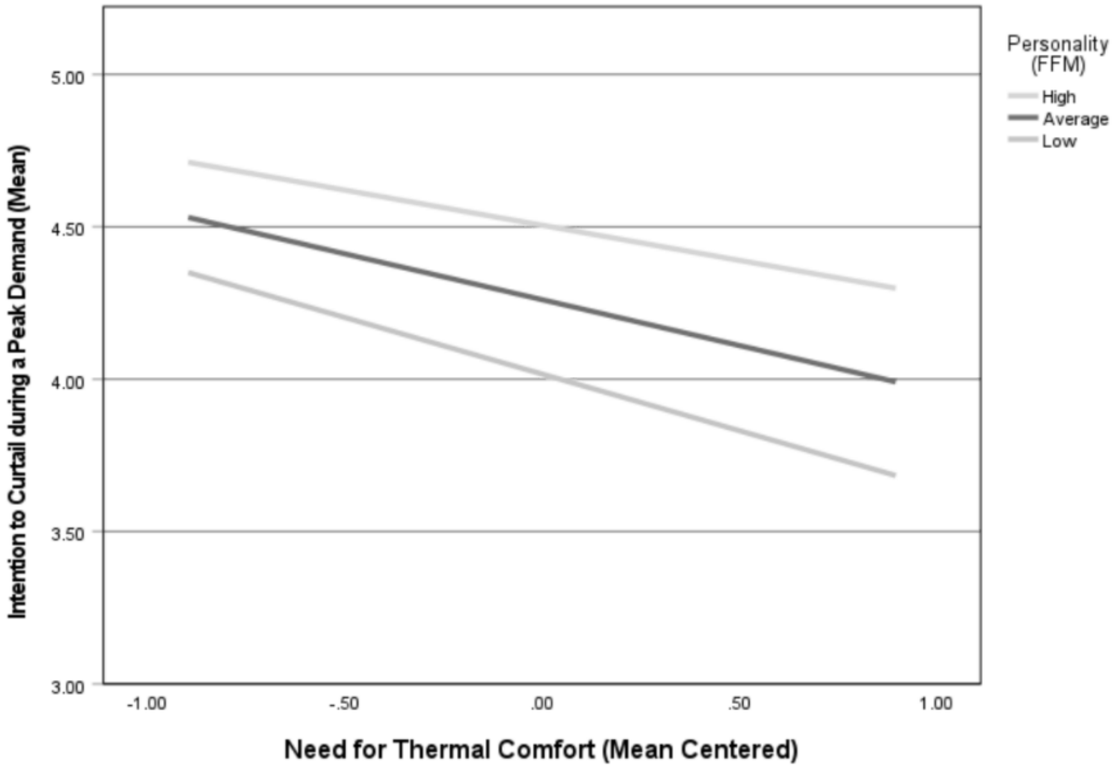

Figure 34: Moderating Effect of Personality on Need for Thermal Comfort

We see that the lines are diverging. As Personality increases the relationship becomes more negative and is attenuated for high FFM. When Personality is high [+1SD, b=-0.23, t(423)=-4.41, p<0.001], average [0 SD, b=-0.30, t(423)=-8.10, p<0.001], and low [-1SD, b=-0.37, t(423)=-7.14, p<0.001], Need for Thermal Comfort is associated with lower levels of Intention. Therefore, Personality appears to strengthen the negative relationship between Need for Thermal Comfort on Intention to Curtail Electric Energy Demand at the Primary Residence. This is certainly an interesting and significant post ad-hoc observation that has value for electric utility companies in better understanding their customer base with respect to curtailment intention. However, as will be noted in the limitations and future research considerations section, additional research with field trials, customer demand curtailment behavior results (i.e. actual curtailment or not), and leveraging Household personas, versus Personality, will be recommended.

Notification Channel

Feedback from the Stakeholder Engagement indicated that communications with the customer were moving towards more digital means specifically towards leveraging notifications via Smartphone apps versus emails and letters. As such, this post ad-hoc analysis focuses specifically on the notification channel via a Smartphone app. Notification Channel via an App (NCA) was reconceptualized as an independent variable

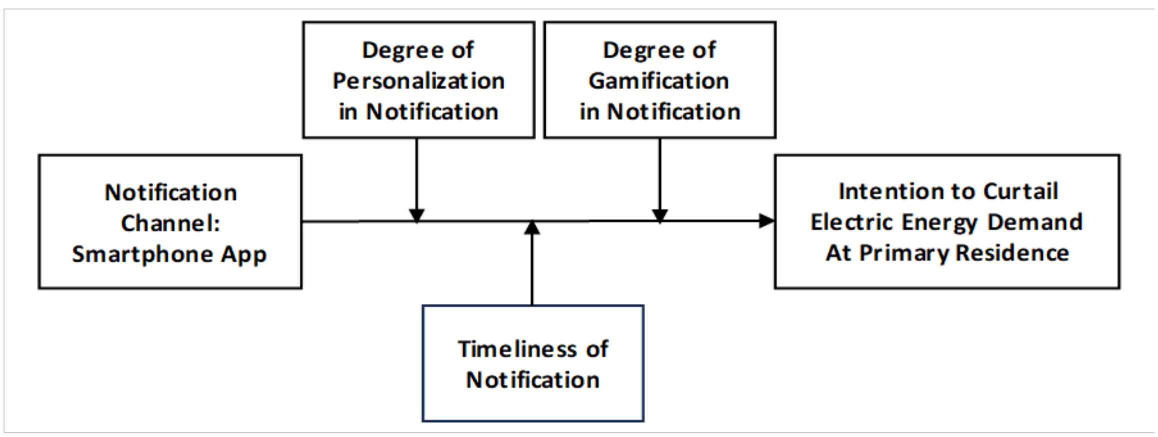

Figure 35: Ad-Hoc Analysis - Notification Channel: Smartphone App

with Intention to Curtail Electric Energy Demand at Primary Residence (INT) as the dependent variable. The three characteristics of the notification itself [Degree of Personalization (DPN), Degree of Gamification (DGN), and Timeliness of Notification (TON)] were added as positive Moderations on the NCA to INT relationship (Figure 35). Each of these moderations were tested separately.

NCA x DPN ---> INT

For the NCA x DPN to INT model, the overall model was significant [$F(3,163) = 18.67$, $p<0.001$] and explained 25.6% of the variance due to these three predictors of Notification Channel (Smartphone App), Degree of Personalization in the Notification, and their interaction. NCA is positively associated with Intention to Curtail [$b=0.78$, $t(163) = 7.45$, $p<0.001$] whereas DPN is negatively associated with Intention to Curtail [$b=-0.09$, $t(163)=-1.89$, $p=0.06$]. With respect to the interaction, the change in explained variance of 9.6% was significant [$F(1,163)=21.03$, $p<0.001$]. This indicates the presence of a significant interaction between Degree of Personalization in the Notification and the Notification Channel (Smartphone App), with the interaction coefficient being 0.374 [$t(163)=4.59$, $p<0.001$]. Figure 36 is presented to better understand the nature of the

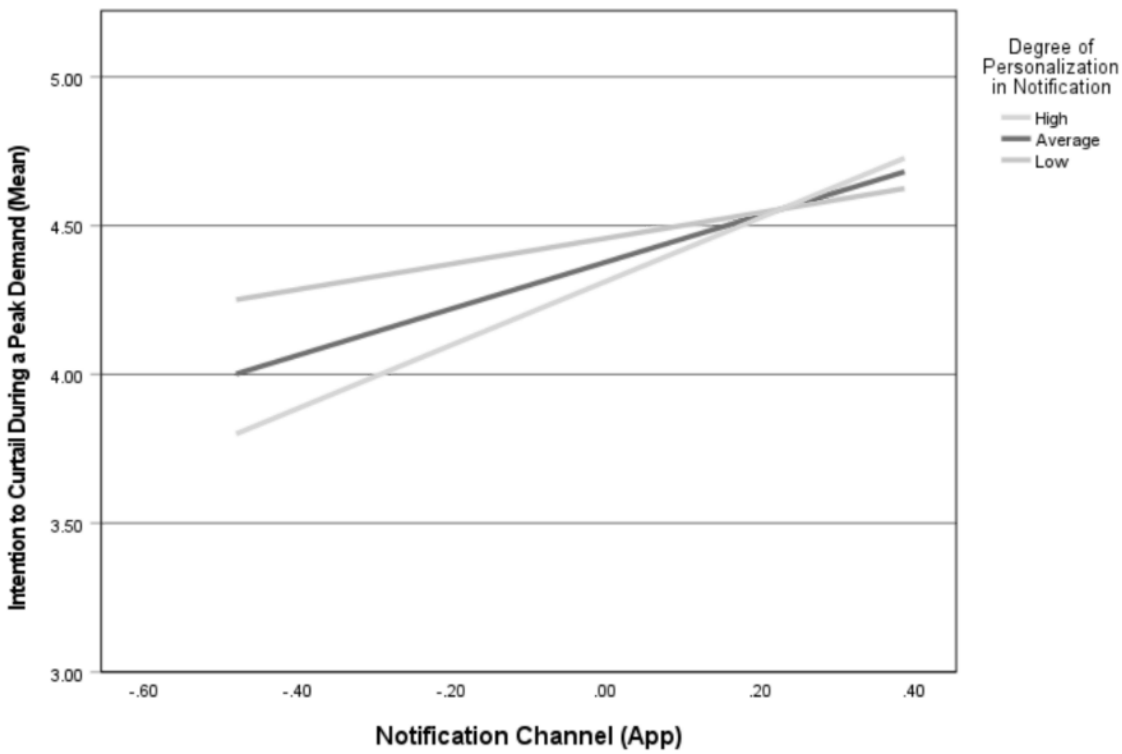

Figure 36: Moderating Effect of DPN on NCA

moderating effects. We see that the lines are converging and cross. As DPN increases, the relationship becomes more positive and is attenuated for low DPN. When DPN is high [+1SD, b=1.07, t(163)=7.21, $p<0.001$], average [0 SD, b=0.78, t(163)=7.45, $p<0.001$], and low [-1SD, b=0.43, t(163)=4.75, $p<0.001$] Notification Channel (Smartphone App) is associated with higher levels of Intention. Therefore, DPN appears to strengthen the relationship between Notification Channel (Smartphone App) on Intention to Curtail Electric Energy Demand at the Primary Residence.

NCA x DGN ---> INT

For the NCA x DGN to INT model, the overall model was significant [$F(3,163) = 10.95$, $p<0.001$] and explained 16.8% of the variance due to these three predictors of Notification Channel (Smartphone App), Degree of Gamification in the Notification, and

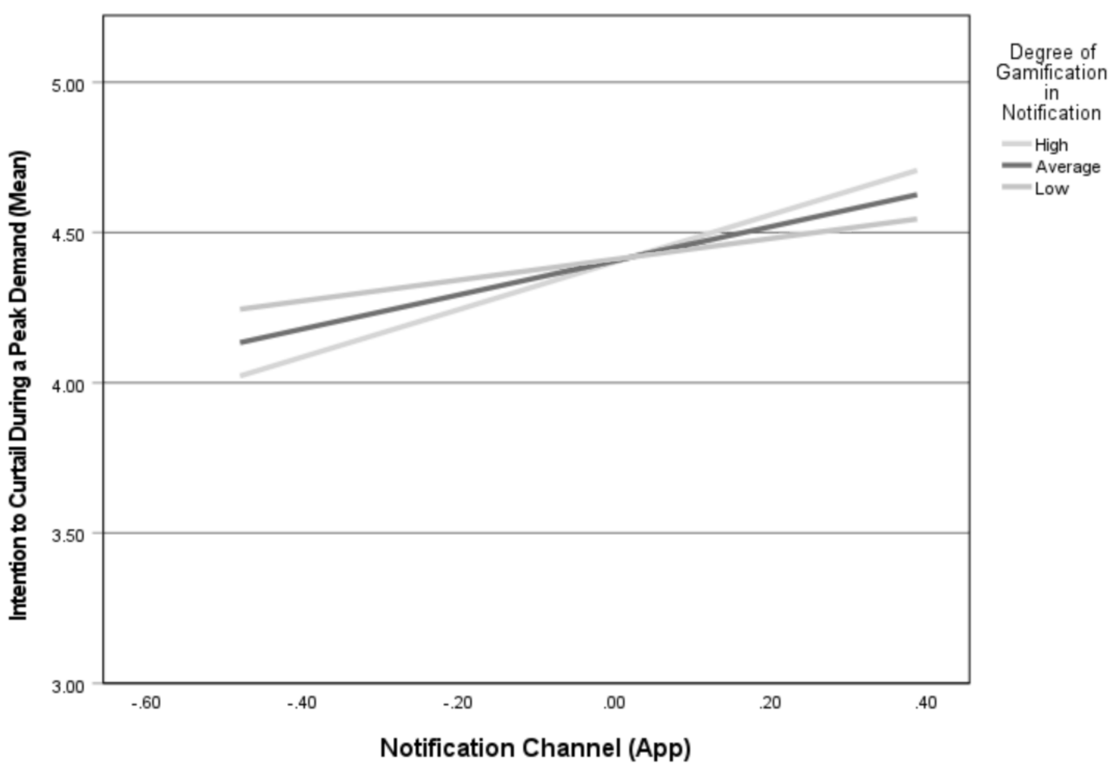

Figure 37: Moderating Effect of DGN on NCA

their interaction. NCA is positively associated with Intention to Curtail [b=0.57, t (163) = 5.56, p<0.001] whereas DGN is non-significant and negatively associated with Intention to Curtail [b=-0.004, t(163)=-0.11, p=0.91]. With respect to the interaction, the change in explained variance of 2.5% was significant [F(1,163)=4.82, p=0.03]. This indicates the presence of a significant interaction between Degree of Gamification in the Notification and the Notification Channel (Smartphone App), with the interaction coefficient being 0.185 [t(163)=2.20, p=0.03]. Figure 37 is presented to better understand the nature of the moderating effects. We see that the lines are converging and cross. As DGN increases, the relationship becomes more positive and is attenuated for low DGN. When DGN is high [+1SD, b=0.79, t(163)=4.56, p<0.001], average [0 SD, b=0.57, t(163)=5.56, p<0.001], and low [-1SD, b=0.35, t(163)=3.25, p=0.001] Notification Channel (Smartphone App) is associated with higher levels of Intention. Therefore, DGN appears to strengthen the relationship between Notification Channel (Smartphone App) on Intention to Curtail Electric Energy Demand at the Primary Residence.

NCA x TON ---> INT

For the NCA x TON to INT model, the overall model was significant [F(3,163) = 11.73, p<0.001] and explained 17.8% of the variance due to these three predictors of Notification Channel (Smartphone App), Timeliness of Notification, and their interaction. NCA is positively associated with Intention to Curtail [b=0.58, t (163) = 5.52, p<0.001] as is TON, however, it is not significant [b=0.05, t(163)=0.86, p=0.39]. With respect to the interaction, the change in explained variance of 3.1% was significant [F(1,163)=6.07, p=0.01]. This indicates the presence of a significant interaction between Timeliness of Notification and the Notification Channel (Smartphone App), with the interaction coefficient being 0.22 [t(163)=2.46, p=0.01]. Figure 38 is presented to better understand the nature of the moderating effects. We see that the lines are converging and cross. As

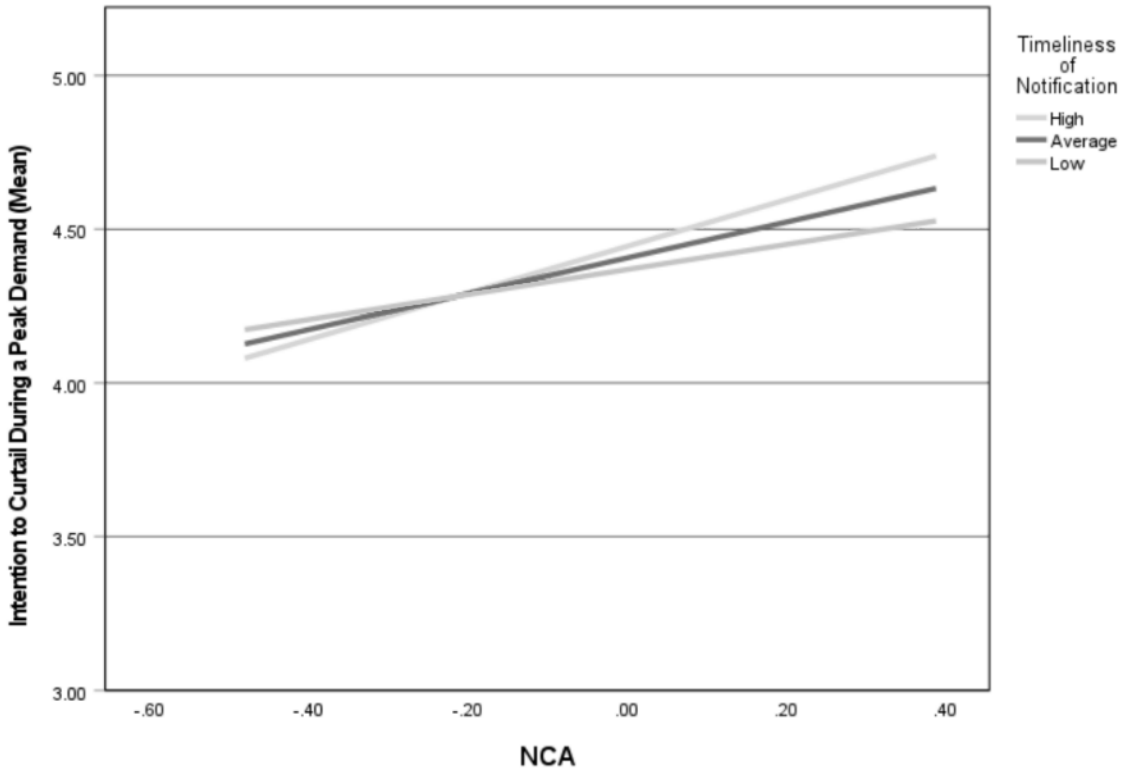

Figure 38: Moderating Effect of TON on NCA

TON increases, the relationship becomes more positive and is attenuated for low TON. When TON is high [+1SD, b=0.76, t(163)=4.92, p<0.001], average [0 SD, b=0.58, t(163)=5.52, p<0.001], and low [-1SD, b=0.41, t(163)=4.38, p<0.001] Notification Channel (Smartphone App) is associated with higher levels of Intention. Therefore, TON appears to strengthen the relationship between Notification Channel (Smartphone App) on Intention to Curtail Electric Energy Demand at the Primary Residence.

Habits

As noted in the Literature Review, behavior intention and the level of cognitive awareness when making an intention decision has been conceptualized differently between Theory of Planned Behavior (TPB) and Triandis' Theory of Interpersonal Behavior (TIB). Theory of Planned Behavior's positioning is that the individual's behavior is under the control of the individual's active awareness and consciousness. Triandis suggests that when an individual is performing a behavior that has become a habit, their level of consciousness is less. In other words, as the habit behavior increases the level of consciousness decreases. As part of our dissertation study, we considered electric energy curtailment habits as Triandis suggests. Other research has noted that Energy Consumption

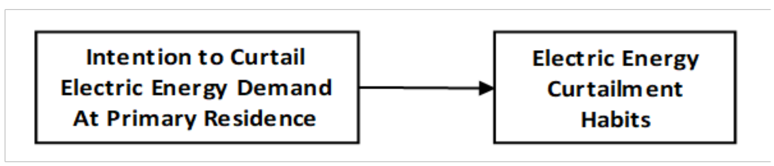

Figure 39: Ad-Hoc Analysis - Habits

behaviors are theorized to be under the unconscious control of habit (Martiskainen, 2007). However, given these differences, along with our significant findings that Curtailment Habits appear to act as a negative facilitating condition on several relationships, our post ad-hoc analysis has reconceptualized Electric Energy Curtailment Habits as a dependent variable with Intention to Curtail Electric Energy Demand at Primary Residence (INT) as the independent variable (Figure 39). This would suggest that, with respect to the curtailment habits, there is an active awareness and consciousness and that an intention towards curtailment is initially formed ahead of the curtailment habit. This is not dissimilar to what we've reviewed in Persuasion Theory & Cognitive Response Theory – change is extensively mediated by people's cognitive response (Greenwald, 1968; Petty et al., 2002, p. 131). No moderations were proposed therefore the Process v4.2 Macro (Hayes, 2022, 2023) was not required and a linear regression was performed with SPSS. The overall model was significant [$F(1,425) = 47.41$, $p<0.001$] and explained 10% of the variance in Habits. The unstandardized coefficient for INT was 0.40 indicating that each unit increase in INT leads to an increase of .40 units in HAB, and this relationship is significantly different from zero [$t(425) = 6.89$, $p < .001$]. Neither Tolerance nor VIF statistics indicated the presence of marked multicollinearity.

VI. DISCUSSION

This dissertation measures the effect of many factors that would lead to residential electric utility customers voluntarily curtailing their electricity demand during an evening peak demand. Chapter VI initiates a discussion of the research limitations, implications to academia and industry, and provides recommendations for future research.

Research Limitations

While this dissertation makes promising contributions to literature and industry, focused on residential customer's voluntary peak demand curtailment intentions, we want to acknowledge several limitations of the study ahead of the discussion and conclusion. The purpose of this section is not to undermine the credibility of the research, but rather to acknowledge the complexities and limitations that are inherent with such complex, novel, and advanced research. While we did our best to account for various Threats to Validity, and followed a rigorous Instrument Validation process (Straub, 1989), we do need to acknowledge and highlight the possibility of limitations in three main areas: data collection, data analysis, and our research context.

Data Collection

The study uses a quantitative cross-sectional online survey approach at that specific point in time. The survey method, while useful, creates several limitations. First, it reduces a user's response to only a Likert scale choice. Second, since the data collection was performed by a respondent at that specific point in time, this study cannot provide direct evidence of how changes in the independent variables affect the dependent variable outcome (because independent variables were not manipulated). While our dissertation research does establish relationships, we cannot 1) establish causation nor 2) determine if the intention of the customer leads to the actual behavior of voluntary peak demand curtailment. Third, notwithstanding the Common Method Bias techniques noted in the Threats to Validity, the data for the independent variables, moderators, and dependent variable were obtained from the same participant and could be subject to common method bias (P. M. Podsakoff et al., 2003). Lastly, survey participants were sought via Connect™ powered by CloudResearch.com which both compensates and measures the quality of their participants' pool. Such paid services, have been found to lead to social desirability bias (Necka et al., 2016) and a reduction in effect size of the research findings (Chandler et al., 2015). For example, the participants may select answers that would make them appear very receptive to voluntary peak demand curtailment, without indicating their true curtailment intention nor needing to exhibit the actual behavior.

Data Analysis

There are a couple limitations that we've grouped within the Data Analysis category. First, although our main study's sample size of 427 valid responses was adequate for testing hypotheses, larger samples are better for maximizing accuracy, minimizing errors, and increasing generalizability. Comrey & Lee (2013), suggest the following sample size scale "*50 – very poor; 100 – poor; 200 – fair; 300 – good; 500 – very good; 1000 or more – excellent.*" Our sample size is between good and very good, presenting another potential limitation regarding the generalizability of our study. Second, the only survey responses removed were from those respondents that did not give consent, failed the screening question, failed the purpose question, or got 2 of the 3 attention check questions wrong. *Outliers can have deleterious effects on statistical analyses* (Osborne & Overbay, 2004). Other types of outliers, such as through evaluations of Mahalanobis, Cook's, Leverage, or a combination of those distance values, were not removed from the analysis. This presents us with a potential data analysis limitation because of not removing outliers through those techniques or the outliers noted throughout the Phase 4: Dissertation Research Study Data Analysis and Results section (i.e. standardized residuals larger than three standard deviations, boxplot evaluations, et cetera).

Research Context

There are a few limitations that are categorized under Research Context. First, and noted above, participants for the survey were sought via Connect™ powered by CloudResearch.com. Participants who participate via Connect, or similar online crowdsource recruitment services, such as Amazon Mechanical Turk (MTurk), are actively seeking financial remuneration to complete surveys. It has been found those that participate in these crowdsourcing services are computer literate, educated, 'rich', democratic, and have more work experience (Behrend et al., 2011; Henrich et al., 2010; Leicht et al., 2016; Sheehan, 2018; Weinberg et al., 2014). Table 39 summarizes that our participants were 55% Male, 41% were between 25-34 years old, 42% have a 4-year university or college degree, and 59% own their primary residence. Electric utilities service all types of residential customers. Our research context might not align with a diverse residential customer population of some electric utilities, thereby reducing generalizability. As a result, the limitation in our study from a research context and generalizability standpoint is that some groups of potential participants might be underrepresented and, therefore, not fully representative of real-world consumers (Goodman & Paolacci, 2017) found within some electric utilities. It is important to consider this potential limitation in generalizing the findings. Second, our main study research context was conducted in the contiguous USA, as noted in Figure 27 and Table 36. As a result, a possible limitation of our study is that it may limit the generalizability of our research findings in other countries. Third, our research model terminates with the customer's intention (Figure 22) to voluntarily curtail their electricity demand at their primary residence during an evening peak demand episode. The full models of both Theory of Planned Behavior and Triandis' Theory of Interpersonal Behavior include the direct relationship between intention and actual behavior. For our research context, this would have required a longitudinal study, which was not feasible due to the time constraints of the dissertation research timeline. This exclusion of an actual behavior measurement limits our ability to draw conclusions on actual residential peak demand behavior change and may have impacted the results. Lastly, our research context was focused on a specific voluntary peak demand curtailment intention (see: Research Question) and did not consider the alternative. Namely, the alternative being using <u>more</u> energy (i.e., increasing their electric energy demand) during an evening peak demand time period. This alternative may have different underlying beliefs that may or may not parallel those of this research's dependent variable. The potential consequence of differing underlying beliefs is unknown and may lead to independent variables and moderators different than those found in this dissertation research.

Recommendations on limitations

Collecting information or data through other approaches, such as interviews, direct observations, or analysis of social media commentary during peak demand curtailment events, might give a broader picture of residential customers perceptions, thoughts, and intentions. In addition to the above methods, replicating the findings using other additional methods, such as an electric utility sponsored field experiment combined with longitudinal studies, in which measures are taken at multiple points in time, would 1) provide a stronger foundation for causal inferences, 2) reduce the possibility of social desirability bias, and 3) remove ‘mostly professional survey takers’ (i.e. nonnative participants) and allow for a representative electric utility cross section of their residential customers. Additionally, this research can be replicated and compared between countries with distance differences on the cultural, administrative, geographic, and economic (CAGE) framework (Ghemawat, 2001) or between countries with differences between the cultural dimensions proposed by Geert Hofstede, (1980, 2011) and Hofstede & Minkov, (2010). Lastly, and in combination with the above recommendations, researching the factors that contributed to residential customers voluntarily increasing their peak demand during an evening or morning peak episode would address one of our research limitations and provide additional context for utilities and regulators to be aware of and contend with.

Discussion: Theoretical Implications

This dissertation research extends and advances several relevant theoretical implications in the area of customer behavior intention theories in the context of an operational challenge faced by regulated electric utilities. The primary contribution of this study to the literature, from a theoretical standpoint, was to close the knowledge gap (Frederiks et al., 2015) regarding what factors are more reliable indicators of U.S. residential electric utility customers intention to voluntarily curtail electricity demand at their primary residence during an evening electric utility peak demand. More specifically, this study advances cross-disciplinary knowledge by integrating social psychology concepts into residential electric utility customer's behavioral change intentions towards an electric utility operational challenge, emphasizing the intricate multidimensional interplay between psychological, technological, and behavioral determinants in a regulated electric utility setting. To reiterate, our research model was based on a union of Triandis' Theory of Interpersonal Behavior (Triandis, 1977) and Ajzen's Theory of Planned Behavior (Ajzen, 1991) and included technological, financial, behavioral, and personality facilitating condition moderations. For personality, the five-factor model (FFM) of openness, conscientiousness, extraversion, agreeableness, and neuroticism (O.C.E.A.N.), whose origins are in Trait Theory (Allport, 1937; Digman, 1990; Goldberg, 1981, 1992; Long, 1952), was leveraged. Our resultant research model (Figure 30) identifies the factors that contribute towards residential customer's intention to voluntarily curtail their electricity demand. These factors are Energy Concern, Electricity Savings Knowledge, Environmental Awareness, Attitude, Injunctive Norms (perceived approval of others), Personal Moral Norms, Perceived Behavioral Control, Affect (feelings engendered about curtailment), Personality, and Habits. Additionally, an important theoretical contribution of this study is the development and operationalization of scales for Financial Incentives, Notification Channel, Timeliness of Notification, Degree of Personalization in Notification, and Degree of Gamification in Notification for academic and practical research in our context; none of which had been operationalized in previous research. Finally, several full models were not significant as hypothesized however have significant reduced models. Our contribution to the theoretical conversation suggests that continued theoretical exploration would have value to literature by closing the knowledge gap in this context. Clearly, the theoretical implications of the factors that contribute towards residential customer's intention to voluntarily curtail their electricity demand are numerous and profound. Following is a discussion, each concentrating on a different element of these implications.

Antecedents

The findings related to the antecedent factors bolster existing research of a mediated relationship structure between Energy Concern and the Theory of Planned Behavior independent variables of Attitude, Injunctive Norms, and Perceived Behavioral Control (Bamberg, 2003; Chen et al., 2017; Chen & Knight, 2014; De Groot & Steg, 2007). Our research has additionally contributed to theory by finding that Energy Concern also acts in a significant manner as an antecedent to the Affect construct from Triandis' Theory of Interpersonal Behavior. Our research corroborates and extends existing theories involving pro-environmental behavior contexts such that 1) Electricity Savings Knowledge influences intention to perform a pro-environmental behavior (voluntary electricity demand curtailment) as a significant cognitive precondition for developing Personal Moral Norms (Bamberg & Möser, 2007; Teksoz et al., 2012) and 2) having an awareness of environmental issues wholistically provides an essential cognitive basis which form Attitudes (Pivetti et al., 2020; L. Wu et al., 2022), Personal Moral Norms (L. Wu et al., 2022), and Affect (*feelings* as theorized by Bamberg & Möser, (2007)). All of these antecedents are relevant because they shape the subsequent factors noted, all of which were found to significantly contribute to a residential customer's intention to voluntarily curtail their electricity demand.

Mediators

The findings related to the mediators, which are the independent variables consolidated from the Theory of Planned Behavior and Theory of Interpersonal Behavior, also bolster the existing research where these individual theories have been used in isolation within a context similar to our research. Our research has merged these two theories and found significance. As observed by both Jackson (2005) and Martiskainen (2007), when used, Triandis' Theory of Interpersonal Behavior appears to have additional explanatory value over Ajzen's model. Most of the literary criticism towards the Triandis' model is that it "*has not been as widely used in empirical research as it could have been*" (Martiskainen, 2007, p. 25). This dissertation, and our contribution towards literature, provides the additional empirical research called for using Theory of Interpersonal Behavior.

Personal Moral Norms

Regarding these factors independently in our context, our research further supports research that Personal Moral Norms do improve explanatory power with significant effects on intention to perform environmental type or energy saving behaviors (Botetzagias et al., 2015; Du & Pan, 2021, 2022; Fornara et al., 2016; Gao et al., 2017; Hien & Chi, 2020; Kácha & Van Der Linden, 2021; F. G. Kaiser & Scheuthle, 2003; Li et al., 2020; Lopes et al., 2019; Qalati et al., 2022; Sia & Jose, 2019; S. Wang et al., 2016, 2018).

Attitude, Injunctive Norms, and Descriptive Norms

Our research has supported that Attitude and Injunctive Norms, when used by past researchers leveraging the Theory of Planned Behavior model (Abrahamse & Steg, 2009; Chen et al., 2017; Chen & Knight, 2014; Cialdini et al., 1990; Du & Pan, 2022; Gao et al., 2017, 2017; Hien & Chi, 2020; Li et al., 2020; Nie et al., 2019; Qalati et al., 2022; Q.-C. Wang et al., 2021; S. Wang et al., 2018), are also found to be significant indicators of U.S. residential electric utility customers intention to voluntarily curtail electric energy demand at their primary residence during an evening electric utility peak demand. While prior research has found that adding Descriptive Norms increases the explanatory power of models based on the Theory of Planned Behavior (De Leeuw et al., 2015; Deutsch & Gerard, 1955; Gao et al., 2017; Greaves et al., 2013; Grube et al., 1986; Manning, 2009; Qalati et al., 2022; Rivis & Sheeran, 2003; Sheeran & Orbell, 1999; Tang et al., 2019; K. M. White et al., 1994), our final Phase 3: Pilot Study Exploratory Factor Analysis (Table D. 4) resulted in a merge of Descriptive Norms items with Injunctive Norms items. However, we found during our Phase 4: Dissertation Research Study Confirmatory Analysis that the two relabeled Descriptive Norms items (SNM_4 & SNM_5) were factoring together but not with the other Injunctive Norms items (Table E. 7). Had we kept one additional Descriptive Norm item in EFA2, or the larger EFA1 from our intermediary Phase 3: Pilot Study Exploratory Factor Analysis (Table D. 3), it's possible we could have kept the construct and tested Hypothesis #11 (H11) and Hypothesis #17 (H17, the moderation on the H11 relationship). Either way, the theoretical implication in our context is that Descriptive Norms appear to be part of the cognitive factors and are deserving of additional research.

Perceived Behavioral Control and Affect

Our research further supports that Perceived Behavioral Control improves explanatory power with significant effects on intention to perform energy savings type behaviors (Chen et al., 2017; Chen & Knight, 2014; Du & Pan, 2022; Gao et al., 2017;

Hien & Chi, 2020; Li et al., 2020; Lopes et al., 2019; Nie et al., 2019; Qalati et al., 2022; Q.-C. Wang et al., 2021; S. Wang et al., 2018). The last mediator, Affect, comes from the Theory of Interpersonal Behavior (TIB) and answers the call for additional empirical research (Frederiks et al., 2015) leveraging TIB and its constructs (Jackson, 2005; Martiskainen, 2007). Our contribution to theory and literature is that this dissertation not only answers the call for more empirical research and found Affect to be a significant factor that influences residential customer's intention to curtail their demand, but we've also operationalized the Affect construct for our context by leveraging prior operationalizations from different contexts (Bamberg & Schmidt, 2003; Boyd & Wandersman, 1991; Godin et al., 1996; Valois et al., 1988) with Bamberg & Schmidt (2003) being the closest in context because it dealt with pro-environmental behaviors.

Moderators

Personality and Habits

Significant moderators were found to be personality and electric energy curtailment habits (Figure 30). With respect to these moderators, this research's contribution to theory continued to close the knowledge gap (Frederiks et al., 2015) regarding what factors are more reliable indicators of U.S. residential electric utility customers intention to voluntarily curtail electric energy demand at their primary residence during an evening electric utility peak demand. Habit, for example, has been an underdeveloped issue that warranted both academic and industry attention (Verplanken & Aarts, 1999; Verplanken & Orbell, 2003).

With respect to our contribution on personality, similar to Wang et al., (2021), we found that the five-factors are associated with intention, however each of the individual factors acted slightly differently in strength and significance. In another energy savings behavior study done by Milfont & Sibley (2012, sec. Study 2), agreeableness and conscientiousness influenced self-reported energy-saving behavior and environmental commitment; greater electricity conservation was significantly associated with higher agreeableness, conscientiousness, and neuroticism; no significant relationships were observed with extraversion or openness. Unlike Milfont & Sibley (2012, sec. Study 2), our research found (Table 46) that openness (H15a- & H20a-) and extraversion (H15c- & H20c-) were significant and that agreeableness, conscientiousness, and neuroticism were not. Either way, the theoretical implication in our context is that personality does appear to moderate a few of the relationships that lead to a residential customer's intention to curtail their electricity demand and is deserving of additional research.

This research's main contribution to the habits construct was answering the call for additional attention given habits has been an underdeveloped construct (Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). Our research has additionally contributed to the literature by further operationalizing the Habits construct for our context by leveraging prior operationalizations from different contexts (Ouellette & Wood, 1998; Venkatesh et al., 2012; Verplanken et al., 1998; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003), or from research that used theory of planned behavior as a base theory and/or whose research context was related to energy savings behavior (Hien & Chi, 2020; Jaciow et al., 2022; Li et al., 2020; Qalati et al., 2022; S. Wang et al., 2018).

Operationalization of unique scales

Additionally, an important theoretical contribution of this study is the development, operationalization, exploratory factor analysis, and confirmatory analysis of scales for Financial Incentives, Notification Channel, Timeliness of the Notification, Degree of

Personalization in the Notification, and the Degree of Gamification in the Notification for academic and practical research in our context; none of which had been operationalized in previous research. We will discuss below that these specific moderations did not prove significant as hypothesized in the full model. However, this does not minimize the contribution to literature that these uniquely developed constructs add to the theoretical conversation, had strong factor loadings in both the Phase 3: Pilot Study Exploratory Factor Analysis (Table D. 4) and our Phase 4: Dissertation Research Study Confirmatory Analysis (Table E. 7), and broadens our understanding of how these may operate in our context.

Significant Reduced Models

Several full models were not significant as hypothesized (Table 45) however did have significant reduced models (Table 44). These are specifically the moderations that were conceptualized for Age, Gender, Education, Financial Incentives, Degree of Need for Thermal Comfort, and Notification Channel. This is not to say that the non-significant moderators have added no value to the theoretical conversation. Quite to the contrary. It is important to reflect on foundational academic scientific instruction whereby finding that something was not as hypothesized (Bhakthavatsalam, 2019) is equally valuable in extending the body of knowledge (Coelho & McClure, 2005; Khanna et al., 2016; Rhaiem & Amara, 2021; Yin et al., 2019). After all, when Thomas Edison was asked about his results on the research and testing that went into the creation of the light bulb, he has been quoted saying "*Results! Why, man, I have gotten a lot of results! I know several thousand things that **won't work***." (Dyer & Martin, 1910, p. 616). Much like Thomas Edison, we found when we conceptualized and tested Age, Gender, Education, Financial Incentives, Degree of Need for Thermal Comfort, and Notification Channel as moderations and Income, Timeliness of the Notification, Degree of Personalization in the Notification, and the Degree of Gamification in the Notification as three-way moderations (Figure 22) we now know these relationships "***won't work***" the way we hypothesized and tested. While they did not appear as moderators, or three-way moderations, our Post Ad-Hoc Analysis provides us with analysis that supports continuing the theoretical discussions. Our contribution to the theoretical conversation suggests that continued theoretical exploration would have value to literature by closing the knowledge gap in this context.

Discussion: Practical and Managerial Implications

Electric utilities are under-utilizing one of their most formidable solutions available to address their peak demand challenges – their very customers' hearts and minds. Customers will voluntarily curtail their electricity demand during a peak demand episode. From a practical perspective, this dissertation's research provides insights into the factors that contribute to residential electric utility customers voluntarily curtailing their electricity demand during an early evening peak demand. Our resultant model (Figure 30) is a tool that helps stakeholders strategically plan approaches and comprehensively understand the complex processing that residential customers internalize ahead of their intention to voluntarily curtail their electricity demand. As a result of this comprehensive understanding, stakeholders can tailor offerings, leverage available technology, and develop marketing campaigns specifically suited to their needs. By emphasizing the previously identified supported factors of Energy Concern, Electricity Savings Knowledge, Environmental Awareness, Attitude, Injunctive Norms (perceived approval of others), Personal Moral Norms, Perceived Behavioral Control, Affect (feelings engendered about curtailment), Personality, and Habits, stakeholders will amplify positive perceptions, address concern areas, focus on customers where efforts yield maximized value, and further increase the customer's intention to voluntarily curtail their electricity demand during challenging evening peak demands. However, this is accomplished when approached wholistically and not in factor-by-factor isolation. The following is a detailed discussion of these wholistic and practical implications, grouped by each of the antecedent factors, specific to this dissertation's findings.

Energy Concern

Residential customers that have a high Energy Concern are more likely to have a lower Attitude, Perceived Behavioral Control, and Affect, and therefore lower intention to voluntarily curtail their electricity. Conversely, if stakeholders work towards lowering residential customer's Energy Concern, the result is an increase in those customers' intention to voluntarily curtail their electricity. This will benefit the stakeholders more if the focus is on customers that are lower on personality dimensions of Openness and Extraversion (Figure 28; Panels B, C, E, and F) however benefits will be seen regardless as personality neither weakened nor strengthened the relationships between Intention to Curtail Electric Energy Demand at Primary Residence and Injunctive Norms (perceived approval of others), Personal Moral Norms, and Perceived Behavioral Control (Figure 30). Additional benefit would be realized if the focus is on customers that presently have lower electricity curtailment habits (Figure 29; Panels G & H). There was no moderation found with Age, Gender, or Education on the relationships between Intention to Curtail Electric Energy Demand at Primary Residence and Attitude (x Education), Subjective Norms (x

Gender), and Perceived Behavioral Control (x Age) therefore targeting residential customers by these parameters do not appear to be a good investment for stakeholders. While not part of this research, lowering customer's Energy Concern could be achieved through a variety of communications and marketing campaigns about the nature of their service, the local electricity grid, and continued work towards ensuring safe and reliable electricity service. Gauging where the customers' present and actual Energy Concern level is at would provide a unique baseline that is not being measured as part of the various national customer satisfaction metrics.

Electricity Savings Knowledge

Residential customers that score high on Electricity Savings Knowledge are more likely to have higher Personal Moral Norms and therefore a higher intention to voluntarily curtail their electricity. This emphasizes the importance of stakeholders working towards educating their customer base about the best ways for residential customers to <u>reduce demand</u> (kW) versus kWh. To develop these, this will require stakeholders to ensure they are engaging with individuals within or external to their organization that understand the practical and electrical differences between kW and kWh. The challenge is to distill the messaging down so that the intended residential recipients do not require an in-depth understanding of electrical science nor electric grid operations to effectuate demand (kW) reduction within their primary residence during predicted peak demand episodes. Benefits across the residential customer base will be seen regardless because our research found that personality neither weakened nor strengthened the relationship between Intention to Curtail Electric Energy Demand at Primary Residence and Personal Moral Norms (Figure 30). Gauging where the customers' present and actual Electricity Savings Knowledge level is, with respect to kW reduction, would provide a unique utility specific baseline. Given the Rational Inattention within our context (see: Literature Review), it's probable that this ESK/kW baseline will be low, thereby providing a large net benefit to stakeholders. While not part of this research, increasing customers Electricity Savings Knowledge could be achieved through a variety of communications and marketing campaigns such as engaging social media updates, informative educational website entries, and entertaining advertisements or smartphone applications. Of practical importance, though, is to note that past research has found that there are trust issues between customers and the energy advice that their utilities provide to them (Craig & McCann, 1978; Ester & Winett, 1981; Stern, 1992). As such, utility stakeholders can consider alternative approaches such as working collaboratively with regulatory partners (Craig & McCann, 1978), software vendors with which customer's trust, and explore working with local influencers (Corbett & Savarimuthu, 2022; Harrigan et al., 2021; Hudders et al., 2021; Jalali & Khalid, 2021; Silva et al., 2022; Vilkaite-Vaitone, 2024).

Environmental Awareness

Residential customers that score high on Environmental Awareness are more likely to have higher Attitude, Personal Moral Norms, and Affect, and therefore a higher intention to voluntarily curtail their electricity. This will benefit the stakeholders more if the focus is on customers that are lower on personality dimensions of Openness and Extraversion (Figure 28; Panels B, C, E, and F) however benefits will be seen regardless as personality neither weakened nor strengthened the relationships between Intention to Curtail Electric Energy Demand at Primary Residence and Personal Moral Norms (Figure 30). Additional benefit would be realized if the focus is on customers that presently have lower electricity curtailment habits (Figure 29; Panel G) however, like personality, benefits will be seen regardless because habits neither weakened nor strengthened the relationships between Intention to Curtail Electric Energy Demand at Primary Residence and Personal Moral Norms, and Affect (feelings engendered about curtailment). As a reminder, this researcher determined all three Environmental Awareness relationships were significant (Table 44; H6, H7, and H8), with Environmental Awareness to Personal Moral Norms (H7) and Affect (H8) significant at $p=.07$ and $p=.079$ respectively, which is slightly above academic mantra of rejecting anything above $p>0.05$. Regardless, these findings emphasize the importance of stakeholders working towards ensuring that their customers have accurate and non-biased information and an awareness of environmental issues wholistically. Our findings and practical recommendation are further supported by research conducted by Lillemo (2014) who found that people with a higher level of environmental awareness were also significantly more likely to have electric energy curtailment behaviors. While not part of this research, increasing customers Environmental Awareness could be achieved through the same mechanisms discussed above in Electricity Savings Knowledge, and are not repeated here.

Mediators and Moderators

The practical and managerial implications discussed above have focused on the antecedents (Energy Concern, Electricity Savings Knowledge, and Environmental Awareness) because they contribute to either Attitude, Injunctive Norms, Personal Moral Norms, Perceived Behavioral Control, and Affect all of which then lead to Intention to Curtail Electric Energy Demand at Primary Residence and are moderated by either Personality or Habits as noted in Figure 30. While stakeholders could implement marketing campaigns in isolation to increase, for example, residential customers Attitudes or Curtailment Habits, these would not be a good investment for stakeholders if done in isolation. As such, we do not feel it necessary to discuss each of these mediator and moderator factors in isolation because the above subsections (Energy Concern, Electricity Savings Knowledge, Environmental Awareness) covered mediators and moderators wholistically. The practical and managerial implication of our research is that improving customers' Attitude, Subjective Norms, Personal Moral Norms, Perceived Behavioral Control, and Affect will lead to their intention to voluntarily curtail electricity during a peak demand, and this is best done via the techniques noted above for Energy Concern, Electricity Savings Knowledge, and Environmental Awareness. This will benefit the stakeholders more if campaigns are strategically executed wholistically. For example, a campaign to improve customers Attitudes towards Electric Demand Curtailment is a good investment when it addresses Energy Concern and Environmental Awareness ideally targeted to customers with lower Openness, lower Extraversion, and presently have low curtailment Habits.

To summarize our practical implications section, our results support the comment from IEA (2022) that *behavior change can save electricity quickly when people and businesses understand what to do and why*. Many of the factors we found that contribute to a voluntary intention to curtail electricity demand are behavioral and psychological. There is no financial downside for utilities to trial test and pursue these non-traditional approaches (i.e., putting the customers in control of their curtailment) because curtailment programs do not decrease sales (Specian et al., 2023). A formidable, yet under-utilized, resource for the utilities is their very customers' hearts and minds. Our resultant model

(Figure 30) is a tool that helps stakeholders strategically plan approaches and comprehensively understand the complex processing that residential customers internalize ahead of their intention to voluntarily curtail their electricity demand. As a result of this comprehensive understanding, stakeholders can tailor offerings, leverage available technology, and develop marketing campaigns specifically suited to their needs and unique environments.

Future Research Considerations

The researcher encourages future research and, in addition to the recommendations on the limitations noted in the Research Limitations section, has several recommendations for researchers to explore.

Financial Incentives did not prove significant as a moderator however our Post Ad-Hoc Analysis seems to suggest that Financial Incentives may act as an independent variable contributing to an intention to curtail electricity demand. We did see in previous literature that financial incentives can lead to reductions in electricity use (Ek & Söderholm, 2010) and that the effect is short-lived (Abrahamse et al., 2005). For long-term reduction in energy (kWh) this is not desirable however, in the context of demand (kW) reduction during a short-lived peak demand (i.e. a couple of hours), this appears to be ideal. Recall that Sexton et al., (1987), found that when individuals were made aware of an upcoming price change in the use of energy, there was significant shifting of electricity use from on-peak to off-peak time periods. One of our Informed Pilot Stakeholder members shared that their utility "…*was simply asking people to try and use less to avoid brownouts and the voluntary participation* <u>*without incentives*</u> ***was high enough to avoid brownouts****. Maybe you need something that assesses people's willingness ...*" Our recommendation is to continue our dissertation's research findings and determine to what degree does the presence, or absence, of a financial incentive contribute to a residential customer's intention to curtail their electricity demand. This has practical significance as it will help determine boundary conditions for electric utilities while electric utility leaders continue to plan for significant electricity demand growth (Sweeney, 2023) while being faced with net-zero challenges (Bennett, 2023; Peevey & Piper, 2024).

Our second future research recommendation is related to our Financial Incentive research recommendation above and was inspired by comments from one of our Informed Pilot Stakeholders. Might it be a Willingness versus an Intention when contemplating using less electricity for a short period of time? This was additionally noted by one of our Informed Pilot Stakeholder participants who asked, "*Are you looking for their WILLINGNESS to make the change or their confirmed intent to make a change?*" Perhaps the Financial Incentive, and its level, initially forms a Willingness and, from that Willingness, an Intention is formed (Luzar & Cosse, 1998). At the same time, our Informed Pilot Stakeholder shared that many customers, without a financial incentive, were not only willing, but through voluntary electricity curtailment actions, a brownout was avoided. We recommend synthesizing the literature around Willingness-To-Pay in our context (Gerpott & Paukert, 2013; Iliopoulos et al., 2020; Irfan et al., 2020; Schniederjans & Starkey, 2014) and research if electricity curtailment intention, along with the significant factors from our study, are mediated through a Willingness-To-Curtail construct. With respect to Financial Incentive, research at what incentive levels individuals become willing to curtail. Ideally, an electric utility sponsored field experiment, leveraging existing enabling technologies (e.g., electric meter interval data; text message notifications), combined with longitudinal studies in which measures are taken at multiple points in time, would provide a stronger foundation for causal inferences between Willingness, Intention, and actual Behavior.

Third, our recommendation is to replace the five-factor personality construct with customer personas - a construct that maps closer to the type of data utilities would have on hand about their customers. While the five-factor model of openness, conscientiousness, extraversion, agreeableness, and neuroticism (O.C.E.A.N.), has been one of the most commonly-employed personality theoretical models in the psychological field (Abdollahi et al., 1999; Çikrikci et al., 2022; Milfont & Sibley, 2012; Poškus & Žukauskienė, 2017) including pro-environmental behaviors (Kvasova, 2015; Passafaro et al., 2015; Pavalache-Ilie & Cazan, 2018; Q.-C. Wang et al., 2021; Yazdanpanah et al., 2016; Yu & Yu, 2017), this is not the case within our context. Utilities do not collect personality data about their customers. However, utilities do create customer (or household) personas based on the data they have readily available for their customers. Therefore, our recommendation is to use a more pragmatic construct, that would resonate with electric utilities, and research how diverse customer personas (Barjak et al., 2022; Bohdanowicz et al., 2022; Dodge et al., 2017; Goulden et al., 2014; Olawale et al., 2022) may moderate the relationships leading to Intention to Curtail Electricity. Along the same lines, our Unit of Analysis and Observation was the individual. Yet, utilities generally analyze their customers data as a single premise, or household. Future researchers are encouraged to consider using the household as the unit of analysis and the individual as the unit of observation.

Our next future research recommendation is related to Gamification Theory and the pragmatic research on how serious games and meaningful gamification contributes to the willingness of residential electric utility customers to voluntarily reduce demand (kW), via a smartphone app, during a peak demand period. Gamification can be designed to alleviate tedious and repetitive tasks by making them more engaging (Cherry, 2011). This researcher believes that for most residential utility customers, curtailing electricity falls into this tedious and repetitive category, and that it is ripe to be made more engaging. As noted by Nicholson (2012), one of the challenges is that some applications of gamification have only implemented the least interesting part of a game – the scoring system. Casals et al., (2020) concluded that games that promote energy efficient behavior have high scalable potential, especially if the game is provided to utility customers at no cost, and has a positive net economic benefit to the utility after 1 year. Yet, the application of gamification to encourage energy conservation lacks empirical evidence of its effectiveness (Casals et al., 2020) and "*more rigorous follow-up studies are required to address this gap*" (Johnson et al., 2017). Our research contributes to the theoretical conversation around gamification, and we learned that the relationship was not how we hypothesized. However, our Post Ad-Hoc Analysis on Notification Channel indicates that there is a significant relationship, with gamification as a significant moderation, when the Notification is delivered to the customer on their smartphone. Future researchers are encouraged to continue the theoretical discussion while addressing the growing peak demand challenge (Patel, 2023; U.S. Department of Energy, 2017) faced by electric utilities.

Our final future research recommendation is for researchers to investigate if the factors that contribute to curtailment intentions are different during morning peak demands versus evening peak demands in those same environments. Theoretically, there may be a difference in intention to voluntarily curtail in the morning, when most people are waking up and getting ready for the day, versus in the evenings. Understanding these boundary conditions will provide the electric utilities with seasonal customer curtailment intention insights that could be used for targeted communications, depending on the timing of the peak demand challenge.

VII. CONCLUSION

Across the United States electric utilities continue to be challenged with meeting peak demand on their electric grids. To address this, electric utilities can either increase the supply or decrease the demand. Our research was focused on the decrease demand aspect of the peak demand challenge. From a positivist and pragmatic perspective, this dissertation researched an industry-novel, customer-centric research question that advances a potential solution via a presently under-utilized resource that is available to electric utilities – their very customers' intentions. The research question posited by this research was - what are the factors that contribute to U.S. residential electric utility customers intention to voluntarily curtail electricity demand at their primary residence during an electric utility peak demand time period? Our research goal was not reducing electric utilities sales - total electric energy usage (kWh) - but, instead, was focused on the behavioral and technological determinants that contribute to customers reducing demand (kW) during an evening peak. The focus on kW curtailment makes pragmatic sense because electric utilities are more likely to embark on kW curtailment programs because those programs do not decrease kWh sales (Specian et al., 2023).

Using a merge of the Theory of Interpersonal Behavior (Triandis, 1977, 1979) and the Theory of Planned Behavior (Ajzen, 1985, 1988) as a theoretical framework, the research investigated 35 relationships that were hypothesized to contribute to a residential electric utility customer to have an intention to voluntarily curtail their electricity demand during an evening peak demand. This quantitative research study incorporated 23 constructs, with residential utility customer as the unit of analysis and observation, and considered the participant's International Energy Conservation Code (IECC) Climate

Region as the Control Variable (Figure 22). The primary instrument for all phases of the research was a researcher constructed questionnaire administered online via Qualtrics. Survey participants were sought via Connect™ powered by CloudResearch.com, which both compensates and measures the quality of their participants' pool. Validation of the survey instrument followed the four phase approach outlined in Straub (1989). Results from the Phase 3: Pilot Study Exploratory Factor Analysis, which were based on 80 valid responses collected across the continental United States on October 17th, 2023 (Figure 25), reduced the survey instrument to 82 final items, down from 203 (Table 33). Descriptive Norms (DNM) was reduced to two items, and it clustered together with the three remaining Injunctive Norms (INM) items. We merged the two DNM items with the three INM items, defined the five-item merge as the Subjective Norms (SNM) scale, and, as a result, were unable to test two hypotheses (H11 & H17). Using the retained items, Reliability Analysis yielded that all scales were above the minimum acceptable Cronbach's alpha value of 0.70 (Cronbach, 1951; Cronbach & Meehl, 1955; Taber, 2018; Ursachi et al., 2015) and are summarized in Table 35.

519 total responses were collected in Qualtrics between November 8th and 11th, 2023 across the continental United States (Figure 27) however, after applying data quality validations, 427 valid responses remained for our Phase 4: Dissertation Research Study analysis. Our Control Variable was recoded to allow for a more even distribution among the IECC Climate Regions (Table 38). To test the effects of three independent variables, eight moderators, four three-way moderators, and five mediators on our intention outcome dependent variable - hierarchical linear regressions were performed separately on each of the 35 hypothesized relationships. The results indicate that 17 of the relationships were

found to be significant (15 of which were as hypothesized, 2 were significant but not as hypothesized), 11 were not significant, and 7 were not tested (Table 46). Figure 30 summarizes and redraws the original research model (Figure 22) based on the significant individual hypothesis full model findings (Table 45).

Our resultant model (Figure 30) is a tool that can help stakeholders strategically plan approaches and comprehensively understand the complex processing that residential customers internalize ahead of their intention to voluntarily curtail their electricity demand. As a result of this comprehensive understanding, stakeholders can tailor offerings, leverage available technology, and develop marketing campaigns specifically suited to their needs and unique environments. Our research results indicate that residential customers that have a high Energy Concern are more likely to have a lower Attitude, Perceived Behavioral Control, and Affect, and lower intention to voluntarily curtail their electricity. Conversely, if stakeholders work towards lowering residential customers' Energy Concern the result is an increase in those customers' intention to voluntarily curtail their electricity. This will benefit the stakeholders more if the focus is on customers that are lower on personality dimensions of Openness and Extraversion (Figure 28; Panels B, C, E, and F) as well as on customers that presently have lower electricity curtailment habits (Figure 29; Panels G & H) however benefits will be seen regardless because personality neither weakened nor strengthened the relationships between Intention to Curtail Electric Energy Demand at Primary Residence and Subjective Norms, Personal Moral Norms, and Affect. Residential customers that score high on Electricity Savings Knowledge are more likely to have higher Personal Moral Norms and a higher intention to voluntarily curtail their electricity. Our research results indicate that benefits to the utility would be realized across the entire residential customer base because personality neither weakened nor strengthened the relationship between Intention to Curtail Electric Energy Demand at Primary Residence and Personal Moral Norms (Figure 30). Additionally, our results indicate that residential customers that score high on Environmental Awareness are more likely to have higher Attitude, Personal Moral Norms, and Affect, and a higher intention to voluntarily curtail their electricity. This will benefit the stakeholders more if the focus is on customers that are lower on personality dimensions of Openness and Extraversion (Figure 28; Panels B, C, E, and F) however benefits will be seen regardless as personality neither weakened nor strengthened the relationship between Intention to Curtail Electric Energy Demand at Primary Residence and Personal Moral Norms (Figure 30). Additional benefit would likely be realized if the focus is on customers that presently have lower electricity curtailment habits (Figure 29; Panel G).

Our research did not find a significant moderation with Age, Gender, or Education on the relationships between Intention to Curtail Electric Energy Demand at Primary Residence and Perceived Behavioral Control (x Age), Subjective Norms (x Gender), and Attitude (x Age) (Table 45; H23, H26, H28) therefore targeting residential customers by these parameters do not appear to be a good investment for stakeholders. Additionally, our research reveals that Financial Incentives, Degree of Need for Thermal Comfort, and Notification Channel do not act as moderators (Table 45; H21, H22, H24-, H25-, H27); however, our Post Ad-Hoc Analysis seems to indicate these may act as independent variables and are suggested for future research. The hypothesized three-way moderations were not tested (Table 45; H31, H32, H33, H34-, H35-) because their moderations were found to be non-significant. The practical and managerial implication of our research is that increasing customers' Attitude, Subjective Norms, Personal Moral Norms, Perceived Behavioral Control, and Affect will lead to their intention to voluntary curtail electricity at their primary residence during an evening peak demand. Increasing these constructs can be effectuated via the individuals' Energy Concern, Electricity Savings Knowledge, and Environmental Awareness. This will benefit the stakeholders more if campaigns are strategically executed wholistically.

Although the study has several limitations, recommendations on limitations are provided and additive to the future research considerations discussed. This researcher would like to underscore that the exclusion of actual behavior measurement, of customers' performing electricity curtailment during an evening peak demand, limits our ability to draw conclusions on actual residential peak demand behavior change. To address this, the researcher would encourage replicating our findings via an electric utility sponsored field experiment combined with longitudinal studies because this would 1) provide a stronger foundation for causal inferences, 2) reduce the possibility of social desirability bias, and 3) remove mostly professional survey takers (i.e. nonnative participants (Chandler et al., 2015)) and allow for a representative electric utility cross section of their residential customers.

In conclusion, various factors, including Energy Concern, Electricity Savings Knowledge, Environmental Awareness, Attitude, Subjective Norms, Personal Moral Norms, Perceived Behavioral Control, Affect, and the customer's Personality and existing Electricity Curtailment Habits create a complex interaction web that forms their Intention to voluntarily curtail electricity demand during an evening peak demand. This research provides a novel contribution both to the literature in our context and the electric utility industry. The research highlights the importance of understanding the residential electric utilities' customers' behavioral processes in forming an intention towards a specific behavior. Our research finds that residential customers will develop an intention to voluntarily curtail their electricity demand during a peak demand episode however future research is required to determine if that intention leads to the anticipated behavior. Electric utilities are encouraged to trial our research findings via a customer-centric option to address evening peak demand (kW) challenges. If strategically executed, utilities have a formidable, yet under-utilized, resource in addressing the growing peak demand challenge – their very customers' hearts and minds.

It's time to get from behind the meter and into the mind!

Figure 40: Behind The Meter and Into The Mind

Figure 40 image courtesy of Juliette Desrosiers (Desrosiers, 2023)

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APPENDICES

NEO Five-Factor Inventory (Form S)

Items below come from the "Your NEO Summary" Form S booklet (Costa & McCrae, 2008).

60 Item (NEO Five-Factor Inventory – Form S; Reorder #1452-TB)

1. I am not a worrier.
2. I like to have a lot of people around me.
3. I don't like to waste my time daydreaming.
4. I try to be courteous to everyone I meet.
5. 1 keep my belongings clean and neat.
6. I often feel inferior to others.
7. I laugh easily.
8. Once I find the right way to do something, I stick to it.
9. I often get into arguments with my family and co-workers.
10. I'm pretty good about pacing myself so as to get things done on time.
11. When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.
12. I don't consider myself especially "light-hearted:'·
13. I.am intrigued by the patterns I find in art and nature.
14. Some people think I'm selfish and egotistical.
15. I am not a very methodical person.
16. I rarely feel lonely or blue.
17. I really enjoy-talking to people.
18. I believe letting students hear controversial speakers can only confuse and mislead them.
19. I would rather cooperate with others than compete with them.
20. I try to perform all the tasks assigned to me conscientiously.
21. I often feel tense and jittery.
22. I like to be where the action is.
23. Poetry has little or no effect on me.
24. I tend to be cynical and skeptical of others' intentions.
25. I have a clear set of goals and work toward them in an orderly fashion.
26. Sometimes I feel completely worthless.
27. I usually prefer to do things alone.
28. I often try new and foreign foods.
29. I believe that most people will take advantage of you if you let them.
30. I waste a lot of time before settling down to work.
31. I rarely feel fearful or anxious.
32. I often feel as if I'm bursting with energy.
33. I seldom notice the moods or feelings that different environments produce.
34. Most people I know like me.

35. I work hard to accomplish my goals.
36. I often get angry at the way people treat me.
37. I am a cheerful, high-spirited person.
38. I believe we should look to our religious authorities for decisions on moral issues.
39. Some people think of me as cold and calculating.
40. When I make a commitment, I can always be counted on to follow through.
41. Too often, when things go wrong, I get discouraged and feel like giving up.
42. I am not a cheerful optimist.
43. Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.
44. I'm hard-headed and tough-minded in my attitudes.
45. Sometimes I'm not as dependable or reliable as I should be.
46. I am seldom sad or depressed.
47. My life is fast-paced.
48. I have little interest in speculating on the nature of the universe or the human condition.
49. I generally try to be thoughtful and considerate.
SO. I am a productive person who always gets the job done.
S 1. I often feel helpless and want someone else to solve my problems.
52. I am a very active person.
53. I have a lot of intellectual curiosity.
54. If I don't like people, I let them know it.
55. I never seem to be able to get organized,
56. At times I have been so ashamed I just wanted to hide.
57. I would rather go my own way than be a leader of others.
58. I often enjoy playing with theories or abstract ideas.
59. If necessary, I am willing to manipulate people to get what I want.
60. I strive for excellence in everything I do.

240 Item (NEO PI-R – Item Booklet Form S – Reorder #RO-2028)

1. I am not a worrier.
2. I really like most people 1 meet.
3. I have a very active imagination.
4. I tend to be cynical and skeptical of others' intentions.
5. I'm known for my prudence and common sense.
6. I often get angry at the way people treat me.
7. I shy away from crowds of people.
8. Aesthetic and artistic concerns aren't very important to me.
9. I'm not crafty or sly.
10. I would rather keep my options open than plan everything in advance.
11. I rarely feel lonely or blue.
12. I am dominant, forceful, and assertive.
13. Without strong emotions, life would be uninteresting to me.
14. Some people think I'm selfish and egotistical.

15. I try to perform all the tasks assigned to me conscientiously.
16. In dealing with other people, I always dread making a social blunder.
17. I have a leisurely style in work and play.
18. I'm pretty set in my ways.
19. I would rather cooperate with others than compete with them.
20. I am easy-going and lackadaisical.
21. I rarely overindulge in anything.
22. I often crave excitement.
23. I often enjoy playing with theories or abstract ideas.
24. I don't mind bragging about my talents and accomplishments.
25. I'm pretty good about pacing myself so as to get things done on time.
26. I often feel helpless and want someone else to solve my problems.
27. I have never literally jumped for joy.
28. I believe letting students hear controversial speakers can only confuse and mislead them.
29. Political leaders need to be more aware of the human side of their policies.
30. Over the years I've done some pretty stupid things.
31. I am easily frightened.
32. I don't get much pleasure from chatting with people.
33. I try to keep all my thoughts directed along realistic lines and avoid flights of fancy.
34. I believe that most people are basically well-intentioned.
35. I don't take civic duties like voting very seriously.
36. I'm an even-tempered person.
37. I like to have a lot of people around me.
38. I am sometimes completely absorbed in music I am listening to.
39. If necessary, I am willing to manipulate people to get what 1 want.
40. I keep my belongings neat and clean.
41. Sometimes I feel complete} y worthless.
42. I sometimes fail to assert myself as much as I should.
43. I rarely experience strong emotions.
44. I try to be courteous to everyone I meet.
45. Sometimes I'm not as dependable or reliable as I should be.
46. I seldom feel self-conscious when I'm around people.
47. When I do things, I do them vigorously.
48. I think it's interesting to learn and develop new hobbies.
49. I can be sarcastic and cutting when I need to be.
50. I have a clear set of goals and work toward them in an orderly fashion.
51. I have trouble resisting my cravings.
52. I wouldn't enjoy vacationing in Las Vegas.
53. I find philosophical arguments boring.
54. I'd rather not talk about myself and my achievements.
55. I waste a lot of time before settling down to work.
56. I feel I am capable of coping with most of my problems.
57. I have sometimes experienced intense joy or ecstasy.

58. I believe that laws and social policies should change to reflect the needs of a changing world.
59. I'm hard-headed and tough-minded in my attitudes.
60. I think things through before coming to a decision.
61. I rarely feel fearful or anxious.
62. I'm known as a warm and friendly person.
63. I have an active fantasy life.
64. I believe that most people will take advantage of you if you let them.
65. I keep myself informed and usually make intelligent decisions.
66. I am known as hot-blooded and quick-tempered.
67. I usually prefer to do things alone.
68. Watching ballet or modem dance bores me.
69. I couldn't deceive anyone even if I wanted to.
70. I am not a very methodical person.
71. I am seldom sad or depressed.
72. I have often been a leader of groups I have belonged to.
73. How I feel about things is important to me.
74. Some people think of me as cold and calculating.
7S: I pay my debts promptly and in full.
76. At times I have been so ashamed I just wanted to hide.
77. My work is likely to be slow but steady.
78. Once I find the right way to do something, I stick to it.
79. I hesitate to express my anger even when it's justified.
80. When I start a self-improvement program, I usually let it slide after a few days.
81. I have little difficulty resisting temptation.
82. I have sometimes done things just for "lcicks" or "thrills."
83. I enjoy solving problems or puzzles.
84. I'm better than most people, and I know it.
85. I am a productive person who always gets the job done.
86. When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.
87. I am not a cheerful optimist.
88. I believe we should look to our religious authorities for decisions on moral issues.
89. We can never do too much for the poor and elderly.
90. Occasionally I act first and think later.
91. I often feel tense and jittery.
92. Many people think of me as somewhat cold and distant.
93. I don't like to waste my time daydreaming.
94. I think most of the people I deal with are honest and trustworthy.
95. I often come into situations without being fully prepared.
96. I am not considered a touchy or temperamental person.
97. I really feel the need for other people if I am by myself for long.
98. I am intrigued by the patterns I find in art and nature.
99. Being perfectly honest is a bad way to do business.
100. I like to keep everything in its place so I know just where it is.
101. I have sometimes experienced a deep sense of guilt or sinfulness.

102. In meetings, I usually let others do the talking.
103. I seldom pay much attention to my feelings of the moment.
104. I generally try to be thoughtful and considerate.
105. Sometimes I cheat when I play solitaire.
106. It doesn't embarrass me too much if people ridicule and tease me.
107. I often feel as if I'm bursting with energy.
108. I often try new and foreign fo ods.
109. If I don't like people, I let them know it.
110. I work hard to accomplish my goals.
111. When I am having my favorite foods, I tend to eat too much.
112. I tend to avoid movies that are shocking or scary.
113. I sometimes lose interest when people talk about very abstract, theoretical matters.
114. I try to be humble.
115. I have trouble making myself do what I should.
116. I keep a cool head in emergencies.
117. Sometimes I bubble with happiness.
118. I believe that the different ideas of right and wrong that people in other societies have may be valid for them.
119. I have no sympathy for panhandlers.
120. I always consider the consequences before I take action.
121. I'm seldom apprehensive about the future.
122. I really enjoy talking to people.
123. I enjoy concentrating on a fantasy or daydream and exploring all its possibilities, letting it grow and develop.
124. I'm suspicious when someone does something nice for me.
125. I pride myself on my sound judgment.
126. I often get disgusted with people I have to deal with.
127. I prefer jobs that let me work alone without being bothered by other people.
128. Poetry has little or no effect on me.
129. I would hate to be thought of as a hypocrite.
130. I never seem to be able to get organized.
131. I tend to blame myself when anything goes wrong.
132. Other people often look to me to make decisions.
133. I experience a wide range of emotions or feelings.
134. I'm not known for my generosity.
135. When I make a commitment, I can always be counted on to follow through.
136. I often feel inferior to others.
137. I'm not as quick and lively as other people.
138. I prefer to spend my time in familiar surroundings.
139. When I've been insulted, I just try to forgive and forget.
140. I don't feel like I'm driven to get ahead.
141. I seldom give in to my impulses.
142. I like to be where the action is.
143. I enjoy working on "mind-twister"-type puzzles.
144. I have a very high opinion of myself.

145. Once I start a project, I almost always finish it.
146. It's often hard for me to make up my mind.
147. I don't consider myself especially "light-hearted."
148. I believe that loyalty to one's ideals and principles is more important than "open-mindedness."
149. Human need should always take priority over economic considerations.
150. I often do things on the spur of the moment.
151. I often worry about things that might go wrong.
152. I find it easy to smile and be outgoing with strangers.
153. If I feel my mind starting to drift off into daydreams, I usually get busy and start concentrating on some work or activity instead.
154. My first reaction is to trust people.
155. I don't seem to be completely successful at anything.
156. It takes a lot to get me mad.
157. I'd rather vacation at a popular beach than an isolated cabin in the woods.
158. Certain kinds of music have an endless fascination for me.
159. Sometimes I trick people into doing what I want.
160. I tend to be somewhat fastidious or exacting.
161. I have a low opinion of myself.
162. I would rather go my own way than be a leader of others.
163. I seldom notice the moods or feelings that different environments produce.
164. Most people I know like me.
165. I adhere strictly to my ethical principles.
166. I feel comfortable in the presence of my bosses or other authorities.
167. I usually seem to be in a hurry.
168. Sometimes I make changes around the house just to try something different.
169. If someone starts a fight, I'm ready to fight back.
170. I strive to achieve all I can.
171. I sometimes eat myself sick.
172. I love the excitement of roller coasters.
173. I have little interest in speculating on the nature of the universe or the human condition.
174. I feel that I am no better than others, no matter what their condition.
175. When a project gets too difficult, I'm inclined to start a new one.
176. I can handle myself pretty well in a crisis.
177. I am a cheerful, high-spirited person.
178. I consider myself broad-minded and tolerant of other people's lifestyles.
179. I believe all human beings are worthy of respect.
180. 1 rarely make hasty decisions.
181. I have fewer fears than most people.
182. I have strong emotional attachments to my friends.
183. As a child I rarely enjoyed games of make believe.
184. I tend to assume the best about people.
185. I'm a very competent person.
186. At times I have felt bitter and resentful.

187. Social gatherings are usually boring to me.
188. Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement
189. At times I bully or flatter people into doing what I want them to.
190. I'm not compulsive about cleaning.
191. Sometimes things look pretty bleak and hopeless to me.
192. In conversations, I tend to do most of the talking.
193. I find it easy to empathize-to feel myself what others are feeling.
194. I think of myself as a charitable person.
195. I try to do jobs carefully, so they won't have to be done again.
196. If l have said or done the wrong thing to someone, I can hardly bear to face them again.
197. My life is fast-paced.
198. On a vacation, I prefer going back to a tried and true spot.
199. I'm hard-headed and stubborn.
200. I strive for excellence in everything I do.
201. Sometimes I do things on impulse that I later regret.
202. I'm attracted to bright colors and flashy styles.
203. I have a lot of intellectual curiosity.
204. I would rather praise others than be praised myself.
205. There are so many little jobs that need to be done that I sometimes just ignore them all.
206. When everything seems to be going wrong, I can still make good decisions.
207. I rarely use words like "fantastic!" or "sensational!" to describe my experiences.
208. I think that if people don't know what they believe in by the time they're 25, there's something wrong with them.
209. I have sympathy for others less fortunate than me.
210. I plan ahead carefully when I go on a trip.
211. Frightening thoughts sometimes come into my head.
212. I take a personal interest in the people I work with.
213. I would have difficulty just letting my mind wander without control or guidance.
214. I have a good deal of faith in human nature.
215. I am efficient and effective at my work.
216. • Even minor annoyances can be frustrating to me.
217. I enjoy parties with lots of people.
218. I enjoy reading poetry that emphasizes feelings and images more than story lines.
219. I pride myself on my shrewdness in handling people.
220. I spend a lot of time looking for things I've misplaced.
221. Too often, when things go wrong, I get discouraged and feel like giving up.
222. I don't find it easy to take charge of a situation.
223. Odd things-like certain scents or the names of distant places-can evoke strong moods in me.
224. I go out of my way to help others if I can.
225. I'd really have to be sick before I'd miss a day of work.
226. When people I know do foolish things, I get embarrassed for them.

227. I am a very active person.
228. I follow the same route when I go someplace.
229. I often get into arguments with my family and co-workers.
230. I'm something of a "workaholic."
231. I am always able to keep my feelings under control.
232. I like being part of the crowd at sporting events.
233. I have a wide range of intellectual interests.
234. I'm a superior person.
235. I have a lot of self-discipline.
236. I'm pretty stable emotionally.
237. I laugh easily.
238. I believe that the "new morality" of permissiveness is no morality at all.
239. I would rather be known as "merciful" than as "just."
240. I think twice before I answer a question.

Informed Pilot Materials

Email

Gregory Desrosiers
To: Gregory Desrosiers
Bcc: Benjamin Womick; Joseph Archer; Patrick Colbert; Courtney White; **+11 others**

Sat 10/7/2023 11:33 PM

GDesrosiers-Informed Pilot L...
261 KB

GDesrosiers-Informed Pilot E...
1 MB

2 attachments (2 MB) Save all to OneDrive - Florida International University Download all

Good evening colleagues,

As you know, I am in the dissertation phase of my doctoral journey at FIU. My dissertation research process includes engaging with industry experts and fellow practitioner-scholars to review and critique my survey instrument. As respected members of your academic and professional communities, I ask you to please read the attached letter and extended abstract. Once you have read this material, I ask that you kindly evaluate the survey instrument itself, evaluate the flow of the survey, evaluate each question in the survey, and provide feedback in the spaces provided. I will review all your feedback and schedule a zoom call to discuss as required.

You can access the survey by clicking the link below or from the attached PDF letter. The informed pilot survey has an optional 12-minute video (closed captioning enabled) that 1) reiterates what I am asking you to perform and 2) summarizes the attached extended abstract. Based on my initial testing, you should be able to resume the survey from where you left off in the event you need to come back later. Simply use the same link from the same device.

I ask that you please review the material and/or provide your feedback in the spaces provided as soon as possible and no later than Monday October 23rd, 2023. My goal is to complete the informed pilot meetings by October 23rd, 2023, or earlier.

Your feedback and participation in this pilot are invaluable to my successful dissertation. Thank you in advance for your participation and your time.

Online survey link:
https://tinyurl.com/informedpilot

QR Code to survey:

Regards,
Greg Desrosiers

Figure B. 1: Informed Pilot Emailed Invitation

Letter

October 7th, 2023

Dear Informed Pilot Participant,

Thank you so much for your willingness to provide your insights regarding a study about **"the factors that contribute to U.S. residential electric utility customers intention to curtail electric energy demand at their primary residence during electric utility peak demand time periods."**

In this study, you are asked to join other panel members to critique the survey instrument intended to be used for initial data collection in this study. I greatly appreciate your interest to share your feedback by assisting in the development of the survey instrument.

Instructions for Review of Survey and Related Materials

Review of the survey

Data will be collected from approximately 385 surveys whose participants will be recruited via Amazon MTurk and administered via Qualtrics. The respondents will be individuals responsible for paying the electric utility bill for their primary residence. All respondents that meet the screening criteria will be asked to read an informed consent form and then acknowledge consent before continuing. Pre-Factor Analysis, the survey instrument has a total of 230 questions and consists of twenty-two (22) constructs.

As a reviewer, you are requested to review and evaluate the survey questionnaire. Specifically, I am asking you to evaluate each question as well as the overall flow of the survey and provide feedback of your evaluation. I ask for all suggestions to improve the overall survey instrument.

To accommodate for multiple schedules, you will have three (3) different manners in which to provide feedback. 1st manner – I will be hosting several recorded Zoom sessions where we can meet as a group and discuss the survey instrument. I will reach each out to each of you to coordinate the best time. My goal is to have this fully completed by October 23rd.

2nd manner – if you cannot attend any of the Zoom sessions, I am providing a "Reviewer Version" of the Qualtrics survey (link and QR code below). Please strive to have the survey completed by Monday October 23rd, 2023. When you open the Reviewer Version of the survey, you will find each question and an input box where you may provide feedback related to the question.

3rd manner / hybrid – you may complete the online Reviewer Version ahead of the recorded Zoom session and we can discuss your replies during your chosen Zoom session. Please strive to have the survey completed by Monday October 23rd, 2023. When you open the Reviewer Version of the survey, you will find each question and an input box where you may provide feedback related to the question.

Regardless of the manner in which you will provide feedback, please consider the following potential issues in evaluating each of the survey sections:

- Does the survey flow well?
- Does it make sense?
- Is the question *clear and understandable*?
- Is the question targeted to *residential electric utility customers* (i.e. the target respondent population)?
- In your opinion, does the question rightly measure the variable of interest?
- Is the question *double barreled*? Double Barreled Questions cover more than one topic. “And” or “or” within a question usually makes it double-barreled.
- Is the question *leading?* A leading question suggests to the respondent that the researcher expects or desires a certain answer.
- Is the question *loaded?* A loaded question asks the respondent to rely on their emotions more than the facts. Loaded questions contain “emotive” words with a positive or negative connotation.
- Is the question *confusing?* A confusing question lacks clarity making it difficult for the respondent to comprehend the question in the desired/required manner
- Is the question *ambiguous?* An ambiguous question is open to more than one interpretation and has a double meaning.
- Is the question *easy to understand and answer*? If the respondent can easily understand and answer the question using the provided response choices

Qualtrics Reviewer Survey Link

Online Survey Link:

https://fiu.qualtrics.com/jfe/form/SV_0PXMliUuNnhLz3o

Online Survey QR Code:

Please direct any questions to me regarding this study or the instructions provided herein:

Greg Desrosiers
gdesr005@fiu.edu (school email)

Regards,

Greg Desrosiers

Technical Validation Materials

Email – October 15th, 2023.

Gregory Desrosiers

To: Gregory Desrosiers

Sun 10/15/2023 11:32 AM

Bcc: [redacted]4@gmail.com; [redacted]rs@gmail.com; **+3 others**

Dear friends,

I have spoken (or text messaged) with each of you this weekend. Thank you for agreeing to help me!

The purpose of asking you perform the survey is so that I can get an average timing from an individual who is taking the survey, without any prior knowledge of my questions, for the 1st time.

I ask that you read each section preface (i.e. the setup to the question) and the questions themselves. I am looking for you to then answer the question truthfully for yourself and/or your home.

This is a long survey and survey participant fatigue strategies are something that I'll need to address with my dissertation chair. Please budget 30 minutes (uninterrupted). I don't know if that's too much or too few. That is what you will help me determine. If you do get tired while taking the survey; kindly note the section (or series of questions) where you were at.

You can access the survey by clicking the link below. My goal is to gather this information from you by October 23rd, 2023, or earlier.

Thank you in advance for your participation and your time.

Online survey link:
https://tinyurl.com/timingpilot

QR Code to survey:

Regards,
Greg Desrosiers

Figure C. 1: Technical Validation Email – October 15th, 2023.

Email – November 4th, 2023.

Gregory Desrosiers
To: g[redacted]6@rcn.com
Sat 11/4/2023 2:53 PM

Dear Greg,
Thank you for agreeing to help me!

The purpose of asking you to perform the survey is so that I can get an average timing from an individual who is taking the survey for the 1st time, without any prior knowledge of my questions.

I ask that you read each section fully. I am looking for you to then answer the questions.

You can access the survey by clicking the link below. My goal is to gather this information from you by Tuesday November 7th, 2023 or earlier.

Thank you in advance for your participation and your time.

Online survey link
Greg A[redacted]s:
https://fiu.qualtrics.com/jfe/form/SV_9KuH9Mxsj0qsbrw?Q_CHL=gl&Q_DL=EMD_MQjenCXBBDuJGE9_9KuH9Mxsj0qsbrw_CGC_MGq3Pqzckyfkav6&_g_=g

Regards,
Greg Desrosiers

Figure C. 2: Technical Validation Email - November 4th, 2023.

Phase 3: Pilot Study

Survey Metrics & Feedback - Connect™ by CloudResearch.com

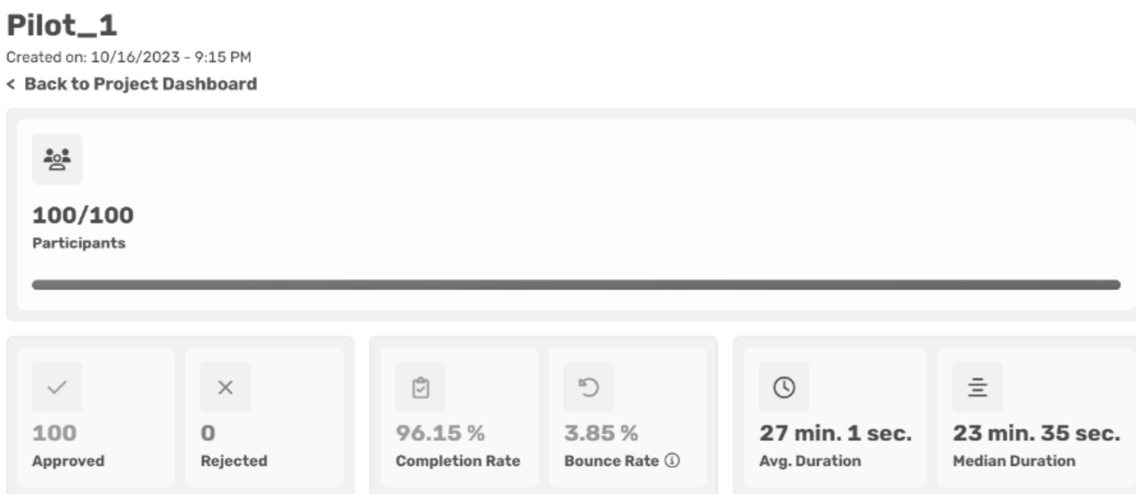


Table D. 1: Pilot_1 Survey Metrics

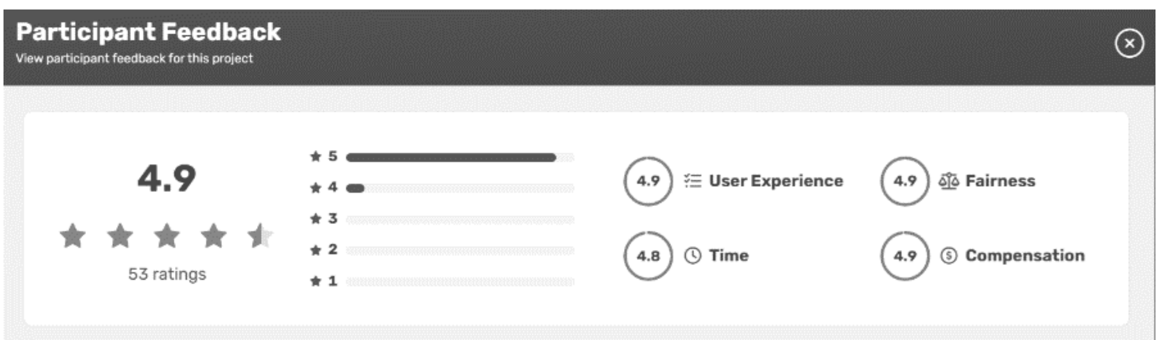


Table D. 2: Pilot_1 Survey Ratings

Pilot_1 Participant Feedback

User B5FE6BC0A3D3462882D0389AC0C2EA3C

I had some confusion with the questions. The questions often used the phrasing using less electricity, but there was no clarity about what the usage should be compared against. I believe that the questions would be much easier to understand if it asked about my intentions to minimize my electricity usage because this is more absolute and it works for people who are already energy conscious in their consumption habits. I also would have like an N/A option, because I do not run *my heater at all during the winter, and I turn my AC off from November-April, and I keep the thermostat at 80 degrees in the remaining months. Therefore, I did not feel that the questions about lowering my thermostat in the winter below 70 were necessarily applicable.*

User C2018F956F2B49F19575F350C793A870

Interesting study! Thank you!

User 01C706008D484E639F3C1E8029E096CA

What a great study. I am fortunate to live in an area where we currently do not have power shortages..... YET. I have been working on getting completely off the power grid. I have a 400 watt solar setup currently that powers my internet and computers for work. I am going to upgrade it with another 400 watt solar setup to power my refrigerator. All of my lights are now LED. I have been looking into solutions for my hot water and electric cook stove, and maybe someday I will have enough solar to power them also. We do not have access to natural gas in my area, which I want to avoid fossil fuels as well. I do not use AC anymore, and if it is truly too hot in the summer, I use an evaporative cooler instead. I also prefer it chilly, and 62 is the max I ever keep the temperature in my home. I also replaced my old electric furnace with a mini split heat pump, and only use it if it drops below 55 degrees. I can always bundle up, and it only uses 1200 watts. I am trying to be rid of reliance on the entire system, and once I figure out hot water and cooking, I will be set. Thank you for letting me participate in such a great survey. Take care!

User B157D5CEE1FE433EA49A56AC1EFCDF9B

It was great.

User 6AA7826FB1FE4155ACE17FE7F4C4DFF3

Thanks for the very fair pay!

Rotated Factor Matrix (EFA1)

Rotated Factor Matrix[a]

	Factor															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DGN_1	.932															
DGN_6	.914															
DGN_7	.908															
DGN_2	.907															
DGN_4	.907															
DGN_5	.873															
DGN_3	.854															
ECN_7		.920														
ECN_8		.904														
ECN_1		.868														
ECN_3		.861														
ECN_2		.850														
ECN_6		.783														
DNM_3			.912													
DNM_2			.898													
DNM_1			.808													
DNM_4			.806													
DNM_5			.792													
PMN_6				.870												
PMN_8				.822												
PMN_7				.808												
PMN_1				.768												
PMN_5				.716												
PMN_4				.694												
DPN_1					.884											
DPN_3					.875											
DPN_4					.862											
DPN_2					.833											
DPN_5					.784											
DPN_6					.683											
TCW_3						.817										
TCW_4						.814										
TCW_6						.789										
TCW_1						.782										
TCW_5						.751										
TCC_3							.823									
TCC_1							.750									
TCC_4							.744									
TCC_2							.663									
TCC_5							.595									
ATT_5								-.807								
ATT_2								-.785								
ATT_3								-.767								
ATT_8								-.585								
INN_6									.828							
INN_7									.763							
INN_8									.688							
INN_4									.631							
INN_3									.562							
TON_3										.708						
TON_1										.691						
TON_7										.689						
TON_2										.651						
TON_8										.602						
PBC_7_recode											.748					
PBC_8_recode											.701					
PBC_3_recode											.661					
PBC_2_recode											.644					
PBC_5											.594					
AFF_4_recode												.861				
AFF_3_recode												.824				
AFF_5_recode												.755				
AFF_6_recode												.720				
FIN20__8													.771			
FIN20__3													.749			
FIN20__7													.679			
FIN20__1													.634			
HAB_11														.727		
HAB_12														.667		
HAB_1														.655		
HAB_8														.533		
NEP_6_recode															.732	
NEP_15_recode															.680	
NEP_9_recode															.627	
NEP_13_recode															.564	
ESK_3																.746
ESK_1																.722
ESK_2																.630

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 11 iterations.

Table D. 3: Rotated Factor Matrix (EFA1)

Rotated Factor Matrix (EFA2)

Rotated Factor Matrix[a]

	Factor																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DGN_1	.915																			
DGN_2	.895																			
DGN_7	.895																			
DGN_6	.888																			
DGN_5	.859																			
DPN_3		.889																		
DPN_1		.869																		
DPN_2		.859																		
DPN_4		.817																		
DPN_5		.748																		
HAB_5			.837																	
HAB_8			.798																	
HAB_10			.760																	
HAB_3			.701																	
HAB_2			.679																	
INM_7				.874																
INM_8				.859																
INM_6				.851																
DNM_4				.645																
DNM_1				.628																
FIN20__3					.780															
FIN20__8					.775															
FIN20__7					.755															
FIN20__6					.693															
FIN20__1					.647															
TON_3						.813														
TON_2						.725														
TON_1						.721														
TON_7						.658														
TON_8						.601														
PMN_6							.790													
PMN_5							.769													
PMN_8							.712													
PMN_4							.706													
ECN_8								.891												
ECN_7								.872												
ECN_3								.748												
ATT_5									-.852											
ATT_2									-.832											
ATT_3									-.795											
TCW_4										.825										
TCW_3										.787										
TCW_6										.763										
NEP_6_recode											.799									
NEP_4_recode											.752									
NEP_15_recode											.641									
NEP_9_recode											.602									
AFF_4_recode												.822								
AFF_3_recode												.820								
AFF_5_recode												.808								
PC_3_recode													.891							
PC_1													.794							
PC_5													.657							
PO_12														.830						
PO_3														.741						
PO_11														.736						
PBC_7_recode															.788					
PBC_8_recode															.688					
PBC_2_recode															.669					
PE_4																.811				
PE_1																.739				
PE_5																.728				
PN_3																	.809			
PN_9																	.757			
PN_6																	.638			
TCC_3																		.799		
TCC_2																		.676		
TCC_1																		.662		
PA_10																			.741	
PA_1																			.677	
PA_12_recode																			.519	
ESK_1																				.669
ESK_2																				.660
ESK_3																				.629

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 10 iterations.

Table D. 4: Rotated Factor Matrix (EFA2)

Item by Item Statistics (pre-EFA)

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
						Std. Error
INT_1	80	3	2	5	4.25	0.093
INT_2	80	4	1	5	4.26	0.097
INT_3	80	4	1	5	4.05	0.123
INT_4	80	4	1	5	4.66	0.079
INT_5	80	4	1	5	4.29	0.113
INT_6	80	4	1	5	4.43	0.108
INT_7	80	4	1	5	4.61	0.081
INT_8	80	4	1	5	4.59	0.079
HAB_1	80	2	3	5	4.28	0.071
HAB_2	80	3	2	5	4.05	0.089
HAB_3	80	4	1	5	3.96	0.103
HAB_4	80	4	1	5	3.54	0.132
HAB_5	80	3	2	5	3.90	0.098
HAB_6	80	4	1	5	3.84	0.120
HAB_7	80	2	3	5	4.20	0.076
HAB_8	80	4	1	5	3.88	0.113
HAB_9	80	4	1	5	3.84	0.120
HAB_10	80	4	1	5	3.71	0.118
HAB_11	80	3	2	5	4.26	0.079
HAB_12	80	4	1	5	4.35	0.093
ECN_1	80	4	1	5	3.18	0.146
ECN_2	80	4	1	5	3.04	0.159
ECN_3	80	4	1	5	2.94	0.155
ECN_4	80	4	1	5	4.39	0.103
ECN_5	80	4	1	5	4.21	0.100
ECN_6	80	4	1	5	3.55	0.153
ECN_7	80	4	1	5	3.35	0.157
ECN_8	80	4	1	5	3.29	0.157
ESK_1	80	4	1	5	4.08	0.122
ESK_2	80	4	1	5	3.40	0.128
ESK_3	80	4	1	5	3.73	0.132
ESK_4	80	2	3	5	4.78	0.050
ESK_5	80	4	1	5	4.26	0.116
ESK_6_recode	80	4	1	5	4.45	0.137
ESK_7	80	4	1	5	4.63	0.082
ESK_8	80	4	1	5	4.58	0.090

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
						Std. Error
NEP_1	80	4	1	5	3.21	0.153
NEP_2_recode	80	4	1	5	3.16	0.146
NEP_3	80	4	1	5	3.91	0.120
NEP_4_recode	80	4	1	5	2.88	0.132
NEP_5	80	4	1	5	4.38	0.101
NEP_6_recode	80	4	1	5	2.36	0.144
NEP_7	80	4	1	5	4.48	0.097
NEP_9_recode	80	4	1	5	3.40	0.131
NEP_10	80	3	2	5	4.50	0.089
NEP_11_recode	80	4	1	5	3.69	0.151
NEP_12	80	4	1	5	3.24	0.152
NEP_13_recode	80	4	1	5	3.35	0.150
NEP_14	80	4	1	5	4.01	0.106
NEP_15_recode	80	4	1	5	3.11	0.146
NEP_16	80	4	1	5	4.13	0.116
ATT_1	80	3	1	4	1.54	0.079
ATT_2	80	3	1	4	1.74	0.094
ATT_3	80	3	1	4	1.54	0.075
ATT_4	80	4	1	5	1.41	0.087
ATT_5	80	3	1	4	1.79	0.103
ATT_6_recode	80	4	1	5	1.70	0.109
ATT_7	80	4	1	5	2.43	0.116
ATT_8	80	4	1	5	2.06	0.109
INM_1	80	4	1	5	3.21	0.120
INM_2	80	4	1	5	3.33	0.143
INM_3	80	4	1	5	3.03	0.124
INM_4	80	4	1	5	2.98	0.131
INM_5	80	4	1	5	3.20	0.144
INM_6	80	4	1	5	2.89	0.125
INM_7	80	4	1	5	2.70	0.124
INM_8	80	4	1	5	3.00	0.122
DNM_1	80	4	1	5	3.26	0.134
DNM_2	80	4	1	5	3.25	0.121
DNM_3	80	4	1	5	3.25	0.124
DNM_4	80	4	1	5	3.18	0.120
DNM_5	80	4	1	5	3.16	0.121
DNM_6	80	4	1	5	3.43	0.132
DNM_8	80	4	1	5	3.14	0.114

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
						Std. Error
DNM_9	80	4	1	5	3.29	0.110
PMN_1	80	4	1	5	3.99	0.125
PMN_2_recode	80	4	1	5	3.71	0.137
PMN_3	80	4	1	5	3.58	0.123
PMN_4	80	4	1	5	4.05	0.119
PMN_5	80	4	1	5	4.05	0.121
PMN_6	80	4	1	5	3.99	0.121
PMN_7	80	4	1	5	3.95	0.111
PMN_8	80	4	1	5	4.04	0.117
PBC_1	80	3	2	5	4.50	0.071
PBC_2_recode	80	4	1	5	4.06	0.113
PBC_3_recode	80	4	1	5	3.90	0.128
PBC_4	80	4	1	5	4.34	0.096
PBC_5	80	2	3	5	4.54	0.064
PBC_6	80	3	2	5	4.41	0.077
PBC_7_recode	80	4	1	5	4.21	0.112
PBC_8_recode	80	4	1	5	3.91	0.108
TCC_1	80	4	1	5	3.56	0.143
TCC_2	80	4	1	5	3.30	0.142
TCC_3	80	4	1	5	3.06	0.149
TCC_4	80	4	1	5	2.86	0.139
TCC_5	80	4	1	5	2.90	0.143
TCC_6	80	4	1	5	2.86	0.149
TCW_1	80	4	1	5	3.20	0.143
TCW_2_recode	80	4	1	5	1.84	0.104
TCW_3	80	4	1	5	2.95	0.139
TCW_4	80	4	1	5	2.55	0.140
TCW_5	80	4	1	5	2.63	0.136
TCW_6	80	4	1	5	2.49	0.133
AFF_1	80	4	1	5	3.26	0.140
AFF_2	80	4	1	5	3.54	0.144
AFF_3_recode	80	4	1	5	4.43	0.102
AFF_4_recode	80	4	1	5	4.55	0.092
AFF_5_recode	80	4	1	5	4.45	0.107
AFF_6_recode	80	4	1	5	4.50	0.101
AFF_7	80	4	1	5	3.43	0.130
AFF_8	80	4	1	5	3.88	0.130
FIN20__1	80	3	2	5	4.54	0.077

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
						Std. Error
FIN20__2	80	3	2	5	4.58	0.068
FIN20__3	80	2	3	5	4.73	0.053
FIN20__4	80	3	2	5	4.48	0.085
FIN20__6	80	3	2	5	4.60	0.068
FIN20__7	80	2	3	5	4.73	0.056
FIN20__8	80	2	3	5	4.75	0.058
FIN20_9_recode	80	4	1	5	4.19	0.136
TON_1	80	4	1	5	4.16	0.103
TON_2	80	4	1	5	3.93	0.126
TON_3	80	4	1	5	4.14	0.105
TON_4_recode	80	4	1	5	3.01	0.169
TON_5	80	2	3	5	4.39	0.077
TON_6	80	3	2	5	4.46	0.079
TON_7	80	3	2	5	4.30	0.096
TON_8	80	4	1	5	4.36	0.091
DPN_1	80	4	1	5	4.10	0.120
DPN_2	80	4	1	5	4.19	0.122
DPN_3	80	4	1	5	4.11	0.125
DPN_4	80	4	1	5	4.30	0.100
DPN_5	80	3	2	5	4.39	0.092
DPN_6	80	3	2	5	4.30	0.103
DPN_7	80	3	2	5	4.24	0.103
DPN_8	80	3	2	5	4.41	0.087
DGN_1	80	4	1	5	3.60	0.141
DGN_2	80	4	1	5	3.54	0.142
DGN_3	80	4	1	5	3.59	0.136
DGN_4	80	4	1	5	3.69	0.148
DGN_5	80	4	1	5	3.71	0.149
DGN_6	80	4	1	5	3.61	0.139
DGN_7	80	4	1	5	3.88	0.146
DGN_8	80	4	1	5	3.64	0.138
NCA_1	33	1	4	5	4.70	0.081
NCA_2	33	1	4	5	4.70	0.081
NCA_3	33	1	4	5	4.70	0.081
NCA_4	33	1	4	5	4.79	0.072
NCA_5	33	2	3	5	4.61	0.097
NCA_6	33	1	4	5	4.85	0.063
NCA_7	33	2	3	5	4.61	0.097

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
						Std. Error
NCA_8	33	2	3	5	4.73	0.090
NCE_1	36	2	3	5	4.36	0.107
NCE_2	36	1	4	5	4.86	0.058
NCE_3	36	2	3	5	4.61	0.092
NCE_4	36	2	3	5	4.64	0.090
NCE_5	36	3	2	5	4.08	0.134
NCE_6	36	3	2	5	4.39	0.121
NCE_7	36	2	3	5	4.75	0.083
NCE_8	36	1	4	5	4.81	0.067
NCL_1	11	2	3	5	4.55	0.207
NCL_2	11	1	4	5	4.73	0.141
NCL_3	11	1	4	5	4.82	0.122
NCL_4	11	3	2	5	4.73	0.273
NCL_5	11	4	1	5	4.27	0.384
NCL_6	11	1	4	5	4.82	0.122
NCL_7	11	0	5	5	5.00	0.000
NCL_8	11	3	2	5	4.55	0.282
PA_1	80	3	2	5	4.60	0.070
PA_2_recode	80	4	1	5	2.94	0.137
PA_3_recode	80	4	1	5	3.89	0.126
PA_4	80	3	2	5	4.28	0.102
PA_5_recode	80	4	1	5	2.65	0.134
PA_6_recode	80	4	1	5	2.89	0.135
PA_7	80	3	2	5	4.04	0.097
PA_8_recode	80	4	1	5	3.80	0.148
PA_9_recode	80	4	1	5	3.86	0.132
PA_10	80	2	3	5	4.53	0.069
PA_11_recode	80	4	1	5	3.45	0.124
PA_12_recode	80	4	1	5	3.83	0.135
PC_1	80	3	2	5	4.24	0.095
PC_2	80	4	1	5	4.28	0.089
PC_3_recode	80	4	1	5	3.94	0.118
PC_4	80	2	3	5	4.46	0.069
PC_5	80	4	1	5	4.20	0.088
PC_6_recode	80	4	1	5	3.89	0.125
PC_7	80	2	3	5	4.50	0.071
PC_8	80	3	2	5	4.45	0.091
PC_9_recode	80	4	1	5	3.85	0.128

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
						Std. Error
PC_10	80	4	1	5	4.25	0.107
PC_11_recode	80	4	1	5	3.98	0.134
PC_12	80	4	1	5	4.35	0.094
PE_1	80	4	1	5	2.68	0.136
PE_2	80	4	1	5	4.03	0.097
PE_3_recode	80	4	1	5	3.49	0.137
PE_4	80	4	1	5	3.41	0.129
PE_5	80	4	1	5	3.13	0.134
PE_6_recode	80	4	1	5	2.39	0.135
PE_7	80	4	1	5	2.99	0.129
PE_8	80	4	1	5	3.63	0.125
PE_9_recode	80	4	1	5	3.50	0.150
PE_10	80	4	1	5	3.00	0.118
PE_11	80	4	1	5	3.40	0.144
PE_12_recode	80	4	1	5	2.50	0.123
PN_1_recode	80	4	1	5	3.28	0.146
PN_2	80	4	1	5	2.39	0.134
PN_3	80	4	1	5	2.49	0.143
PN_4_recode	80	4	1	5	2.84	0.158
PN_5	80	4	1	5	2.20	0.117
PN_6	80	4	1	5	2.05	0.141
PN_7_recode	80	4	1	5	3.00	0.150
PN_8	80	4	1	5	2.04	0.120
PN_9	80	4	1	5	2.24	0.132
PN_10_recode	80	4	1	5	2.70	0.149
PN_11	80	4	1	5	2.14	0.130
PN_12	80	4	1	5	2.26	0.143
PO_1_recode	80	4	1	5	3.00	0.147
PO_2_recode	80	4	1	5	2.68	0.119
PO_3	80	4	1	5	3.86	0.115
PO_4_recode	80	4	1	5	3.85	0.130
PO_5_recode	80	4	1	5	3.53	0.135
PO_6	80	4	1	5	3.35	0.151
PO_7_recode	80	4	1	5	3.78	0.115
PO_8_recode	80	4	1	5	3.46	0.155
PO_9	80	4	1	5	3.43	0.130
PO_10_recode	80	4	1	5	3.88	0.129
PO_11	80	4	1	5	4.05	0.122

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
						Std. Error
PO_12	80	4	1	5	3.75	0.134

Table D. 5: Item by Item Descriptive Statistics

Descriptive Statistics

	N	Std. Deviation	Variance	Skewness		Kurtosis	
					Std. Error		Std. Error
INT_1	80	0.834	0.696	-1.039	0.269	0.646	0.532
INT_2	80	0.868	0.753	-1.377	0.269	2.200	0.532
INT_3	80	1.101	1.213	-1.268	0.269	0.901	0.532
INT_4	80	0.711	0.505	-2.878	0.269	10.240	0.532
INT_5	80	1.009	1.018	-1.824	0.269	3.167	0.532
INT_6	80	0.965	0.931	-2.167	0.269	4.769	0.532
INT_7	80	0.720	0.519	-2.595	0.269	8.780	0.532
INT_8	80	0.706	0.499	-2.531	0.269	9.036	0.532
HAB_1	80	0.636	0.404	-0.304	0.269	-0.640	0.532
HAB_2	80	0.794	0.630	-0.713	0.269	0.414	0.532
HAB_3	80	0.920	0.847	-0.924	0.269	0.733	0.532
HAB_4	80	1.179	1.391	-0.543	0.269	-0.750	0.532
HAB_5	80	0.880	0.775	-0.601	0.269	-0.166	0.532
HAB_6	80	1.073	1.150	-0.614	0.269	-0.593	0.532
HAB_7	80	0.683	0.466	-0.274	0.269	-0.825	0.532
HAB_8	80	1.011	1.022	-1.025	0.269	0.930	0.532
HAB_9	80	1.073	1.150	-0.677	0.269	-0.262	0.532
HAB_10	80	1.058	1.119	-0.646	0.269	-0.292	0.532
HAB_11	80	0.707	0.500	-0.865	0.269	1.093	0.532
HAB_12	80	0.828	0.686	-1.424	0.269	2.518	0.532
ECN_1	80	1.310	1.716	-0.229	0.269	-1.184	0.532
ECN_2	80	1.418	2.011	-0.068	0.269	-1.362	0.532
ECN_3	80	1.390	1.933	0.027	0.269	-1.294	0.532
ECN_4	80	0.921	0.848	-1.954	0.269	4.082	0.532
ECN_5	80	0.896	0.802	-1.412	0.269	2.146	0.532
ECN_6	80	1.368	1.871	-0.594	0.269	-0.924	0.532
ECN_7	80	1.406	1.977	-0.343	0.269	-1.284	0.532
ECN_8	80	1.407	1.980	-0.223	0.269	-1.334	0.532
ESK_1	80	1.088	1.184	-1.301	0.269	1.066	0.532
ESK_2	80	1.143	1.306	-0.321	0.269	-0.604	0.532

Descriptive Statistics

	N	Std. Deviation	Variance	Skewness		Kurtosis	
					Std. Error		Std. Error
ESK_3	80	1.180	1.392	-1.009	0.269	0.332	0.532
ESK_4	80	0.449	0.202	-1.763	0.269	2.196	0.532
ESK_5	80	1.040	1.082	-1.312	0.269	0.740	0.532
ESK_6_recode	80	1.221	1.491	-2.213	0.269	3.480	0.532
ESK_7	80	0.736	0.541	-2.599	0.269	8.300	0.532
ESK_8	80	0.808	0.653	-2.318	0.269	5.847	0.532
NEP_1	80	1.366	1.866	-0.457	0.269	-1.065	0.532
NEP_2_recode	80	1.307	1.707	-0.065	0.269	-1.137	0.532
NEP_3	80	1.070	1.144	-1.095	0.269	0.667	0.532
NEP_4_recode	80	1.184	1.402	0.107	0.269	-0.779	0.532
NEP_5	80	0.905	0.820	-2.083	0.269	5.307	0.532
NEP_6_recode	80	1.285	1.652	0.571	0.269	-0.787	0.532
NEP_7	80	0.871	0.759	-1.807	0.269	3.134	0.532
NEP_9_recode	80	1.176	1.382	-0.497	0.269	-0.497	0.532
NEP_10	80	0.796	0.633	-1.470	0.269	1.247	0.532
NEP_11_recode	80	1.346	1.813	-0.747	0.269	-0.677	0.532
NEP_12	80	1.362	1.854	-0.352	0.269	-1.075	0.532
NEP_13_recode	80	1.342	1.800	-0.413	0.269	-0.952	0.532
NEP_14	80	0.948	0.899	-1.031	0.269	1.184	0.532
NEP_15_recode	80	1.302	1.696	-0.002	0.269	-1.157	0.532
NEP_16	80	1.036	1.073	-1.238	0.269	1.285	0.532
ATT_1	80	0.711	0.505	1.384	0.269	2.075	0.532
ATT_2	80	0.838	0.702	1.062	0.269	0.654	0.532
ATT_3	80	0.674	0.454	1.133	0.269	1.164	0.532
ATT_4	80	0.774	0.600	2.480	0.269	7.202	0.532
ATT_5	80	0.924	0.853	1.133	0.269	0.543	0.532
ATT_6_recode	80	0.973	0.947	1.655	0.269	2.579	0.532
ATT_7	80	1.041	1.083	0.447	0.269	-0.477	0.532
ATT_8	80	0.972	0.945	0.635	0.269	-0.153	0.532
INM_1	80	1.076	1.157	-0.125	0.269	-0.706	0.532
INM_2	80	1.281	1.640	-0.303	0.269	-0.991	0.532
INM_3	80	1.113	1.240	0.063	0.269	-0.763	0.532
INM_4	80	1.169	1.366	0.001	0.269	-0.663	0.532
INM_5	80	1.287	1.656	-0.202	0.269	-0.980	0.532
INM_6	80	1.114	1.240	0.058	0.269	-0.682	0.532
INM_7	80	1.107	1.225	0.223	0.269	-0.325	0.532
INM_8	80	1.091	1.190	0.000	0.269	-0.590	0.532
DNM_1	80	1.199	1.437	-0.481	0.269	-0.691	0.532

Descriptive Statistics

	N	Std. Deviation	Variance	Skewness		Kurtosis	
					Std. Error		Std. Error
DNM_2	80	1.085	1.177	-0.457	0.269	-0.518	0.532
DNM_3	80	1.108	1.228	-0.515	0.269	-0.515	0.532
DNM_4	80	1.077	1.159	-0.484	0.269	-0.294	0.532
DNM_5	80	1.084	1.176	-0.088	0.269	-0.610	0.532
DNM_6	80	1.178	1.387	-0.364	0.269	-0.756	0.532
DNM_8	80	1.016	1.031	-0.134	0.269	0.062	0.532
DNM_9	80	0.983	0.967	-0.202	0.269	-0.290	0.532
PMN_1	80	1.119	1.253	-1.030	0.269	0.095	0.532
PMN_2_recode	80	1.224	1.499	-0.870	0.269	-0.221	0.532
PMN_3	80	1.100	1.209	-0.547	0.269	-0.498	0.532
PMN_4	80	1.066	1.137	-1.259	0.269	1.112	0.532
PMN_5	80	1.078	1.162	-1.345	0.269	1.460	0.532
PMN_6	80	1.085	1.177	-1.134	0.269	0.701	0.532
PMN_7	80	0.992	0.985	-1.014	0.269	0.791	0.532
PMN_8	80	1.049	1.100	-1.157	0.269	0.740	0.532
PBC_1	80	0.636	0.405	-1.209	0.269	1.794	0.532
PBC_2_recode	80	1.011	1.021	-0.882	0.269	0.033	0.532
PBC_3_recode	80	1.143	1.306	-1.052	0.269	0.351	0.532
PBC_4	80	0.856	0.733	-1.836	0.269	4.567	0.532
PBC_5	80	0.572	0.328	-0.773	0.269	-0.388	0.532
PBC_6	80	0.688	0.473	-1.231	0.269	2.094	0.532
PBC_7_recode	80	1.002	1.005	-1.448	0.269	1.763	0.532
PBC_8_recode	80	0.970	0.942	-0.674	0.269	-0.052	0.532
TCC_1	80	1.281	1.642	-0.605	0.269	-0.738	0.532
TCC_2	80	1.267	1.605	-0.091	0.269	-1.219	0.532
TCC_3	80	1.334	1.781	-0.182	0.269	-1.145	0.532
TCC_4	80	1.240	1.538	0.268	0.269	-0.976	0.532
TCC_5	80	1.279	1.635	0.154	0.269	-1.033	0.532
TCC_6	80	1.329	1.766	-0.007	0.269	-1.205	0.532
TCW_1	80	1.277	1.630	-0.124	0.269	-1.222	0.532
TCW_2_recode	80	0.934	0.872	1.482	0.269	2.494	0.532
TCW_3	80	1.242	1.542	0.056	0.269	-0.970	0.532
TCW_4	80	1.252	1.567	0.598	0.269	-0.687	0.532
TCW_5	80	1.216	1.478	0.329	0.269	-0.865	0.532
TCW_6	80	1.191	1.418	0.446	0.269	-0.686	0.532
AFF_1	80	1.250	1.563	-0.436	0.269	-1.091	0.532
AFF_2	80	1.292	1.669	-0.663	0.269	-0.822	0.532
AFF_3_recode	80	0.911	0.830	-1.679	0.269	2.446	0.532

Descriptive Statistics

	N	Std. Deviation	Variance	Skewness		Kurtosis	
					Std. Error		Std. Error
AFF_4_recode	80	0.825	0.681	-2.035	0.269	4.268	0.532
AFF_5_recode	80	0.953	0.909	-2.011	0.269	3.812	0.532
AFF_6_recode	80	0.900	0.810	-1.923	0.269	3.271	0.532
AFF_7	80	1.167	1.361	-0.844	0.269	-0.300	0.532
AFF_8	80	1.162	1.351	-1.238	0.269	1.004	0.532
FIN20__1	80	0.693	0.480	-1.662	0.269	3.061	0.532
FIN20__2	80	0.612	0.374	-1.486	0.269	2.823	0.532
FIN20__3	80	0.477	0.227	-1.382	0.269	0.776	0.532
FIN20__4	80	0.763	0.582	-1.406	0.269	1.445	0.532
FIN20__6	80	0.608	0.370	-1.608	0.269	3.218	0.532
FIN20__7	80	0.503	0.253	-1.624	0.269	1.814	0.532
FIN20__8	80	0.516	0.266	-1.989	0.269	3.224	0.532
FIN20_9_recode	80	1.213	1.471	-1.506	0.269	1.186	0.532
TON_1	80	0.920	0.847	-1.232	0.269	1.425	0.532
TON_2	80	1.123	1.260	-0.895	0.269	-0.164	0.532
TON_3	80	0.938	0.880	-1.037	0.269	0.754	0.532
TON_4_recode	80	1.514	2.291	-0.156	0.269	-1.455	0.532
TON_5	80	0.684	0.468	-0.675	0.269	-0.645	0.532
TON_6	80	0.711	0.505	-1.167	0.269	0.838	0.532
TON_7	80	0.863	0.744	-1.235	0.269	0.997	0.532
TON_8	80	0.815	0.664	-1.628	0.269	3.524	0.532
DPN_1	80	1.074	1.154	-1.145	0.269	0.554	0.532
DPN_2	80	1.092	1.192	-1.282	0.269	0.739	0.532
DPN_3	80	1.114	1.240	-1.186	0.269	0.649	0.532
DPN_4	80	0.892	0.795	-1.295	0.269	1.556	0.532
DPN_5	80	0.819	0.671	-1.117	0.269	0.304	0.532
DPN_6	80	0.920	0.846	-1.040	0.269	-0.061	0.532
DPN_7	80	0.917	0.842	-0.899	0.269	-0.283	0.532
DPN_8	80	0.774	0.600	-1.041	0.269	0.063	0.532
DGN_1	80	1.259	1.585	-0.759	0.269	-0.392	0.532
DGN_2	80	1.272	1.619	-0.691	0.269	-0.604	0.532
DGN_3	80	1.219	1.486	-0.660	0.269	-0.514	0.532
DGN_4	80	1.327	1.762	-0.833	0.269	-0.438	0.532
DGN_5	80	1.333	1.777	-0.800	0.269	-0.553	0.532
DGN_6	80	1.248	1.557	-0.664	0.269	-0.613	0.532
DGN_7	80	1.306	1.706	-0.917	0.269	-0.373	0.532
DGN_8	80	1.235	1.525	-0.718	0.269	-0.489	0.532
NCA_1	33	0.467	0.218	-0.899	0.409	-1.274	0.798

Descriptive Statistics

	N	Std. Deviation	Variance	Skewness		Kurtosis	
					Std. Error		Std. Error
NCA_2	33	0.467	0.218	-0.899	0.409	-1.274	0.798
NCA_3	33	0.467	0.218	-0.899	0.409	-1.274	0.798
NCA_4	33	0.415	0.172	-1.476	0.409	0.187	0.798
NCA_5	33	0.556	0.309	-1.029	0.409	0.116	0.798
NCA_6	33	0.364	0.133	-2.038	0.409	2.287	0.798
NCA_7	33	0.556	0.309	-1.029	0.409	0.116	0.798
NCA_8	33	0.517	0.267	-1.769	0.409	2.511	0.798
NCE_1	36	0.639	0.409	-0.485	0.393	-0.585	0.768
NCE_2	36	0.351	0.123	-2.180	0.393	2.913	0.768
NCE_3	36	0.549	0.302	-1.017	0.393	0.057	0.768
NCE_4	36	0.543	0.294	-1.163	0.393	0.424	0.768
NCE_5	36	0.806	0.650	-0.503	0.393	-0.309	0.768
NCE_6	36	0.728	0.530	-1.236	0.393	1.897	0.768
NCE_7	36	0.500	0.250	-1.906	0.393	3.076	0.768
NCE_8	36	0.401	0.161	-1.612	0.393	0.631	0.768
NCL_1	11	0.688	0.473	-1.324	0.661	0.976	1.279
NCL_2	11	0.467	0.218	-1.189	0.661	-0.764	1.279
NCL_3	11	0.405	0.164	-1.923	0.661	2.037	1.279
NCL_4	11	0.905	0.818	-3.317	0.661	11.000	1.279
NCL_5	11	1.272	1.618	-2.046	0.661	4.187	1.279
NCL_6	11	0.405	0.164	-1.923	0.661	2.037	1.279
NCL_7	11	0.000	0.000				
NCL_8	11	0.934	0.873	-2.408	0.661	6.063	1.279
PA_1	80	0.628	0.395	-1.645	0.269	2.985	0.532
PA_2_recode	80	1.226	1.502	0.206	0.269	-1.208	0.532
PA_3_recode	80	1.125	1.266	-0.867	0.269	-0.026	0.532
PA_4	80	0.914	0.835	-1.193	0.269	0.620	0.532
PA_5_recode	80	1.202	1.446	0.264	0.269	-0.971	0.532
PA_6_recode	80	1.212	1.468	0.002	0.269	-0.987	0.532
PA_7	80	0.863	0.745	-0.799	0.269	0.236	0.532
PA_8_recode	80	1.326	1.757	-0.792	0.269	-0.539	0.532
PA_9_recode	80	1.177	1.386	-0.920	0.269	-0.053	0.532
PA_10	80	0.616	0.379	-0.931	0.269	-0.118	0.532
PA_11_recode	80	1.113	1.238	-0.465	0.269	-0.367	0.532
PA_12_recode	80	1.209	1.463	-0.931	0.269	-0.080	0.532
PC_1	80	0.846	0.715	-1.123	0.269	0.925	0.532
PC_2	80	0.795	0.632	-1.469	0.269	3.423	0.532
PC_3_recode	80	1.060	1.123	-0.921	0.269	0.197	0.532

Descriptive Statistics

	N	Std. Deviation	Variance	Skewness		Kurtosis	
					Std. Error		Std. Error
PC_4	80	0.615	0.378	-0.691	0.269	-0.456	0.532
PC_5	80	0.786	0.618	-1.335	0.269	3.185	0.532
PC_6_recode	80	1.114	1.240	-1.126	0.269	0.626	0.532
PC_7	80	0.636	0.405	-0.906	0.269	-0.204	0.532
PC_8	80	0.810	0.656	-1.595	0.269	2.193	0.532
PC_9_recode	80	1.148	1.319	-0.779	0.269	-0.469	0.532
PC_10	80	0.961	0.924	-1.579	0.269	2.486	0.532
PC_11_recode	80	1.201	1.442	-1.165	0.269	0.441	0.532
PC_12	80	0.843	0.711	-1.524	0.269	2.769	0.532
PE_1	80	1.220	1.488	0.439	0.269	-0.759	0.532
PE_2	80	0.871	0.759	-0.992	0.269	1.266	0.532
PE_3_recode	80	1.222	1.494	-0.461	0.269	-0.726	0.532
PE_4	80	1.155	1.334	-0.312	0.269	-0.829	0.532
PE_5	80	1.195	1.427	-0.156	0.269	-0.907	0.532
PE_6_recode	80	1.206	1.456	0.582	0.269	-0.593	0.532
PE_7	80	1.153	1.329	-0.077	0.269	-0.825	0.532
PE_8	80	1.118	1.250	-0.657	0.269	-0.259	0.532
PE_9_recode	80	1.341	1.797	-0.566	0.269	-0.894	0.532
PE_10	80	1.055	1.114	-0.066	0.269	-0.696	0.532
PE_11	80	1.289	1.661	-0.683	0.269	-0.661	0.532
PE_12_recode	80	1.102	1.215	0.233	0.269	-0.870	0.532
PN_1_recode	80	1.302	1.696	-0.354	0.269	-1.118	0.532
PN_2	80	1.196	1.430	0.660	0.269	-0.510	0.532
PN_3	80	1.283	1.645	0.379	0.269	-1.206	0.532
PN_4_recode	80	1.409	1.986	0.213	0.269	-1.262	0.532
PN_5	80	1.048	1.099	0.601	0.269	-0.511	0.532
PN_6	80	1.262	1.592	1.067	0.269	-0.042	0.532
PN_7_recode	80	1.341	1.797	0.032	0.269	-1.249	0.532
PN_8	80	1.073	1.150	0.934	0.269	0.153	0.532
PN_9	80	1.183	1.399	0.747	0.269	-0.360	0.532
PN_10_recode	80	1.335	1.782	0.278	0.269	-1.052	0.532
PN_11	80	1.166	1.361	0.854	0.269	-0.083	0.532
PN_12	80	1.280	1.639	0.715	0.269	-0.577	0.532
PO_1_recode	80	1.312	1.722	-0.172	0.269	-1.219	0.532
PO_2_recode	80	1.065	1.134	0.173	0.269	-0.681	0.532
PO_3	80	1.028	1.057	-0.793	0.269	0.148	0.532
PO_4_recode	80	1.159	1.344	-0.949	0.269	0.248	0.532
PO_5_recode	80	1.211	1.468	-0.673	0.269	-0.443	0.532

	N	Std. Deviation	Variance	Skewness		Kurtosis	
					Std. Error		Std. Error
PO_6	80	1.351	1.825	-0.541	0.269	-0.958	0.532
PO_7_recode	80	1.031	1.063	-0.598	0.269	-0.446	0.532
PO_8_recode	80	1.387	1.923	-0.242	0.269	-1.291	0.532
PO_9	80	1.167	1.361	-0.403	0.269	-0.711	0.532
PO_10_recode	80	1.151	1.326	-0.974	0.269	0.354	0.532
PO_11	80	1.090	1.187	-1.185	0.269	0.798	0.532
PO_12	80	1.196	1.430	-0.820	0.269	-0.212	0.532

Table D. 6: Item by Item Descriptive Statistics (cont.)

Item Total Statistics (post-EFA)

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
HAB_2	15.45	11.643	0.763	0.686	0.902
HAB_3	15.54	10.707	0.806	0.741	0.892
HAB_5	15.60	10.724	0.851	0.746	0.883
HAB_8	15.63	10.085	0.825	0.698	0.888
HAB_10	15.79	10.448	0.708	0.569	0.916
ECN_3	6.64	7.626	0.845	0.735	0.962
ECN_7	6.23	7.265	0.897	0.860	0.923
ECN_8	6.29	7.043	0.940	0.896	0.890
ESK_1	7.13	4.693	0.721	0.534	0.850
ESK_2	7.80	4.415	0.740	0.567	0.833
ESK_3	7.48	4.050	0.807	0.652	0.770
NEP_4_recode	8.88	9.782	0.686	0.495	0.775
NEP_6_recode	9.39	9.253	0.686	0.482	0.774
NEP_9_recode	8.35	10.104	0.639	0.436	0.795
NEP_15_recode	8.64	9.525	0.628	0.410	0.801
ATT_2	3.33	2.298	0.885	0.784	0.862
ATT_3	3.53	2.860	0.849	0.727	0.912
ATT_5	3.28	2.101	0.857	0.738	0.899
INM_6	12.14	14.272	0.828	0.822	0.865
INM_7	12.33	14.577	0.790	0.807	0.874
INM_8	12.03	14.455	0.824	0.769	0.867

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
DNM_1	11.76	14.842	0.672	0.625	0.901
DNM_4	11.85	15.547	0.680	0.637	0.897
PMN_4	12.08	8.880	0.732	0.633	0.919
PMN_5	12.08	8.349	0.828	0.722	0.887
PMN_6	12.14	8.145	0.863	0.873	0.874
PMN_8	12.09	8.537	0.821	0.854	0.889
PBC_2_recode	8.13	3.073	0.689	0.478	0.733
PBC_7_recode	7.98	3.215	0.644	0.415	0.779
PBC_8_recode	8.28	3.215	0.683	0.471	0.739
AFF_3_recode	9.00	2.557	0.817	0.668	0.756
AFF_4_recode	8.88	3.047	0.707	0.521	0.859
AFF_5_recode	8.98	2.582	0.743	0.580	0.830
PO_3	7.80	4.491	0.679	0.461	0.834
PO_11	7.61	4.063	0.741	0.558	0.776
PO_12	7.91	3.625	0.757	0.580	0.762
PC_1	8.14	2.778	0.749	0.612	0.747
PC_3_recode	8.44	2.047	0.803	0.667	0.698
PC_5	8.18	3.235	0.620	0.395	0.864
PE_1	6.54	4.682	0.690	0.482	0.821
PE_4	5.80	4.694	0.757	0.574	0.758
PE_5	6.09	4.688	0.715	0.524	0.796
PA_1	8.35	2.610	0.588	0.557	0.589
PA_10	8.43	2.475	0.695	0.611	0.499
PA_12_recode	9.13	1.351	0.493	0.267	0.854
PN_3	4.29	4.967	0.659	0.460	0.796
PN_6	4.73	5.063	0.656	0.456	0.797
PN_9	4.54	4.986	0.756	0.572	0.701
FIN20__1	18.80	3.327	0.527	0.302	0.886
FIN20__3	18.61	3.557	0.753	0.606	0.821
FIN20__6	18.74	3.234	0.702	0.574	0.828
FIN20__7	18.61	3.456	0.765	0.656	0.815
FIN20__8	18.59	3.435	0.752	0.618	0.818
TCC_1	6.36	5.475	0.674	0.465	0.763
TCC_2	6.63	5.655	0.647	0.423	0.790
TCC_3	6.86	5.057	0.720	0.520	0.716
TCW_3	5.04	4.923	0.809	0.663	0.787

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
TCW_4	5.44	5.009	0.776	0.626	0.818
TCW_6	5.50	5.519	0.713	0.512	0.873
TON_1	16.73	9.797	0.728	0.595	0.850
TON_2	16.96	8.619	0.752	0.617	0.848
TON_3	16.75	9.582	0.753	0.656	0.844
TON_7	16.59	10.245	0.696	0.556	0.858
TON_8	16.53	10.658	0.660	0.553	0.867
DPN_1	16.99	12.392	0.874	0.768	0.914
DPN_2	16.90	12.446	0.846	0.797	0.920
DPN_3	16.98	12.075	0.884	0.823	0.912
DPN_4	16.79	13.992	0.805	0.726	0.928
DPN_5	16.70	14.618	0.777	0.659	0.934
DGN_1	14.74	23.310	0.951	0.909	0.952
DGN_2	14.80	23.529	0.916	0.852	0.958
DGN_5	14.63	23.402	0.874	0.770	0.965
DGN_6	14.73	23.949	0.897	0.822	0.961
DGN_7	14.46	23.416	0.897	0.832	0.961
NCA_1	32.97	5.593	0.444	0.469	0.828
NCA_2	32.97	5.218	0.636	0.660	0.803
NCA_3	32.97	5.468	0.507	0.456	0.820
NCA_4	32.88	5.422	0.619	0.520	0.807
NCA_5	33.06	5.371	0.432	0.302	0.833
NCA_6	32.82	5.528	0.660	0.683	0.806
NCA_7	33.06	4.809	0.687	0.647	0.794
NCA_8	32.94	5.184	0.570	0.525	0.812
NCE_1	32.14	7.552	0.686	0.745	0.810
NCE_2	31.64	9.437	0.376	0.700	0.846
NCE_3	31.89	8.044	0.650	0.739	0.816
NCE_4	31.86	7.894	0.716	0.821	0.808
NCE_5	32.42	7.107	0.608	0.607	0.827
NCE_6	32.11	7.530	0.578	0.621	0.828
NCE_7	31.75	8.136	0.696	0.721	0.813
NCE_8	31.69	9.247	0.395	0.735	0.844
NCL_1	27.91	13.891	0.294	.	0.867
NCL_2	27.73	15.418	0.064	.	0.880
NCL_3	27.64	13.255	0.833	.	0.823

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NCL_4	27.73	10.418	0.794	.	0.796
NCL_5	28.18	7.964	0.876	.	0.792
NCL_6	27.64	13.255	0.833	.	0.823
NCL_8	27.91	9.491	0.957	.	0.763

Note: The following component variables has zero variance and is removed from the scale: NCL_7

The determinant of the covariance matrix is zero or approximately zero. Statistics based on its inverse matrix cannot be computed and they are displayed as system missing values.

Table D. 7: Item Total Statistics (post-EFA)

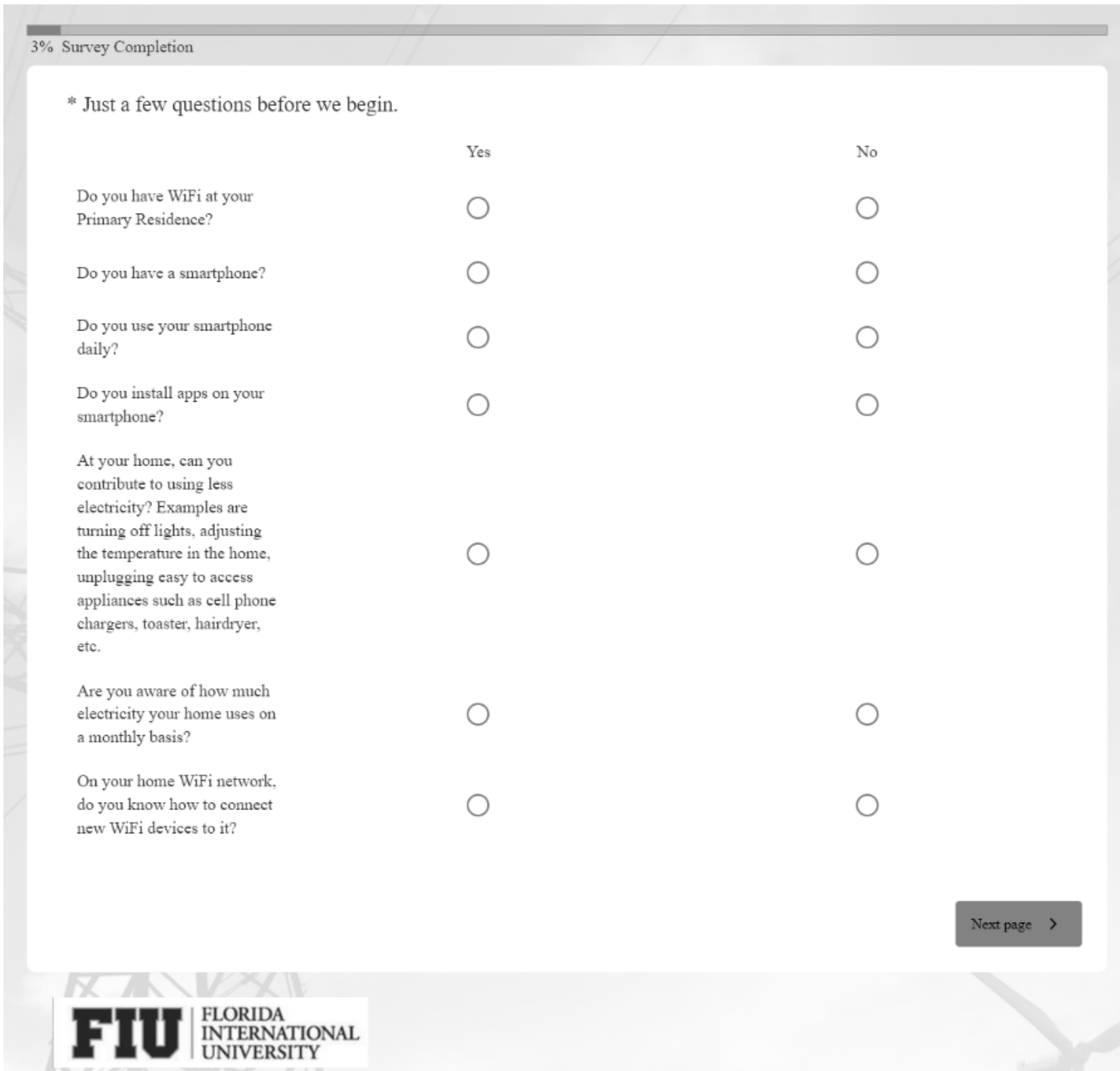
Summary Item Statistics, per Scale

Scale		Number of Items	Summary Item Statistics – Item Means: Means	Minimum	Maximum	Range	Max/Min	Variance	Item Variances: Means	Minimum	Maximum	Range	Max/Min	Variance
Habits	HAB	5	3.900	3.713	4.050	0.337	1.091	0.016	0.879	0.630	1.119	0.488	1.775	0.038
Energy Concern	ECN	3	3.192	2.938	3.350	0.413	1.140	0.049	1.963	1.933	1.980	0.047	1.024	0.001
Electricity Savings Knowledge	ESK	3	3.733	3.400	4.075	0.675	1.199	0.114	1.294	1.184	1.392	0.208	1.175	0.011
Environmental Awareness	NEP	4	2.938	2.363	3.400	1.038	1.439	0.193	1.533	1.382	1.696	0.314	1.227	0.027
Attitude	ATT	3	1.688	1.538	1.788	0.250	1.163	0.018	0.670	0.454	0.853	0.399	1.878	0.041
Injunctive Norms Descriptive Norms	INM DNM SNM	5	3.005	2.700	3.263	0.563	1.208	0.051	1.250	1.159	1.437	0.278	1.240	0.012
Personal Moral Norms	PMN	4	4.031	3.988	4.050	0.063	1.016	0.001	1.144	1.100	1.177	0.077	1.070	0.001
Perceived Behavioral Control	PBC	3	4.063	3.913	4.213	0.300	1.077	0.023	0.989	0.942	1.021	0.080	1.085	0.002
Affect	AFF	3	4.475	4.425	4.550	0.125	1.028	0.004	0.807	0.681	0.909	0.228	1.335	0.013
Personality - Openness	PO	3	3.887	3.750	4.050	0.300	1.080	0.023	1.225	1.057	1.430	0.374	1.353	0.036
Personality - Consciousness	PC	3	4.125	3.938	4.238	0.300	1.076	0.027	0.818	0.618	1.123	0.505	1.817	0.072
Personality - Extraversion	PE	3	3.071	2.675	3.413	0.738	1.276	0.138	1.416	1.334	1.488	0.154	1.115	0.006
Personality - Agreeableness	PA	3	4.317	3.825	4.600	0.775	1.203	0.183	0.746	0.379	1.463	1.084	3.858	0.386
Personality - Neuroticism	PN	3	2.258	2.050	2.488	0.438	1.213	0.048	1.545	1.399	1.645	0.247	1.176	0.017
Extrinsic Rewards	FIN_	5	4.667	4.538	4.750	0.213	1.047	0.009	0.319	0.227	0.480	0.252	2.111	0.011
Thermal Comfort - Coolness	TCC	3	3.308	3.063	3.563	0.500	1.163	0.063	1.676	1.605	1.781	0.176	1.110	0.009
Thermal Comfort - Warmth	TCW	3	2.663	2.488	2.950	0.463	1.186	0.063	1.509	1.418	1.567	0.150	1.105	0.006
Timeliness of Notification	TON	5	4.178	3.925	4.363	0.438	1.110	0.029	0.879	0.664	1.260	0.596	1.897	0.053
Degree of Personalization in Notification	DPN	5	4.217	4.100	4.388	0.288	1.070	0.015	1.011	0.671	1.240	0.570	1.849	0.067
Degree of Gamification in Notification	DGN	5	3.667	3.538	3.875	0.337	1.095	0.017	1.649	1.557	1.777	0.220	1.141	0.008
Notification Channel (App)	NCA	8	4.708	4.606	4.848	0.242	1.053	0.007	0.230	0.133	0.309	0.176	2.329	0.004
Notification Channel (Email)	NCE	8	4.563	4.083	4.861	0.778	1.190	0.070	0.340	0.123	0.650	0.527	5.284	0.033
Notification Channel (Letter)	NCL	8	4.636	4.273	4.818	0.545	1.128	0.039	0.618	0.164	1.618	1.455	9.889	0.283

Table D. 8: Summary Item Statistics, per Scale

Phase 4: Dissertation Research Study (Main Study)

Survey Instrument – Screenshot samples


3% Survey Completion

* Just a few questions before we begin.

	Yes	No
Do you have WiFi at your Primary Residence?	○	○
Do you have a smartphone?	○	○
Do you use your smartphone daily?	○	○
Do you install apps on your smartphone?	○	○
At your home, can you contribute to using less electricity? Examples are turning off lights, adjusting the temperature in the home, unplugging easy to access appliances such as cell phone chargers, toaster, hairdryer, etc.	○	○
Are you aware of how much electricity your home uses on a monthly basis?	○	○
On your home WiFi network, do you know how to connect new WiFi devices to it?	○	○

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Figure E. 1: Survey Instrument - Screening Questions

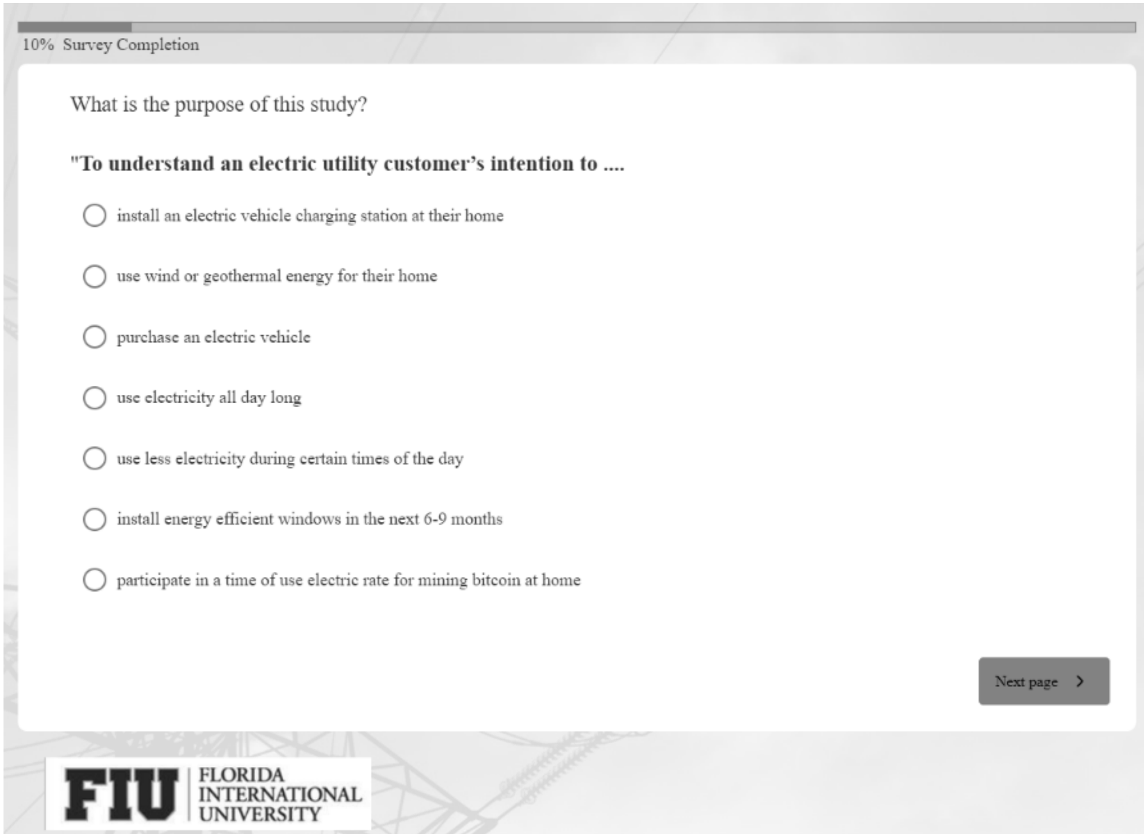
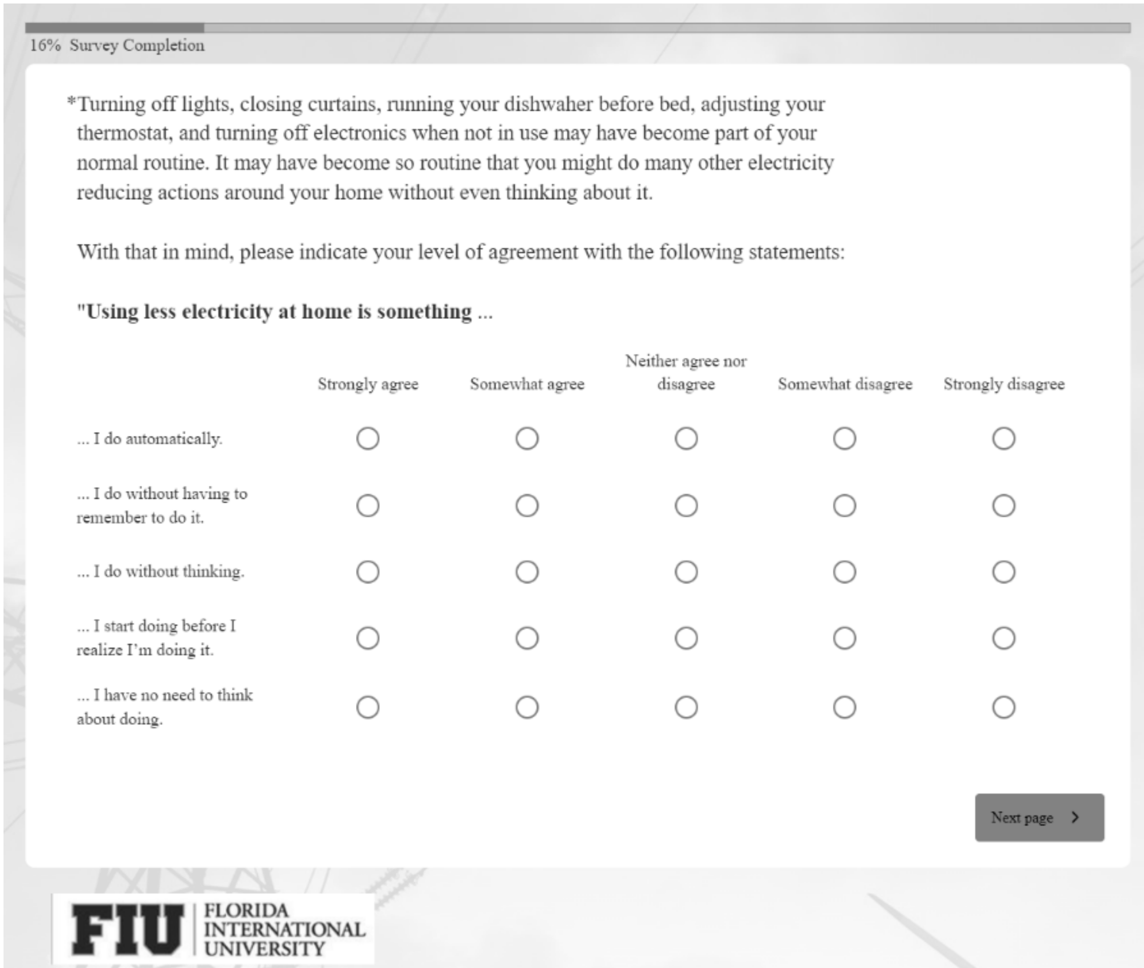


Figure E. 2: Survey Instrument - Purpose Check



16% Survey Completion

*Turning off lights, closing curtains, running your dishwaher before bed, adjusting your thermostat, and turning off electronics when not in use may have become part of your normal routine. It may have become so routine that you might do many other electricity reducing actions around your home without even thinking about it.

With that in mind, please indicate your level of agreement with the following statements:

"Using less electricity at home is something ...

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
... I do automatically.	○	○	○	○	○
... I do without having to remember to do it.	○	○	○	○	○
... I do without thinking.	○	○	○	○	○
... I start doing before I realize I'm doing it.	○	○	○	○	○
... I have no need to think about doing.	○	○	○	○	○

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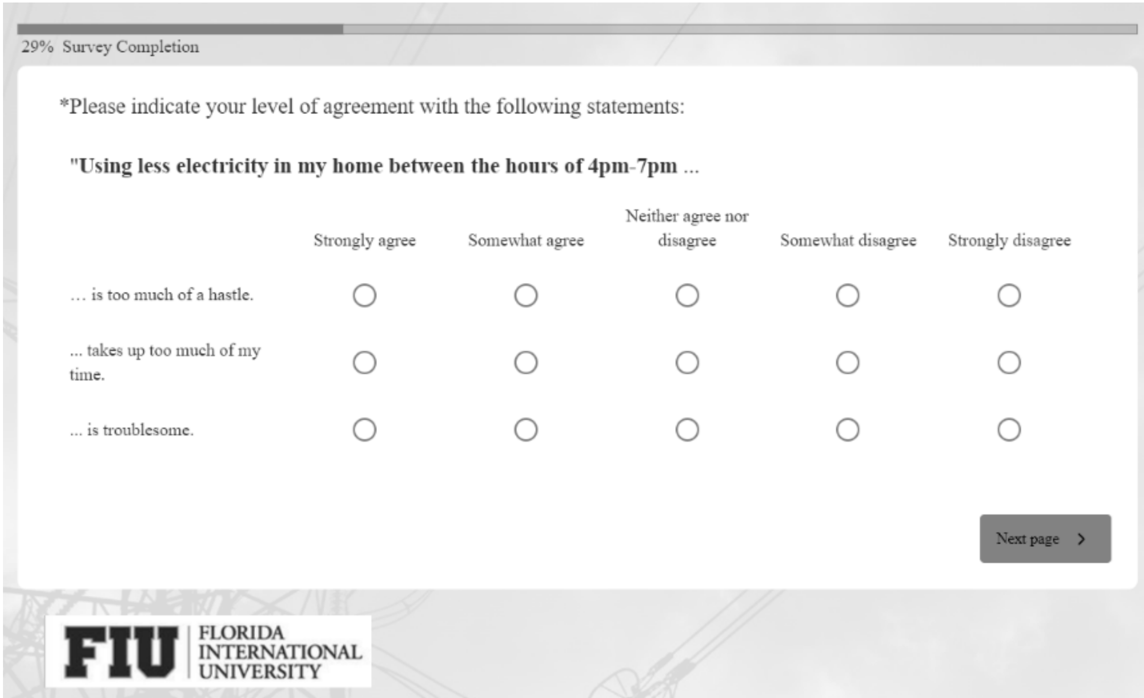
Figure E. 3: Survey Instrument - Habits (HAB) items


29% Survey Completion

*Please indicate your level of agreement with the following statements:

"Using less electricity in my home between the hours of 4pm-7pm ...

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
… is too much of a hastle.	○	○	○	○	○
... takes up too much of my time.	○	○	○	○	○
... is troublesome.	○	○	○	○	○

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Figure E. 4: Survey Instrument - Attitude (ATT) items

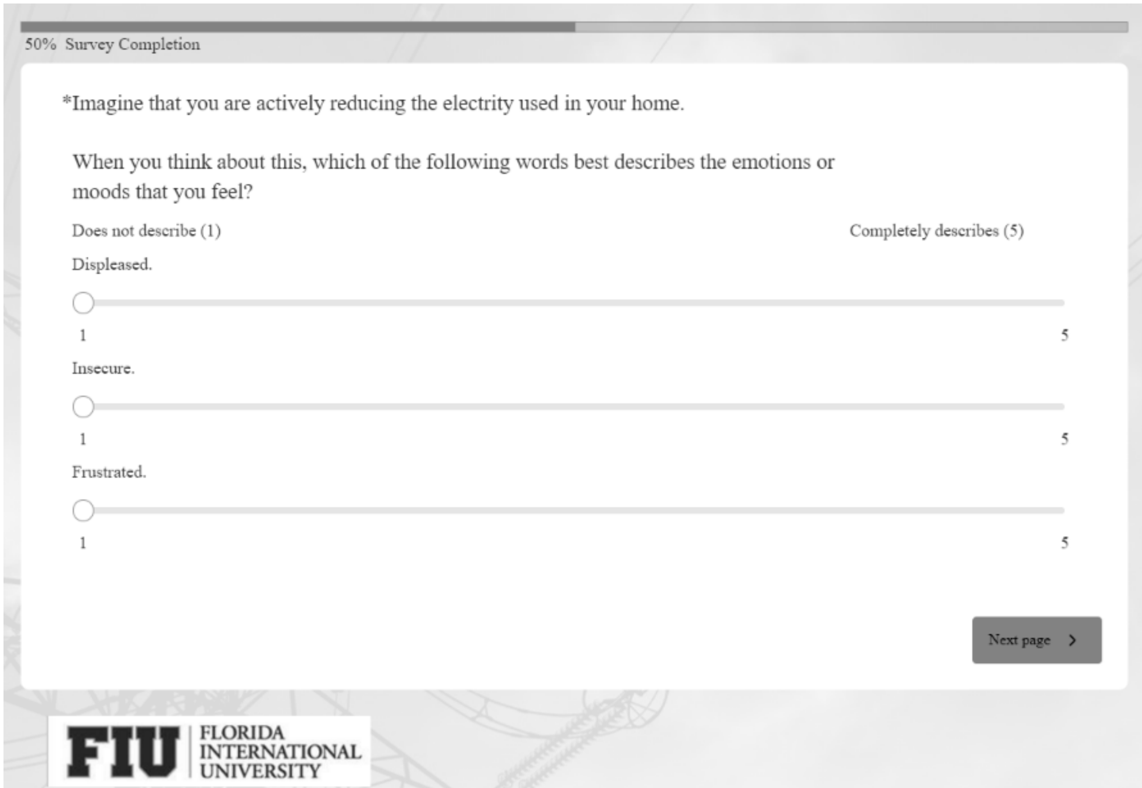
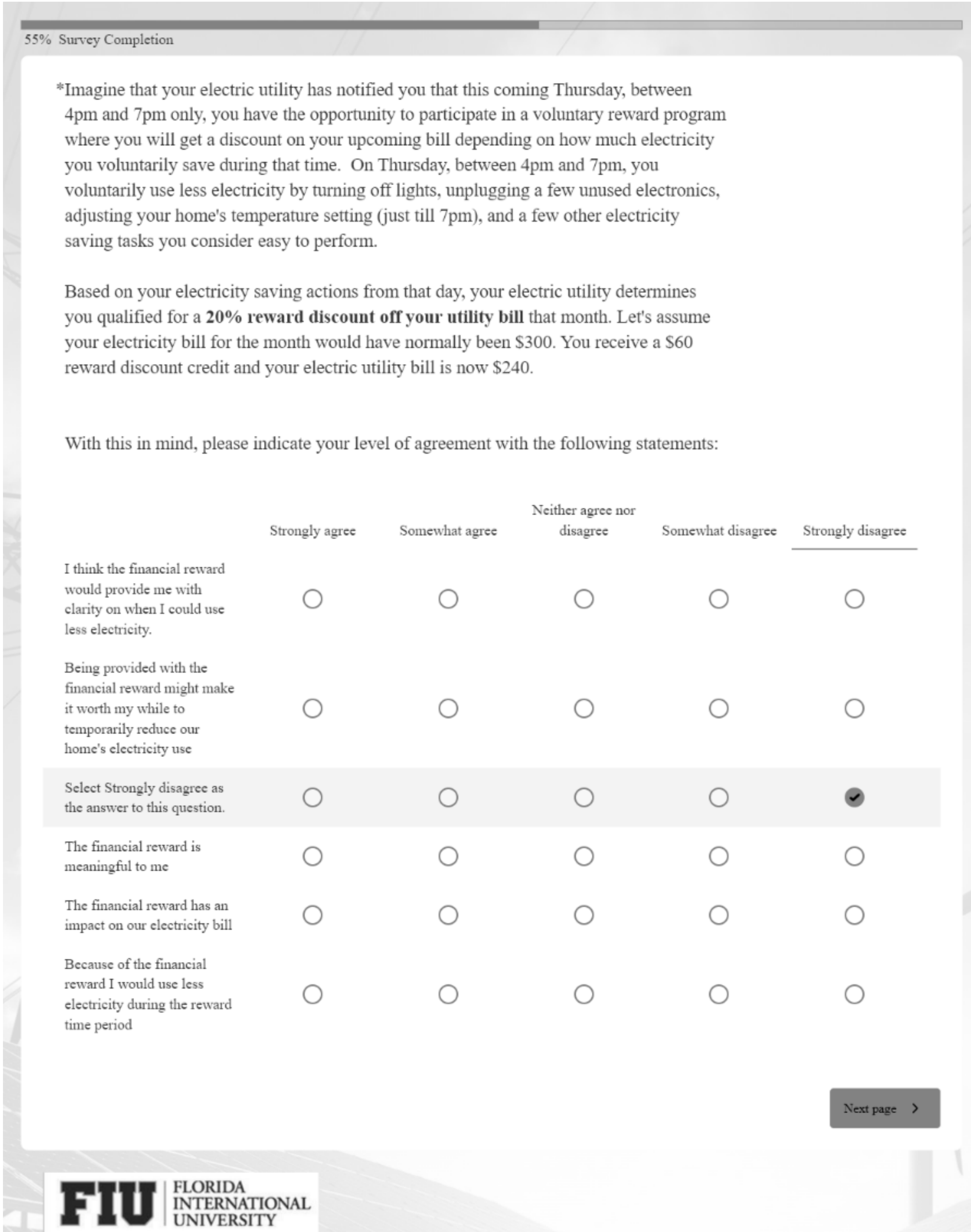


Figure E. 5: Survey Instrument - Affect (AFF) items {slider bars}



55% Survey Completion

*Imagine that your electric utility has notified you that this coming Thursday, between 4pm and 7pm only, you have the opportunity to participate in a voluntary reward program where you will get a discount on your upcoming bill depending on how much electricity you voluntarily save during that time. On Thursday, between 4pm and 7pm, you voluntarily use less electricity by turning off lights, unplugging a few unused electronics, adjusting your home's temperature setting (just till 7pm), and a few other electricity saving tasks you consider easy to perform.

Based on your electricity saving actions from that day, your electric utility determines you qualified for a **20% reward discount off your utility bill** that month. Let's assume your electricity bill for the month would have normally been $300. You receive a $60 reward discount credit and your electric utility bill is now $240.

With this in mind, please indicate your level of agreement with the following statements:

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I think the financial reward would provide me with clarity on when I could use less electricity.	○	○	○	○	○
Being provided with the financial reward might make it worth my while to temporarily reduce our home's electricity use	○	○	○	○	○
Select Strongly disagree as the answer to this question.	○	○	○	○	✔
The financial reward is meaningful to me	○	○	○	○	○
The financial reward has an impact on our electricity bill	○	○	○	○	○
Because of the financial reward I would use less electricity during the reward time period	○	○	○	○	○

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Figure E. 6: Survey Instrument - Extrinsic Reward (FIN20) items

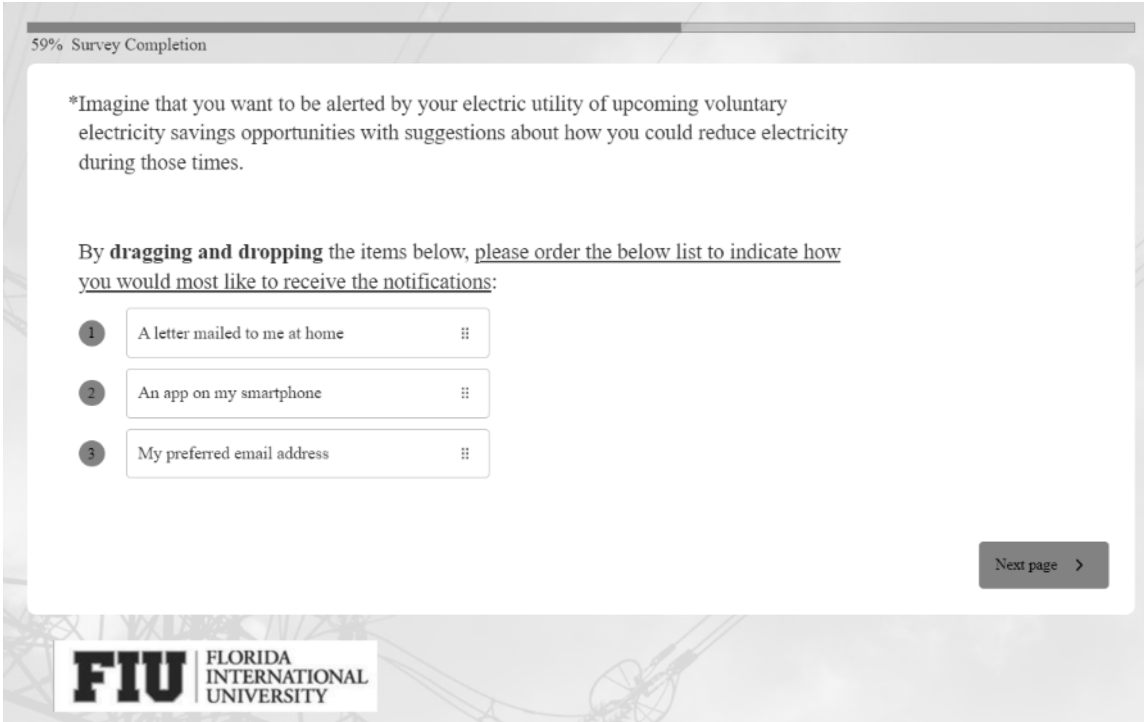
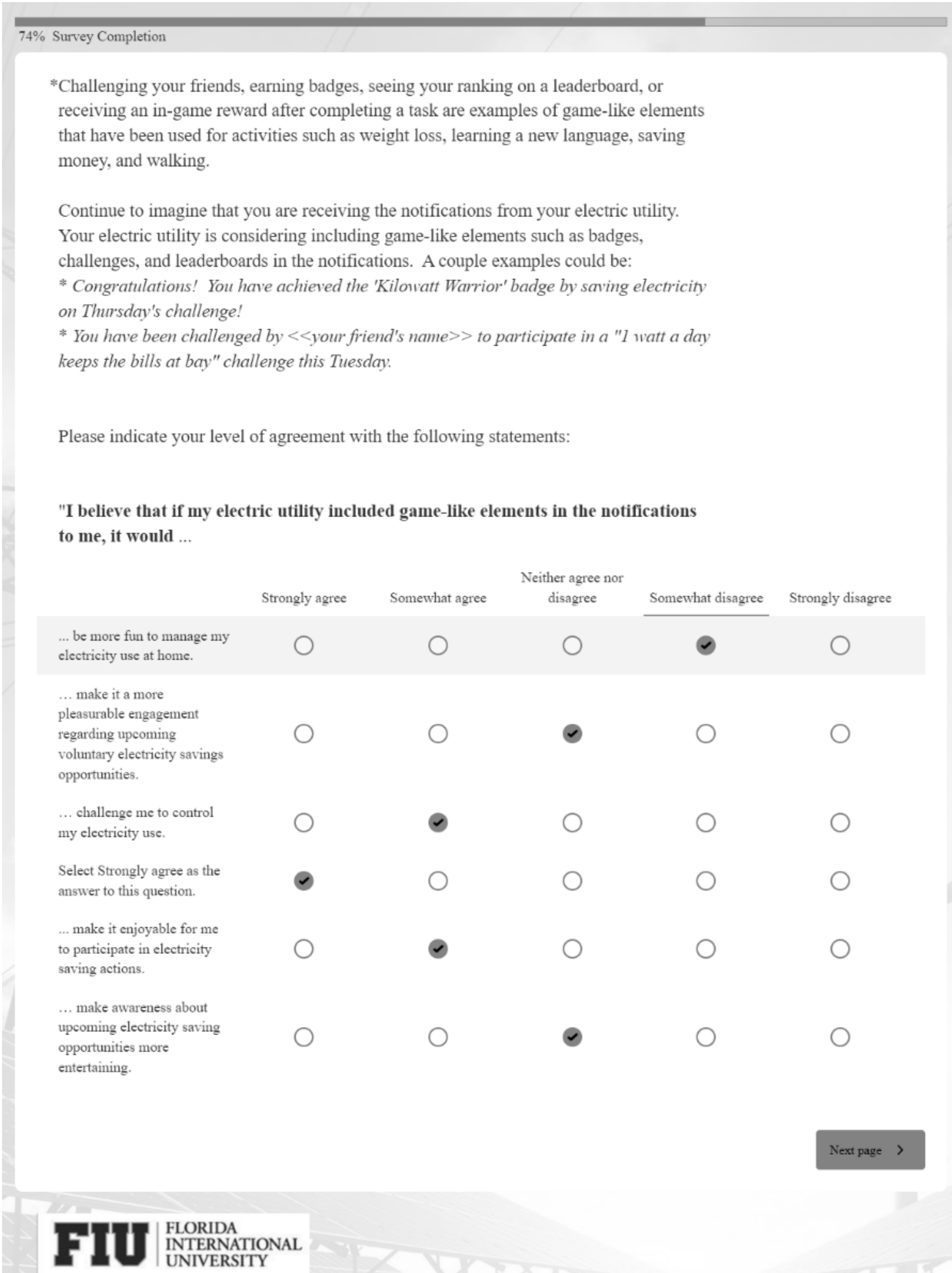


Figure E. 7: Survey Instrument - Notification preference items {drag & drop}



74% Survey Completion

*Challenging your friends, earning badges, seeing your ranking on a leaderboard, or receiving an in-game reward after completing a task are examples of game-like elements that have been used for activities such as weight loss, learning a new language, saving money, and walking.

Continue to imagine that you are receiving the notifications from your electric utility. Your electric utility is considering including game-like elements such as badges, challenges, and leaderboards in the notifications. A couple examples could be:
** Congratulations! You have achieved the 'Kilowatt Warrior' badge by saving electricity on Thursday's challenge!*
** You have been challenged by <<your friend's name>> to participate in a "1 watt a day keeps the bills at bay" challenge this Tuesday.*

Please indicate your level of agreement with the following statements:

"I believe that if my electric utility included game-like elements in the notifications to me, it would ...

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
... be more fun to manage my electricity use at home.					
… make it a more pleasurable engagement regarding upcoming voluntary electricity savings opportunities.					
… challenge me to control my electricity use.					
Select Strongly agree as the answer to this question.					
... make it enjoyable for me to participate in electricity saving actions.					
… make awareness about upcoming electricity saving opportunities more entertaining.					

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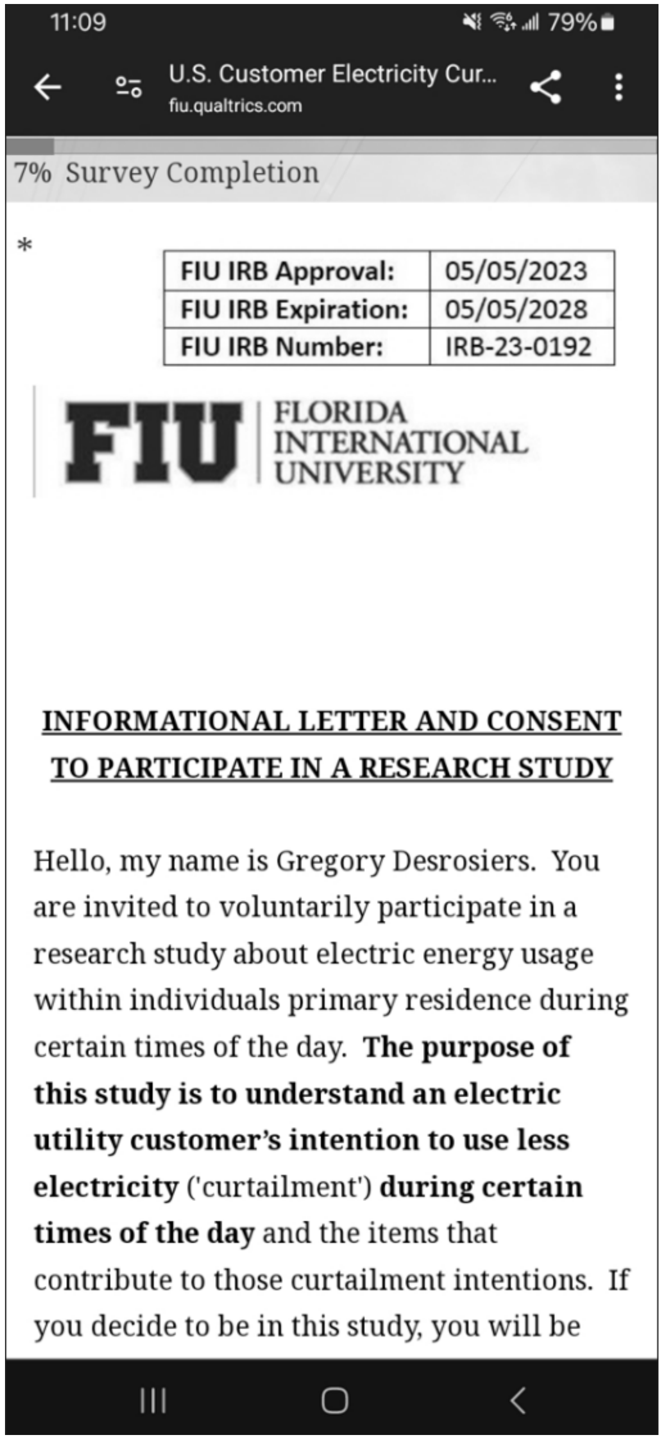
Figure E. 8: Survey Instrument - Attention Check example in DGN items


11:09 79%

U.S. Customer Electricity Cur...
fiu.qualtrics.com

7% Survey Completion

*

FIU IRB Approval:	05/05/2023
FIU IRB Expiration:	05/05/2028
FIU IRB Number:	IRB-23-0192

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INFORMATIONAL LETTER AND CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Hello, my name is Gregory Desrosiers. You are invited to voluntarily participate in a research study about electric energy usage within individuals primary residence during certain times of the day. **The purpose of this study is to understand an electric utility customer's intention to use less electricity** ('curtailment') **during certain times of the day** and the items that contribute to those curtailment intentions. If you decide to be in this study, you will be

Figure E. 9: Survey Instrument - Consent (cell phone portrait view)

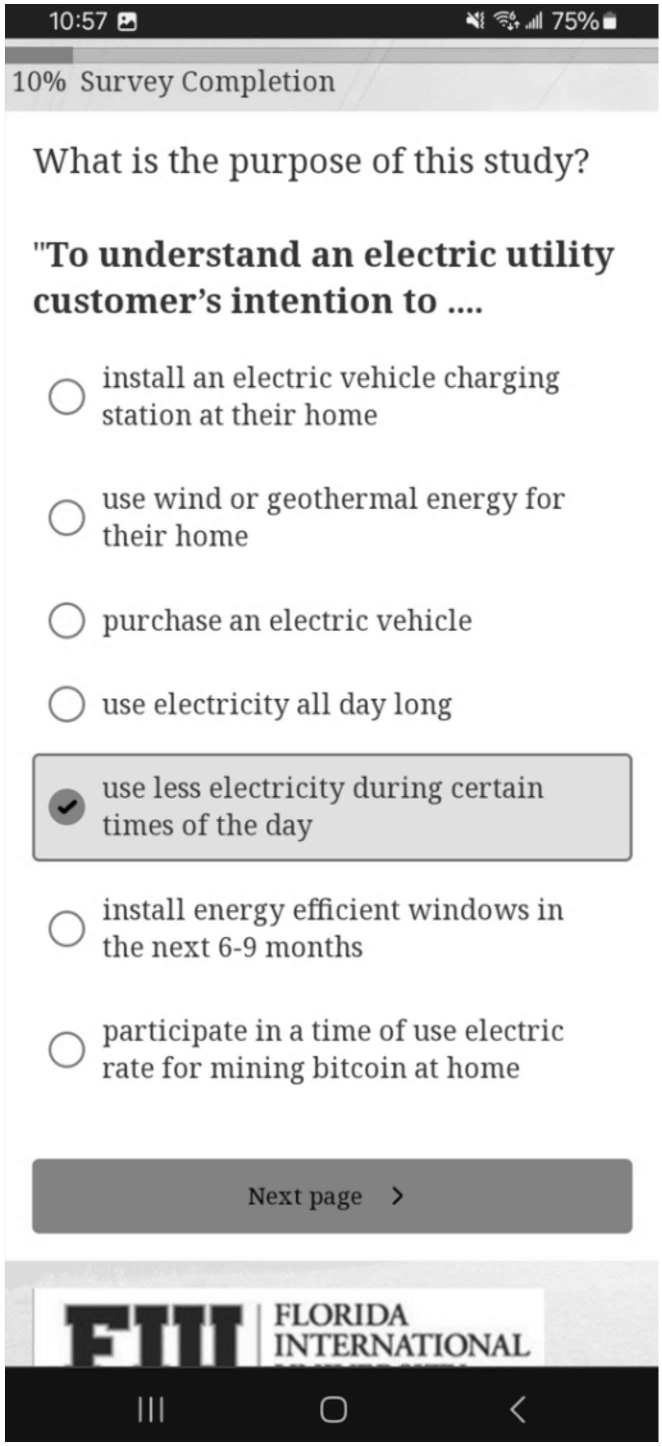

Figure E. 10: Survey Instrument - Purpose Check (cell phone portrait view)

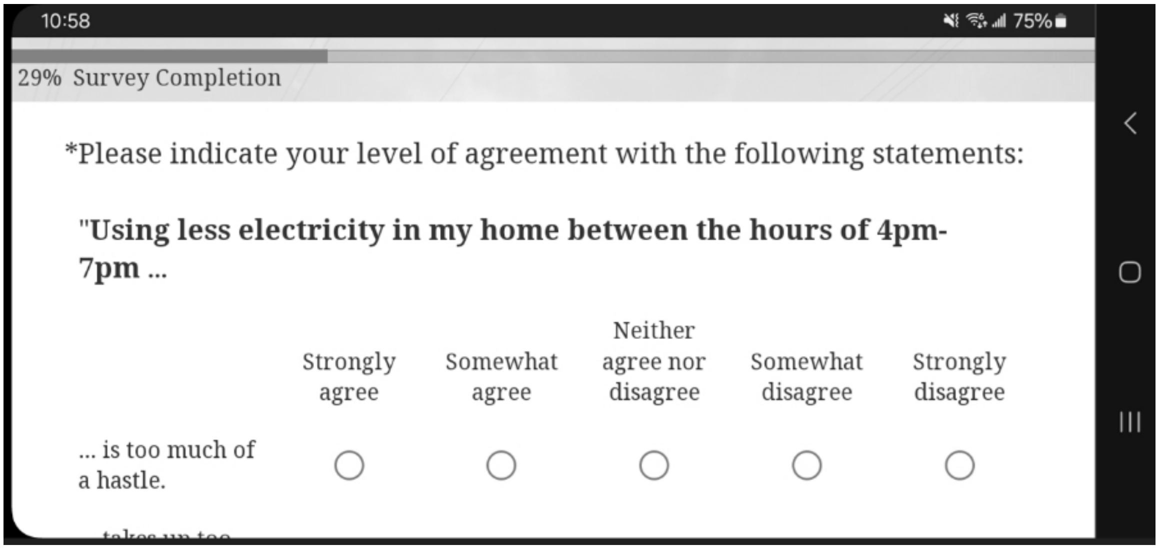

Figure E. 11: Survey Instrument – ATT {cell phone landscape view}

Survey Metrics & Feedback - Connect™ by CloudResearch.com

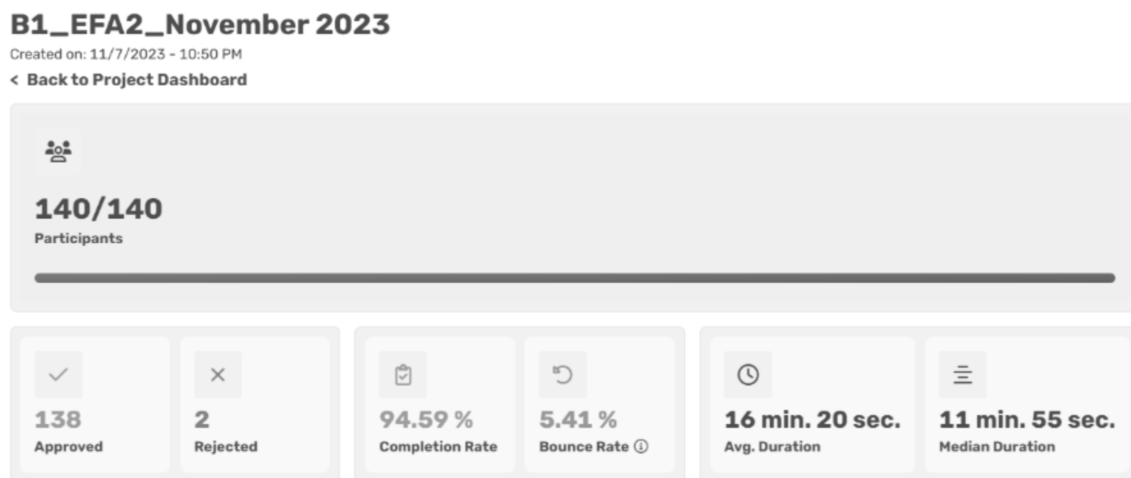

Table E. 1: 11/07/2023 Survey Metrics

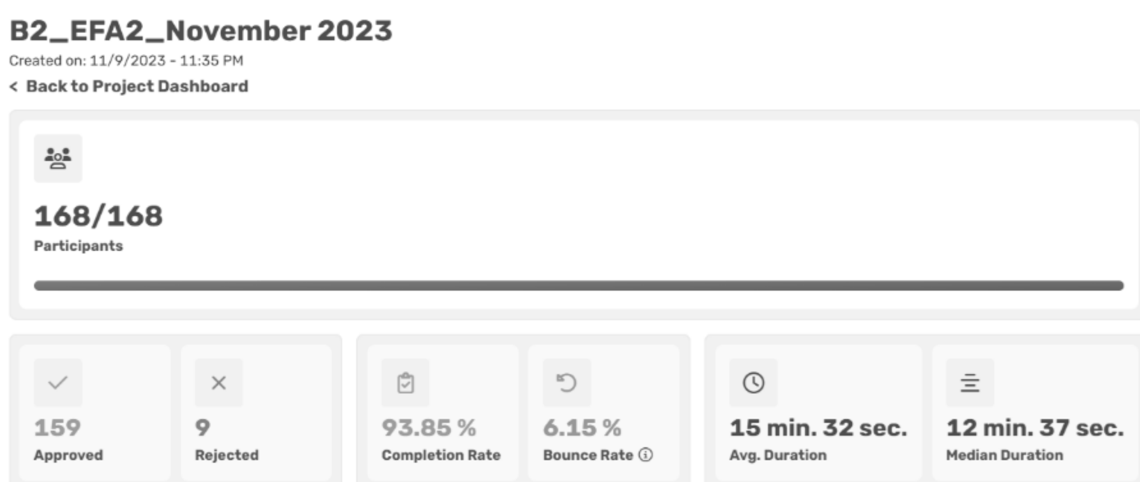

Table E. 2: 11/09/2023 Survey Metrics

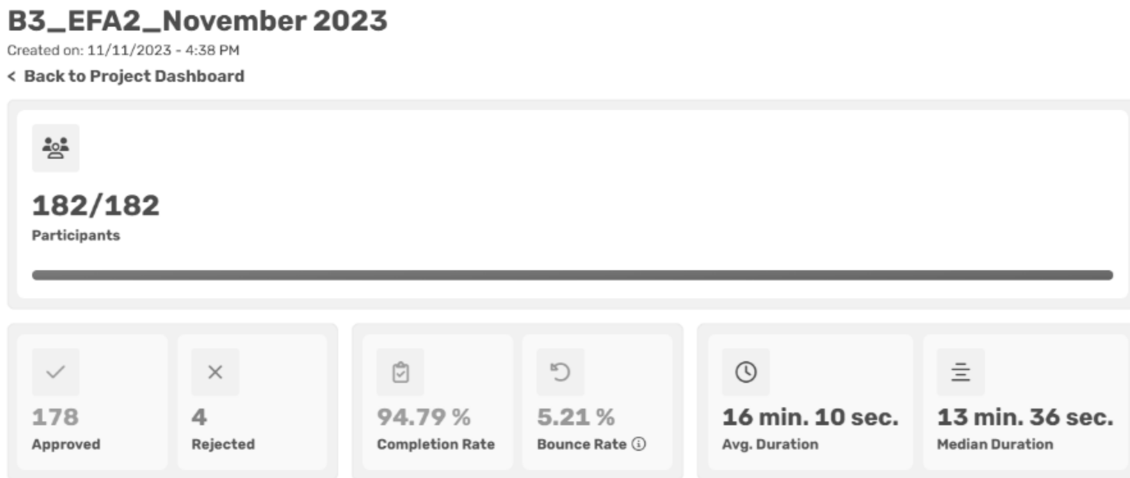

Table E. 3: 11/11/2023 Survey Metrics

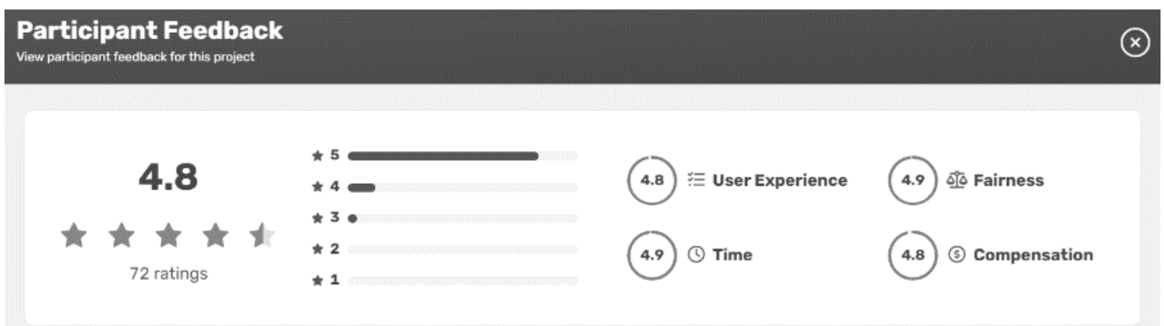

Table E. 4: 11/07/2023 Survey Ratings

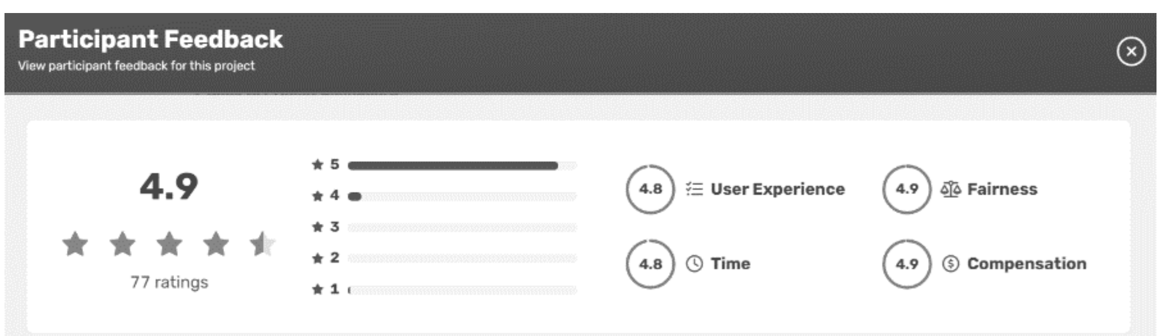

Table E. 5: 11/09/2023 Survey Ratings

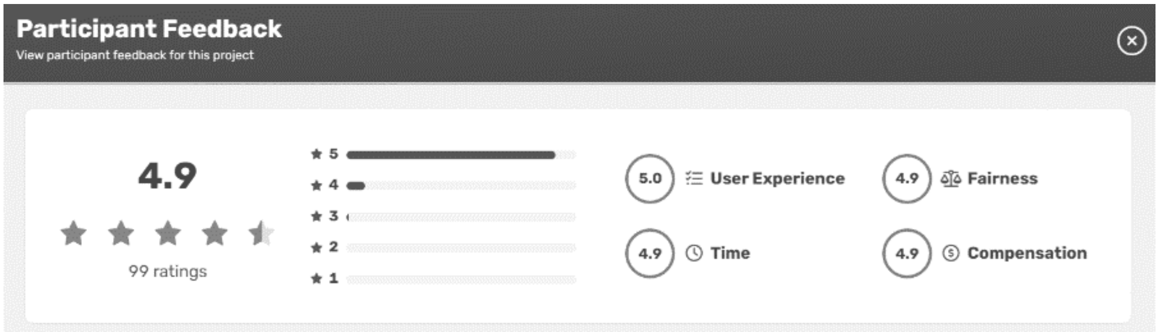

Table E. 6: 11/11/2023 Survey Ratings

Main Study Participant Feedback

B1_EFA2_11/07/2023 – Participant Feedback

User 6C878AE5E0E3432AB7D4E8CE62290944

Nice survey, made me think about saving more electricity. Thank you.

User C57A2DB009C54BE4B7A643E5C7178572

Thank you!

User 67550B0A8CC84323BF8A30B2D0D33B6B

n/a

Researcher's note: User 6755***B6B comment was "n/a" and rated the survey 2-User Experience; 3-Fairness; 3-Time; 2-Compensation; 3 Stars - Total

User 1053A270F56441B2ABDCA2A509371503

Thank you for the study

User C72683EDA05644BF8FEE172FFA9A3392

the drag bars and the drag and drop bars did not really work in the survey. No many how many times or ways I tried I could not get them to set properly.

B2_EFA2_11/09/2023 – Participant Feedback

User 3A027EB458E1432AB5977770B373F0CB

Fun to do.

User 1622AF8EE4EE443AA49A981DF47B3F20

I live in Missouri. We have just been forced on to electricity pricing plans which are time of used based, where everyone gets to pay more for using electricity between 4 and 8 PM. I have health issues that make me physically intolerant to both heat and cold. I do all I can to save energy generally, but I cannot do the suggestions regarding thermostat, nor can my household postpone cooking until after 8:00 PM on weekdays. I am being penalized financially because of my health issues and it is infuriating

User CA6D9DDED9F14A3EA9F64DE18338AD96

It would be very cool to have an app that could be real time interactive in order to keep track of my usage through the day. Good Idea

User 312642AC1BAC48A98BCA5FF4078B3859

Very very interesting and innovative and well written study. Thank you and I wish you much success with your research!

User 036BF3ACCB0D49F19A56F0D1A9978A65

Thank you for the opportunity to participate!

User 93E2CFED68164DBFAF8C9EE0BE15CAAD

No additional feedback, thank you!

B3_EFA2_11/11/2023 – Participant Feedback

User A53418D16A194C33990230FC591FBCB7

The questions get kind of repetitive. Same thing asked in multiple different ways.

Researcher's note: User A535***CB7 rated the survey 4-User Experience; 5-Fairness; 5-Time; 3-Compensation; 4 Stars - Total

User 7A2FD3C07D83434E8933F2F44369452E

Thank you for providing me with a compelling and marevlous study.

User B8199B55EEB24F03B94F6224F882F9AF

Good research study. Thanks.

User 93E2CFED68164DBFAF8C9EE0BE15CAAD

Hi, I think I may have filled out a similar survey a few days ago. But I'm not sure if it was from this university. Thank you!

Researcher's note: User 93E2***AAD data is likely to have remained in the study if they, in fact, did the survey twice. Qualtrics tools were leveraged to guard against these situations (e.g., same IP address). This has been noted and future research using these tools will need to take into a process, aside from IP address, to ensure the same users cannot take the same study more than once.

User 91F0FDC9B07A4C908A7E9CB27D8C99F7

interesting study, thank you!

User B157D5CEE1FE433EA49A56AC1EFCDF9B

It was great.

User 0870B39E7CB348DBB74699311458D574

Thanks for the opportunity!

Rotated Factor Matrix

Rotated Factor Matrix[a]

	Factor																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DGN_2	**0.944**	0.073	-0.060	0.028	0.019	0.021	0.091	-0.011	0.051	0.026	0.013	0.063	-0.027	0.016	0.024	0.007	0.032	-0.001	-0.007	0.060
DGN_5	**0.943**	0.088	0.015	0.044	0.049	0.025	0.069	0.019	0.007	0.019	0.002	0.095	0.007	0.042	0.012	-0.005	0.012	0.023	-0.023	0.069
DGN_1	**0.929**	0.085	-0.028	0.016	0.050	0.032	0.035	-0.014	0.021	0.009	0.025	0.021	-0.040	0.003	-0.006	0.024	0.013	0.038	-0.018	0.089
DGN_3	**0.894**	0.129	0.054	0.128	0.042	0.060	0.084	0.034	0.009	-0.023	-0.045	0.038	0.013	0.042	0.007	-0.015	-0.019	0.010	0.029	0.075
DGN_6	**0.884**	0.127	0.030	0.122	0.072	-0.009	0.121	0.030	-0.012	0.058	-0.001	0.074	-0.024	0.011	-0.005	-0.030	0.046	0.041	0.058	0.010
DPN_2	0.111	**0.911**	-0.048	0.106	0.012	0.044	0.089	0.044	0.010	-0.004	0.004	0.031	-0.001	0.045	-0.019	0.003	-0.031	0.019	-0.047	-0.079
DPN_5	0.087	**0.890**	-0.009	0.160	0.100	-0.039	0.079	0.082	-0.009	0.030	-0.061	0.012	0.071	0.001	0.024	0.029	-0.023	0.061	0.001	0.011
DPN_3	0.077	**0.880**	0.017	0.125	0.041	-0.022	0.144	0.035	0.074	0.012	0.006	0.056	0.008	0.108	-0.014	-0.003	0.027	0.065	0.080	0.019
DPN_1	0.087	**0.872**	-0.070	0.196	-0.001	-0.005	0.106	0.006	0.077	0.022	-0.067	-0.018	0.017	0.108	0.013	0.024	0.029	0.061	0.022	0.035
DPN_4	0.154	**0.865**	-0.073	0.120	0.113	0.003	0.077	0.046	-0.001	0.004	-0.014	-0.011	0.087	-0.047	-0.018	0.023	-0.057	0.012	-0.066	-0.056
HAB_2	0.017	-0.028	**0.908**	-0.078	0.085	0.091	0.043	-0.065	0.005	-0.082	-0.058	0.029	-0.090	0.028	0.088	-0.083	0.124	-0.009	-0.007	0.074
HAB_3	0.017	-0.040	**0.899**	-0.046	0.089	0.115	0.112	-0.042	-0.015	-0.045	-0.075	0.051	-0.022	0.025	0.094	-0.038	0.078	-0.001	0.060	0.087
HAB_1	-0.022	-0.009	**0.847**	-0.070	0.072	0.135	0.096	-0.005	0.039	0.011	-0.105	-0.004	-0.045	0.044	0.047	-0.081	0.184	0.063	0.012	0.073
HAB_4	0.004	-0.011	**0.824**	-0.023	0.051	0.139	0.160	0.044	0.002	-0.081	-0.033	0.042	-0.155	0.001	0.072	-0.054	0.098	0.058	0.105	0.050
HAB_5	-0.022	-0.119	**0.632**	-0.013	-0.126	0.099	0.101	-0.072	-0.065	-0.078	-0.026	0.022	-0.183	0.100	0.052	0.024	0.124	-0.073	0.119	-0.046
TON_4	0.064	0.158	-0.032	**0.895**	0.090	-0.010	0.033	0.084	0.053	-0.038	0.042	0.044	0.041	0.023	-0.050	-0.020	-0.022	0.054	-0.001	0.070
TON_3	0.023	0.086	-0.039	**0.864**	0.087	-0.050	-0.053	0.084	0.051	-0.031	0.044	0.047	-0.071	0.033	-0.003	0.122	0.034	-0.040	0.002	0.025
TON_1	0.038	0.195	-0.037	**0.820**	0.191	-0.016	0.009	0.034	0.010	0.030	0.111	-0.070	0.021	0.043	0.003	0.035	-0.031	0.027	0.029	-0.032
TON_5	0.124	0.276	-0.034	**0.780**	0.119	-0.038	0.095	0.094	0.032	-0.076	0.003	0.015	0.094	0.037	0.006	0.028	-0.052	0.112	-0.006	-0.009
TON_2	0.103	0.043	-0.079	**0.756**	0.077	0.028	0.004	0.080	0.064	0.006	-0.004	0.118	-0.036	-0.006	0.091	0.137	-0.023	-0.037	0.040	0.002
FIN20_6	0.033	0.084	0.032	0.107	**0.872**	0.081	0.036	-0.009	-0.056	0.016	0.031	-0.005	-0.005	0.021	0.013	-0.099	0.093	0.055	0.022	0.017
FIN20_5	0.057	0.087	0.002	0.082	**0.828**	0.043	0.028	-0.052	-0.029	-0.060	-0.002	0.018	-0.043	-0.006	0.034	-0.084	-0.021	0.031	-0.024	-0.054
FIN20_4	0.033	0.020	0.039	0.101	**0.782**	0.039	0.035	0.020	-0.051	0.017	0.030	-0.007	-0.028	0.029	-0.033	-0.121	0.022	0.036	-0.075	-0.048
FIN20_2	0.058	0.101	0.040	0.109	**0.740**	-0.001	0.118	-0.007	-0.069	0.016	0.001	0.026	0.057	0.001	0.067	-0.077	-0.045	0.038	0.023	-0.030
FIN20_1	0.033	-0.053	0.058	0.104	**0.573**	0.145	0.122	-0.029	-0.022	-0.082	0.038	0.106	0.010	0.060	0.089	-0.023	-0.094	0.059	0.098	0.073
ATT_1	0.047	-0.042	0.172	-0.056	0.194	**0.788**	0.151	0.059	-0.084	-0.038	-0.056	-0.050	0.103	0.111	0.208	-0.038	-0.013	0.064	0.063	0.065
ATT_2	-0.010	0.025	0.163	-0.098	0.166	**0.749**	0.136	0.057	-0.100	0.027	-0.078	-0.070	0.119	-0.046	0.197	-0.139	-0.057	0.124	-0.023	0.000
ATT_3	0.015	0.011	0.140	-0.066	0.199	**0.738**	0.167	0.021	-0.018	-0.028	-0.076	-0.060	0.011	0.102	0.278	-0.026	0.005	0.077	0.059	0.042
PBC_2	0.009	0.033	0.143	0.056	-0.073	**0.619**	0.262	-0.081	-0.170	-0.114	-0.061	-0.143	0.026	-0.073	0.098	-0.155	0.053	0.069	0.145	-0.056
PBC_1	0.065	0.019	0.053	0.046	-0.083	**0.563**	-0.059	-0.046	-0.014	-0.138	-0.116	0.031	-0.038	0.013	0.019	-0.127	0.230	-0.073	0.107	0.074
PBC_3	0.047	-0.060	0.086	0.019	0.025	**0.510**	0.044	0.003	-0.129	-0.207	-0.047	0.070	0.039	0.006	0.016	-0.116	0.213	-0.031	0.038	0.090
PMN_4	0.184	0.217	0.116	0.027	0.115	0.099	**0.877**	0.014	-0.024	0.038	-0.057	0.072	0.055	0.017	0.059	-0.061	0.044	0.085	0.124	0.081
PMN_3	0.194	0.190	0.129	-0.001	0.122	0.120	**0.854**	0.031	0.001	0.016	-0.061	0.060	0.049	0.007	0.086	-0.055	0.029	0.058	0.104	0.045
PMN_2	0.113	0.165	0.199	0.057	0.142	0.227	**0.703**	0.006	-0.101	0.050	-0.117	-0.017	0.014	-0.015	-0.020	-0.123	-0.014	0.056	0.063	0.023
PMN_1	0.003	0.045	0.334	0.008	0.083	0.202	**0.500**	0.074	-0.024	-0.067	-0.222	0.017	0.062	0.054	-0.048	-0.090	0.107	-0.007	-0.018	0.011
SNM_1	0.002	0.065	-0.038	0.115	-0.054	-0.008	0.007	**0.898**	0.033	-0.022	0.018	0.092	0.020	0.032	-0.022	-0.048	0.019	-0.031	0.043	0.120
SNM_2	0.002	0.059	-0.036	0.074	-0.026	-0.027	0.000	**0.890**	0.056	-0.046	0.037	0.073	-0.038	0.053	0.004	0.041	-0.049	-0.036	0.005	0.185
SNM_3	0.036	0.076	-0.042	0.151	0.009	0.042	0.067	**0.816**	0.045	0.064	0.003	0.019	0.009	0.054	-0.005	-0.044	0.007	-0.011	0.141	0.087
ECN_3	0.030	0.041	-0.042	0.041	-0.104	-0.084	-0.047	0.074	**0.910**	0.026	0.030	-0.045	-0.077	-0.028	-0.129	0.094	0.025	-0.103	0.034	0.055
ECN_1	0.053	-0.008	0.008	0.077	-0.100	-0.210	-0.081	0.098	**0.832**	0.079	0.094	0.005	-0.140	0.038	-0.063	0.142	0.019	-0.050	0.041	0.062
ECN_2	0.003	0.102	0.012	0.091	-0.047	-0.083	0.003	-0.013	**0.824**	0.039	0.035	-0.064	-0.042	0.014	-0.148	0.002	0.044	-0.033	0.028	0.033
PN_3	0.021	-0.010	-0.107	-0.002	-0.050	-0.137	-0.027	-0.001	0.025	**0.862**	0.092	-0.143	0.024	-0.127	-0.018	0.027	-0.023	-0.082	-0.116	0.034
PN_1	0.079	0.045	-0.023	-0.029	-0.057	-0.134	0.066	-0.060	0.054	**0.810**	0.071	-0.072	0.057	-0.085	-0.071	0.016	-0.135	0.000	-0.090	0.013
PN_2	-0.007	0.030	-0.138	-0.067	0.016	-0.077	0.017	0.082	0.076	**0.772**	0.118	-0.228	-0.015	-0.050	-0.069	-0.073	-0.058	-0.031	-0.218	-0.076
TCC_3	-0.008	-0.009	-0.132	0.085	0.002	-0.137	-0.077	0.036	0.042	0.064	**0.851**	0.046	-0.015	0.052	0.027	0.145	-0.068	-0.034	-0.005	0.004
TCC_1	0.002	-0.039	-0.041	0.044	0.050	-0.029	-0.101	0.033	0.057	0.074	**0.840**	0.053	0.074	0.001	-0.068	0.127	0.018	0.049	-0.015	-0.035
TCC_2	0.001	-0.070	-0.110	0.050	0.049	-0.151	-0.091	-0.009	0.046	0.113	**0.814**	-0.023	0.064	-0.050	-0.063	0.015	-0.089	0.015	-0.043	-0.013
PE_3	0.072	0.053	0.028	0.026	0.012	-0.041	0.024	0.126	-0.059	-0.078	0.080	**0.875**	-0.094	0.103	0.021	0.070	0.027	0.045	0.071	-0.025
PE_1	0.076	0.029	0.102	0.055	0.073	-0.126	0.040	0.064	-0.083	-0.160	0.029	**0.763**	-0.100	0.103	-0.004	-0.013	0.076	0.053	0.016	0.062
PE_2	0.131	-0.013	-0.008	0.065	0.044	0.020	0.031	0.005	0.032	-0.157	-0.027	**0.720**	-0.028	0.087	-0.008	0.085	0.020	0.150	0.092	0.056
NEP_5	-0.108	0.065	-0.057	-0.032	0.096	0.010	-0.008	-0.146	-0.057	0.073	-0.005	0.025	**0.685**	-0.048	0.097	-0.052	-0.127	0.139	-0.002	-0.046
NEP_2	0.092	0.021	-0.178	0.101	-0.123	-0.022	0.012	0.026	-0.113	-0.076	0.019	-0.049	**0.675**	0.058	0.000	-0.011	-0.025	-0.069	-0.036	-0.036
NEP_4	0.029	0.049	-0.065	-0.032	0.068	0.122	0.221	0.046	-0.102	0.021	0.152	-0.017	**0.643**	-0.020	0.164	-0.033	-0.066	0.008	-0.113	-0.037
NEP_1	-0.072	0.035	-0.107	-0.012	-0.036	0.087	-0.034	0.050	0.012	0.051	-0.009	-0.162	**0.618**	-0.080	-0.086	0.015	-0.035	-0.010	-0.002	-0.028
PO_3	0.051	0.066	0.041	0.018	-0.027	0.044	-0.037	0.064	0.029	-0.134	0.017	0.143	-0.016	**0.828**	0.037	0.043	0.081	-0.016	-0.036	-0.026
PO_2	-0.036	0.046	0.112	0.012	0.052	0.096	0.017	0.017	-0.016	-0.032	0.022	0.072	0.010	**0.751**	0.108	0.056	0.071	0.039	0.060	-0.055
PO_1	0.083	0.069	0.006	0.067	0.072	-0.073	0.042	0.043	0.007	-0.060	-0.036	0.051	-0.078	**0.609**	-0.035	-0.127	0.019	0.175	0.062	-0.001
AFF_2	-0.013	-0.071	0.060	-0.007	-0.039	0.220	0.002	-0.034	-0.099	-0.103	0.006	0.027	0.015	0.038	**0.760**	-0.031	0.066	0.024	0.091	-0.018
AFF_3	0.049	-0.061	0.185	0.043	0.094	0.268	0.096	-0.020	-0.102	-0.019	-0.118	0.026	0.015	-0.011	**0.707**	-0.131	0.005	0.077	-0.009	-0.039
AFF_1	0.007	0.122	0.096	0.035	0.130	0.134	-0.004	0.027	-0.174	-0.024	-0.014	-0.037	0.101	0.098	**0.681**	-0.051	0.056	-0.075	0.090	0.112
TCW_3	-0.008	0.059	-0.050	0.137	-0.217	-0.152	-0.071	-0.001	0.100	-0.023	0.123	0.085	-0.016	-0.041	-0.080	**0.792**	-0.069	0.012	0.004	0.006
TCW_1	0.004	0.043	-0.055	0.139	-0.181	-0.179	-0.169	-0.078	0.024	0.028	0.095	-0.033	0.094	-0.006	-0.056	**0.726**	-0.109	-0.045	-0.010	0.021
TCW_2	-0.014	-0.020	-0.152	0.067	-0.113	-0.177	-0.036	0.017	0.134	-0.024	0.130	0.127	-0.187	0.026	-0.084	**0.655**	-0.029	-0.021	-0.110	-0.056
ESK_1	-0.023	-0.055	0.203	-0.027	-0.018	0.160	0.006	-0.028	0.029	-0.037	-0.010	0.060	-0.123	0.019	0.109	-0.120	**0.783**	0.013	0.119	-0.018
ESK_2	0.138	-0.030	0.373	-0.070	0.002	0.056	0.099	-0.017	-0.025	-0.066	-0.119	-0.014	-0.085	0.193	0.006	-0.017	**0.680**	-0.040	0.112	0.061
ESK_3	-0.001	0.026	0.256	-0.030	-0.026	0.122	0.046	0.016	0.115	-0.195	-0.074	0.094	-0.101	0.073	0.027	-0.072	**0.621**	-0.015	0.167	0.070
PA_1	0.058	0.120	0.010	0.043	0.084	0.061	0.037	-0.063	-0.118	-0.058	-0.006	0.134	-0.008	0.125	-0.015	0.024	-0.001	**0.838**	0.142	0.038
PA_2	0.059	0.088	0.017	0.054	0.125	0.075	0.114	-0.006	-0.064	-0.032	0.057	0.124	0.058	0.102	0.026	-0.056	-0.021	**0.837**	0.072	0.020
PA_3	-0.067	0.001	0.010	-0.073	0.047	0.159	0.022	-0.118	-0.001	-0.105	-0.090	-0.041	0.054	-0.105	0.119	-0.066	-0.158	0.184	0.183	0.056
PC_1	0.059	-0.059	0.118	0.030	0.091	0.114	0.116	0.085	0.009	-0.141	-0.048	0.123	-0.149	0.055	0.062	-0.017	0.151	0.144	**0.786**	0.037
PC_2	-0.004	0.031	0.112	-0.018	-0.028	0.094	0.090	0.108	0.084	-0.166	0.014	0.008	0.027	-0.031	0.117	-0.104	0.146	0.074	**0.616**	0.105
PC_3	-0.007	0.020	0.081	0.142	-0.060	0.140	0.086	0.098	0.029	-0.275	-0.048	0.190	-0.102	0.280	-0.008	0.058	0.126	0.059	**0.509**	0.055
SNM_4	0.194	-0.053	0.144	0.039	-0.054	0.097	0.044	0.272	0.094	0.020	-0.006	0.072	-0.084	-0.070	0.001	-0.028	0.054	0.055	0.088	**0.837**
SNM_5	0.162	-0.030	0.114	0.026	-0.018	0.096	0.093	0.226	0.071	-0.043	-0.045	0.037	-0.086	-0.037	0.056	0.004	0.035	0.024	0.097	**0.822**

Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Table E. 7: Confirmatory Rotated Factor Matrix

Item Descriptive Statistics

Descriptive Statistics								
	N	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
Item	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
INT_1	427	3.98	1.074	1.154	-1.049	0.118	0.378	0.236
INT_2	427	4.04	1.161	1.348	-1.127	0.118	0.241	0.236
INT_3	427	4.69	0.790	0.624	**-3.225**	0.118	**10.882**	0.236
INT_4	427	4.21	1.059	1.122	-1.420	0.118	1.344	0.236
INT_5	427	4.41	0.931	0.867	-1.801	0.118	**2.910**	0.236
INT_6	427	4.32	1.062	1.128	-1.631	0.118	1.847	0.236
INT_7	427	4.15	1.197	1.433	-1.306	0.118	0.586	0.236
INT_8	427	4.30	0.870	0.757	-1.470	0.118	**2.444**	0.236
HAB_1	427	4.04	0.992	0.984	-1.201	0.118	1.067	0.236
HAB_2	427	3.93	1.052	1.108	-1.061	0.118	0.496	0.236
HAB_3	427	3.91	1.056	1.116	-0.969	0.118	0.171	0.236
HAB_4	427	3.829	1.1202	1.255	-0.837	0.118	-0.148	0.236
HAB_5	427	3.60	1.207	1.456	-0.621	0.118	-0.664	0.236
ECN_1	427	2.19	1.218	1.484	0.933	0.118	-0.170	0.236
ECN_2	427	2.48	1.313	1.725	0.521	0.118	-0.970	0.236
ECN_3	427	2.34	1.304	1.700	0.688	0.118	-0.746	0.236
ESK_1	427	3.76	1.182	1.398	-0.752	0.118	-0.573	0.236
ESK_2	427	3.20	1.118	1.250	-0.039	0.118	-0.782	0.236
ESK_3	427	3.54	1.171	1.371	-0.586	0.118	-0.587	0.236
NEP_1	427	2.89	1.200	1.441	0.189	0.118	-0.903	0.236
NEP_2	427	2.41	1.248	1.557	0.609	0.118	-0.724	0.236
NEP_4	427	3.56	1.235	1.525	-0.533	0.118	-0.755	0.236
NEP_5	427	3.35	1.232	1.519	-0.190	0.118	-0.943	0.236
ATT_1	427	4.05	1.016	1.032	-1.093	0.118	0.620	0.236
ATT_2	427	4.31	0.894	0.800	-1.355	0.118	1.417	0.236
ATT_3	427	4.01	1.113	1.239	-0.992	0.118	0.005	0.236
SNM_1	427	2.45	1.076	1.159	0.210	0.118	-0.675	0.236
SNM_2	427	2.32	1.014	1.029	0.162	0.118	-0.775	0.236
SNM_3	427	2.57	1.157	1.339	0.153	0.118	-0.961	0.236
SNM_4	427	2.68	1.030	1.062	-0.036	0.118	-0.423	0.236
SNM_5	427	2.70	0.994	0.988	-0.073	0.118	-0.428	0.236
PMN_1	427	3.97	1.031	1.062	-1.205	0.118	1.126	0.236
PMN_2	427	3.94	1.084	1.175	-1.088	0.118	0.579	0.236
PMN_3	427	3.83	1.144	1.308	-1.019	0.118	0.348	0.236
PMN_4	427	3.88	1.123	1.260	-1.063	0.118	0.504	0.236
PBC_1	427	3.99	1.050	1.103	-1.105	0.118	0.534	0.236

Descriptive Statistics								
	N	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
Item	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PBC_2	427	4.35	0.854	0.730	-1.530	0.118	**2.492**	0.236
PBC_3	427	3.97	1.043	1.088	-0.829	0.118	-0.085	0.236
TCC_1	427	3.48	1.311	1.720	-0.479	0.118	-1.033	0.236
TCC_2	427	3.63	1.334	1.778	-0.672	0.118	-0.833	0.236
TCC_3	427	3.27	1.348	1.818	-0.261	0.118	-1.180	0.236
TCW_1	427	2.56	1.223	1.495	0.500	0.118	-0.857	0.236
TCW_2	427	2.33	1.227	1.506	0.729	0.118	-0.506	0.236
TCW_3	427	2.34	1.322	1.747	0.695	0.118	-0.762	0.236
AFF_1	427	4.2951	0.96757	0.936	-1.463	0.118	1.672	0.236
AFF_2	427	4.4988	0.84023	0.706	-1.964	0.118	**3.883**	0.236
AFF_3	427	4.3794	0.88617	0.785	-1.552	0.118	**2.080**	0.236
FIN20_1	213	4.51	0.775	0.600	**-2.160**	0.167	**5.906**	0.332
FIN20_2	213	4.77	0.567	0.322	**-3.575**	0.167	**17.736**	0.332
FIN20_4	213	4.64	0.718	0.515	**-2.739**	0.167	**9.336**	0.332
FIN20_5	213	4.77	0.621	0.386	**-3.859**	0.167	**18.374**	0.332
FIN20_6	213	4.71	0.712	0.507	**-3.396**	0.167	**13.320**	0.332
FIN05_1	214	4.03	0.903	0.816	-1.174	0.166	1.581	0.331
FIN05_2	214	4.21	1.006	1.012	-1.438	0.166	1.689	0.331
FIN05_4	214	3.93	1.090	1.188	-1.011	0.166	0.266	0.331
FIN05_5	214	4.14	0.972	0.944	-1.546	0.166	**2.663**	0.331
FIN05_6	214	4.18	1.039	1.079	-1.386	0.166	1.426	0.331
NCA_1	167	4.56	0.607	0.369	-1.364	0.188	**2.395**	0.374
NCA_2	167	4.74	0.526	0.277	**-2.458**	0.188	**7.843**	0.374
NCA_3	167	4.61	0.579	0.336	-1.384	0.188	1.930	0.374
NCA_4	167	4.64	0.633	0.400	**-2.279**	0.188	**7.461**	0.374
NCA_5	167	4.40	0.760	0.578	-1.305	0.188	**2.046**	0.374
NCA_6	167	4.57	0.653	0.427	-1.922	0.188	**5.640**	0.374
NCA_7	167	4.63	0.595	0.354	-1.580	0.188	**2.305**	0.374
NCA_8	167	4.74	0.572	0.328	**-2.663**	0.188	**8.351**	0.374
NCE_1	198	4.24	0.775	0.601	-1.177	0.173	1.988	0.344
NCE_2	198	4.57	0.763	0.582	**-2.338**	0.173	**6.403**	0.344
NCE_3	198	4.41	0.812	0.660	-1.756	0.173	**3.638**	0.344
NCE_4	198	4.48	0.752	0.566	-1.792	0.173	**3.857**	0.344
NCE_5	198	3.98	0.890	0.791	-0.965	0.173	1.272	0.344
NCE_6	198	4.40	0.772	0.596	-1.494	0.173	**2.692**	0.344
NCE_7	198	4.56	0.708	0.501	-1.993	0.173	**4.961**	0.344
NCE_8	198	4.68	0.583	0.340	-1.985	0.173	**4.323**	0.344
NCL_1	62	4.02	0.896	0.803	-0.880	0.304	0.980	0.599

Descriptive Statistics								
	N	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
Item	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
NCL_2	62	4.45	0.843	0.711	-1.879	0.304	**4.166**	0.599
NCL_3	62	4.32	0.883	0.779	-1.430	0.304	**2.283**	0.599
NCL_4	62	4.29	0.894	0.800	-1.327	0.304	1.881	0.599
NCL_5	62	3.71	1.179	1.390	-0.586	0.304	-0.523	0.599
NCL_6	62	4.18	0.950	0.902	-1.198	0.304	1.235	0.599
NCL_7	62	4.50	0.784	0.615	**-2.214**	0.304	**6.557**	0.599
NCL_8	62	4.44	0.842	0.709	-1.834	0.304	**4.050**	0.599
TON_1	427	4.09	0.972	0.945	-1.072	0.118	0.645	0.236
TON_2	427	3.73	1.154	1.332	-0.680	0.118	-0.511	0.236
TON_3	427	3.92	1.056	1.115	-0.913	0.118	0.181	0.236
TON_4	427	4.06	1.034	1.069	-1.203	0.118	0.857	0.236
TON_5	427	4.28	0.935	0.875	-1.474	0.118	1.907	0.236
DPN_1	427	3.96	1.149	1.320	-1.153	0.118	0.533	0.236
DPN_2	427	4.18	1.159	1.344	-1.478	0.118	1.244	0.236
DPN_3	427	4.02	1.193	1.424	-1.214	0.118	0.549	0.236
DPN_4	427	4.27	1.080	1.165	-1.614	0.118	1.889	0.236
DPN_5	427	4.20	1.083	1.172	-1.434	0.118	1.403	0.236
DGN_1	427	3.35	1.385	1.917	-0.383	0.118	-1.183	0.236
DGN_2	427	3.31	1.390	1.932	-0.344	0.118	-1.210	0.236
DGN_3	427	3.42	1.367	1.868	-0.512	0.118	-0.989	0.236
DGN_5	427	3.40	1.333	1.776	-0.512	0.118	-0.941	0.236
DGN_6	427	3.53	1.334	1.780	-0.633	0.118	-0.813	0.236
PO_1	427	4.17	0.868	0.754	-1.107	0.118	1.216	0.236
PO_2	427	4.35	0.844	0.712	-1.516	0.118	**2.424**	0.236
PO_3	427	3.90	1.080	1.167	-0.830	0.118	-0.078	0.236
PC_1	427	4.15	0.975	0.951	-1.209	0.118	0.864	0.236
PC_2	427	3.78	1.211	1.466	-0.813	0.118	-0.374	0.236
PC_3	427	3.94	0.959	0.919	-0.959	0.118	0.634	0.236
PE_1	427	2.47	1.247	1.555	0.476	0.118	-0.899	0.236
PE_2	427	3.21	1.264	1.599	-0.262	0.118	-1.044	0.236
PE_3	427	2.72	1.204	1.449	0.147	0.118	-0.962	0.236
PA_1	427	4.60	0.655	0.429	**-2.026**	0.118	**5.651**	0.236
PA_2	427	4.65	0.611	0.373	**-2.176**	0.118	**6.801**	0.236
PA_3	427	3.96	1.156	1.336	-0.971	0.118	0.036	0.236
PN_1	427	2.97	1.351	1.825	-0.098	0.118	-1.328	0.236
PN_2	427	2.54	1.489	2.216	0.386	0.118	-1.377	0.236
PN_3	427	2.67	1.372	1.884	0.266	0.118	-1.285	0.236

Table E. 8: Item by Item Descriptive Statistics

Item Tests of Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Item	Statistic	df	Sig.	Statistic	df	Sig.
INT_1	0.279	427	0.000	0.809	427	0.000
INT_2	0.261	427	0.000	0.776	427	0.000
INT_3	0.458	427	0.000	0.447	427	0.000
INT_4	0.293	427	0.000	0.740	427	0.000
INT_5	0.359	427	0.000	0.667	427	0.000
INT_6	0.353	427	0.000	0.680	427	0.000
INT_7	0.326	427	0.000	0.725	427	0.000
INT_8	0.289	427	0.000	0.746	427	0.000
HAB_1	0.303	427	0.000	0.786	427	0.000
HAB_2	0.309	427	0.000	0.805	427	0.000
HAB_3	0.307	427	0.000	0.809	427	0.000
HAB_4	0.270	427	0.000	0.841	427	0.000
HAB_5	0.268	427	0.000	0.863	427	0.000
ECN_1	0.286	427	0.000	0.817	427	0.000
ECN_2	0.251	427	0.000	0.862	427	0.000
ECN_3	0.257	427	0.000	0.842	427	0.000
ESK_1	0.292	427	0.000	0.826	427	0.000
ESK_2	0.171	427	0.000	0.913	427	0.000
ESK_3	0.265	427	0.000	0.875	427	0.000
NEP_1	0.192	427	0.000	0.910	427	0.000
NEP_2	0.255	427	0.000	0.864	427	0.000
NEP_4	0.231	427	0.000	0.878	427	0.000
NEP_5	0.159	427	0.000	0.901	427	0.000
ATT_1	0.268	427	0.000	0.803	427	0.000
ATT_2	0.303	427	0.000	0.743	427	0.000
ATT_3	0.247	427	0.000	0.801	427	0.000
SNM_1	0.204	427	0.000	0.891	427	0.000
SNM_2	0.228	427	0.000	0.870	427	0.000
SNM_3	0.168	427	0.000	0.899	427	0.000
SNM_4	0.248	427	0.000	0.892	427	0.000
SNM_5	0.242	427	0.000	0.896	427	0.000
PMN_1	0.306	427	0.000	0.797	427	0.000
PMN_2	0.284	427	0.000	0.812	427	0.000

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Item	Statistic	df	Sig.	Statistic	df	Sig.
PMN_3	0.284	427	0.000	0.825	427	0.000
PMN_4	0.280	427	0.000	0.819	427	0.000
PBC_1	0.302	427	0.000	0.793	427	0.000
PBC_2	0.306	427	0.000	0.729	427	0.000
PBC_3	0.230	427	0.000	0.835	427	0.000
TCC_1	0.255	427	0.000	0.862	427	0.000
TCC_2	0.265	427	0.000	0.837	427	0.000
TCC_3	0.209	427	0.000	0.887	427	0.000
TCW_1	0.275	427	0.000	0.870	427	0.000
TCW_2	0.265	427	0.000	0.852	427	0.000
TCW_3	0.256	427	0.000	0.839	427	0.000
AFF_1	0.317	427	0.000	0.730	427	0.000
AFF_2	0.383	427	0.000	0.639	427	0.000
AFF_3	0.337	427	0.000	0.708	427	0.000
FIN20_1	0.360	213	0.000	0.637	213	0.000
FIN20_2	0.468	213	0.000	0.451	213	0.000
FIN20_4	0.420	213	0.000	0.547	213	0.000
FIN20_5	0.475	213	0.000	0.412	213	0.000
FIN20_6	0.459	213	0.000	0.451	213	0.000
FIN05_1	0.310	214	0.000	0.795	214	0.000
FIN05_2	0.274	214	0.000	0.750	214	0.000
FIN05_4	0.286	214	0.000	0.814	214	0.000
FIN05_5	0.290	214	0.000	0.751	214	0.000
FIN05_6	0.275	214	0.000	0.756	214	0.000
NCA_1	0.372	167	0.000	0.670	167	0.000
NCA_2	0.460	167	0.000	0.519	167	0.000
NCA_3	0.402	167	0.000	0.650	167	0.000
NCA_4	0.416	167	0.000	0.593	167	0.000
NCA_5	0.320	167	0.000	0.740	167	0.000
NCA_6	0.383	167	0.000	0.644	167	0.000
NCA_7	0.419	167	0.000	0.630	167	0.000
NCA_8	0.462	167	0.000	0.504	167	0.000
NCE_1	0.266	198	0.000	0.767	198	0.000
NCE_2	0.387	198	0.000	0.596	198	0.000
NCE_3	0.320	198	0.000	0.693	198	0.000

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Item	Statistic	df	Sig.	Statistic	df	Sig.
NCE_4	0.349	198	0.000	0.673	198	0.000
NCE_5	0.277	198	0.000	0.828	198	0.000
NCE_6	0.312	198	0.000	0.721	198	0.000
NCE_7	0.384	198	0.000	0.637	198	0.000
NCE_8	0.440	198	0.000	0.581	198	0.000
NCL_1	0.251	62	0.000	0.837	62	0.000
NCL_2	0.355	62	0.000	0.679	62	0.000
NCL_3	0.311	62	0.000	0.747	62	0.000
NCL_4	0.302	62	0.000	0.760	62	0.000
NCL_5	0.194	62	0.000	0.872	62	0.000
NCL_6	0.258	62	0.000	0.791	62	0.000
NCL_7	0.351	62	0.000	0.643	62	0.000
NCL_8	0.345	62	0.000	0.689	62	0.000
TON_1	0.262	427	0.000	0.803	427	0.000
TON_2	0.257	427	0.000	0.857	427	0.000
TON_3	0.267	427	0.000	0.835	427	0.000
TON_4	0.288	427	0.000	0.783	427	0.000
TON_5	0.293	427	0.000	0.737	427	0.000
DPN_1	0.280	427	0.000	0.794	427	0.000
DPN_2	0.302	427	0.000	0.715	427	0.000
DPN_3	0.256	427	0.000	0.773	427	0.000
DPN_4	0.326	427	0.000	0.697	427	0.000
DPN_5	0.298	427	0.000	0.738	427	0.000
DGN_1	0.239	427	0.000	0.868	427	0.000
DGN_2	0.231	427	0.000	0.872	427	0.000
DGN_3	0.241	427	0.000	0.864	427	0.000
DGN_5	0.250	427	0.000	0.869	427	0.000
DGN_6	0.260	427	0.000	0.852	427	0.000
PO_1	0.258	427	0.000	0.796	427	0.000
PO_2	0.304	427	0.000	0.728	427	0.000
PO_3	0.243	427	0.000	0.842	427	0.000
PC_1	0.269	427	0.000	0.771	427	0.000
PC_2	0.265	427	0.000	0.837	427	0.000
PC_3	0.292	427	0.000	0.827	427	0.000
PE_1	0.235	427	0.000	0.876	427	0.000

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Item	Statistic	df	Sig.	Statistic	df	Sig.
PE_2	0.221	427	0.000	0.897	427	0.000
PE_3	0.178	427	0.000	0.908	427	0.000
PA_1	0.396	427	0.000	0.624	427	0.000
PA_2	0.421	427	0.000	0.593	427	0.000
PA_3	0.238	427	0.000	0.814	427	0.000
PN_1	0.233	427	0.000	0.878	427	0.000
PN_2	0.220	427	0.000	0.830	427	0.000
PN_3	0.221	427	0.000	0.871	427	0.000

a. Lilliefors Significance Correction

Table E. 9: Item by Item Tests of Normality

Constructs Descriptive Statistics

Descriptive Statistics							
Construct	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Variance Statistic
INT	427	4.00	1.00	5.00	4.2623	0.77610	0.602
ECN	427	4.00	1.00	5.00	2.3372	1.18116	1.395
ESK	427	4.00	1.00	5.00	3.4996	0.99277	0.986
NEP	427	4.00	1.00	5.00	3.0515	0.93289	0.870
ATT	427	4.00	1.00	5.00	4.1249	0.92409	0.854
SNM	427	4.00	1.00	5.00	2.5457	0.82783	0.685
PMN	427	4.00	1.00	5.00	3.9052	0.93640	0.877
PBC	427	3.67	1.33	5.00	4.1038	0.75984	0.577
AFF	427	3.67	1.33	5.00	4.3911	0.76762	0.589
FFM	427	2.80	2.07	4.87	3.6056	0.40996	0.168
PO	427	4.00	1.00	5.00	4.1405	0.79745	0.636
PC	427	4.00	1.00	5.00	3.9563	0.85560	0.732
PE	427	4.00	1.00	5.00	2.8017	1.10895	1.230
PA	427	4.00	1.00	5.00	4.4020	0.59905	0.359
PN	427	4.00	1.00	5.00	2.7276	1.25491	1.575
FIN	427	4.00	1.00	5.00	4.3883	0.78540	0.617
FIN05	214	4.00	1.00	5.00	4.0981	0.86708	0.752
FIN20	213	4.00	1.00	5.00	4.6798	0.56017	0.314
HAB	427	4.00	1.00	5.00	3.8628	0.96764	0.936
NTC	427	4.00	1.00	5.00	2.9364	0.89596	0.803
TCC	427	4.00	1.00	5.00	3.4614	1.19718	1.433
TCW	427	4.00	1.00	5.00	2.4114	1.11711	1.248
NCN	427	4.00	1.00	5.00	4.4666	0.59609	0.355
NCA	167	3.00	2.00	5.00	4.6115	0.48003	0.230
NCE	198	3.50	1.50	5.00	4.4160	0.60084	0.361
NCL	62	4.00	1.00	5.00	4.2379	0.75467	0.570
TON	427	4.00	1.00	5.00	4.0169	0.87848	0.772
DPN	427	4.00	1.00	5.00	4.1265	1.05016	1.103
DGN	427	4.00	1.00	5.00	3.4014	1.28439	1.650

Table E. 10: Constructs - Descriptive Statistics

	Descriptive Statistics			
	Skewness		Kurtosis	
Construct	Statistic	Std. Error	Statistic	Std. Error
INT	-1.562	0.118	2.994	0.236
ECN	0.680	0.118	-0.558	0.236
ESK	-0.430	0.118	-0.537	0.236
NEP	0.026	0.118	-0.416	0.236
ATT	-1.050	0.118	0.467	0.236
SNM	0.217	0.118	-0.046	0.236
PMN	-0.996	0.118	0.734	0.236
PBC	-0.646	0.118	-0.083	0.236
AFF	-1.351	0.118	1.421	0.236
FFM	-0.209	0.118	0.869	0.236
PO	-1.082	0.118	1.150	0.236
PC	-0.883	0.118	0.498	0.236
PE	0.156	0.118	-0.846	0.236
PA	-1.114	0.118	2.073	0.236
PN	0.192	0.118	-1.153	0.236
FIN	-1.933	0.118	4.276	0.236
FIN05	-1.350	0.166	1.789	0.331
FIN20	-3.526	0.167	17.615	0.332
HAB	-0.899	0.118	0.239	0.236
NTC	0.035	0.118	-0.193	0.236
TCC	-0.507	0.118	-0.797	0.236
TCW	0.642	0.118	-0.538	0.236
NCN	-1.870	0.118	5.306	0.236
NCA	-2.078	0.188	7.253	0.374
NCE	-1.707	0.173	3.954	0.344
NCL	-1.568	0.304	4.288	0.599
TON	-1.069	0.118	0.891	0.236
DPN	-1.449	0.118	1.370	0.236
DGN	-0.505	0.118	-0.979	0.236

Table E. 11: Constructs - Skewness and Kurtosis

Constructs Tests of Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Construct	Statistic	df	Sig.	Statistic	df	Sig.
INT	0.171	427	0.000	0.842	427	0.000
ECN	0.198	427	0.000	0.897	427	0.000
ESK	0.122	427	0.000	0.957	427	0.000
NEP	0.062	427	0.000	0.984	427	0.000
ATT	0.179	427	0.000	0.854	427	0.000
SNM	0.081	427	0.000	0.980	427	0.000
PMN	0.168	427	0.000	0.906	427	0.000
PBC	0.136	427	0.000	0.918	427	0.000
AFF	0.248	427	0.000	0.791	427	0.000
FFM	0.070	427	0.000	0.989	427	0.003
PO	0.149	427	0.000	0.888	427	0.000
PC	0.143	427	0.000	0.917	427	0.000
PE	0.100	427	0.000	0.963	427	0.000
PA	0.191	427	0.000	0.862	427	0.000
PN	0.106	427	0.000	0.935	427	0.000
FIN	0.218	427	0.000	0.765	427	0.000
FIN05	0.179	214	0.000	0.865	214	0.000
FIN20	0.284	213	0.000	0.600	213	0.000
HAB	0.165	427	0.000	0.902	427	0.000
NTC	0.075	427	0.000	0.986	427	0.000
TCC	0.135	427	0.000	0.926	427	0.000
TCW	0.178	427	0.000	0.922	427	0.000
NCN	0.185	427	0.000	0.814	427	0.000
NCA	0.209	167	0.000	0.772	167	0.000
NCE	0.166	198	0.000	0.834	198	0.000
NCL	0.156	62	0.001	0.857	62	0.000
TON	0.155	427	0.000	0.899	427	0.000
DPN	0.203	427	0.000	0.797	427	0.000
DGN	0.164	427	0.000	0.910	427	0.000

a. Lilliefors Significance Correction

Table E. 12: Constructs - Tests of Normality

Construct Boxplots

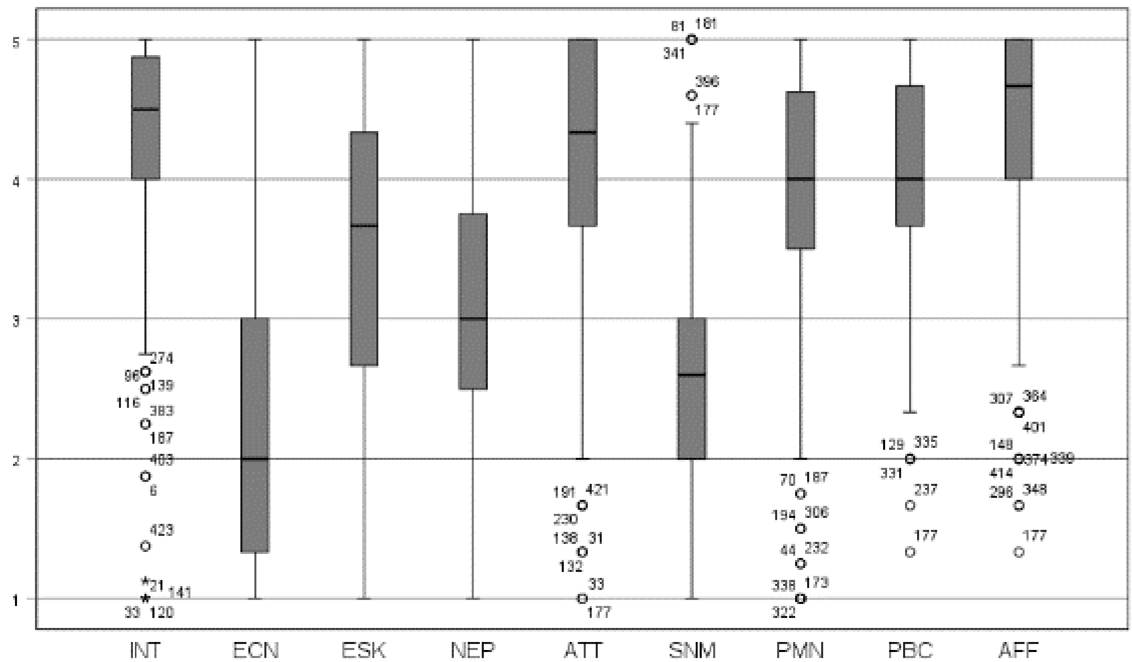

Figure E. 12: Boxplots - INT, ECN, ESK, NEP, ATT, SNM, PMN, PBC, AFF

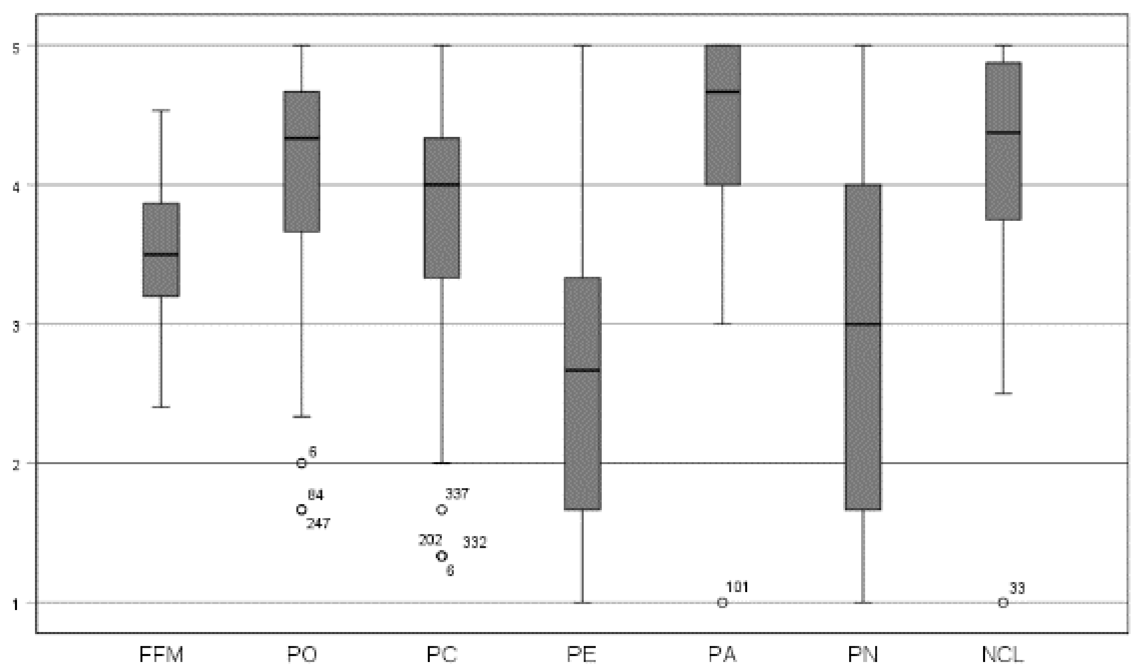

Figure E. 13: Boxplots - FFM, PO, PC, PE, PA, PN, NCL

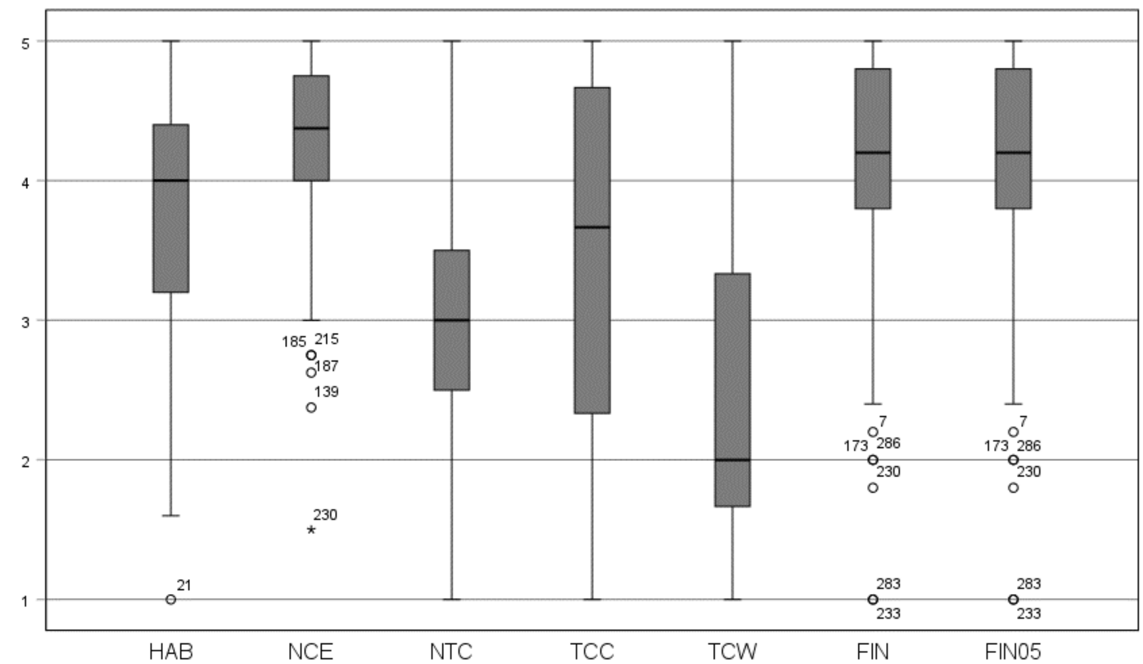

Figure E. 14: Boxplots - HAB, NCE, NTC, TCC, TCW, FIN, FIN05

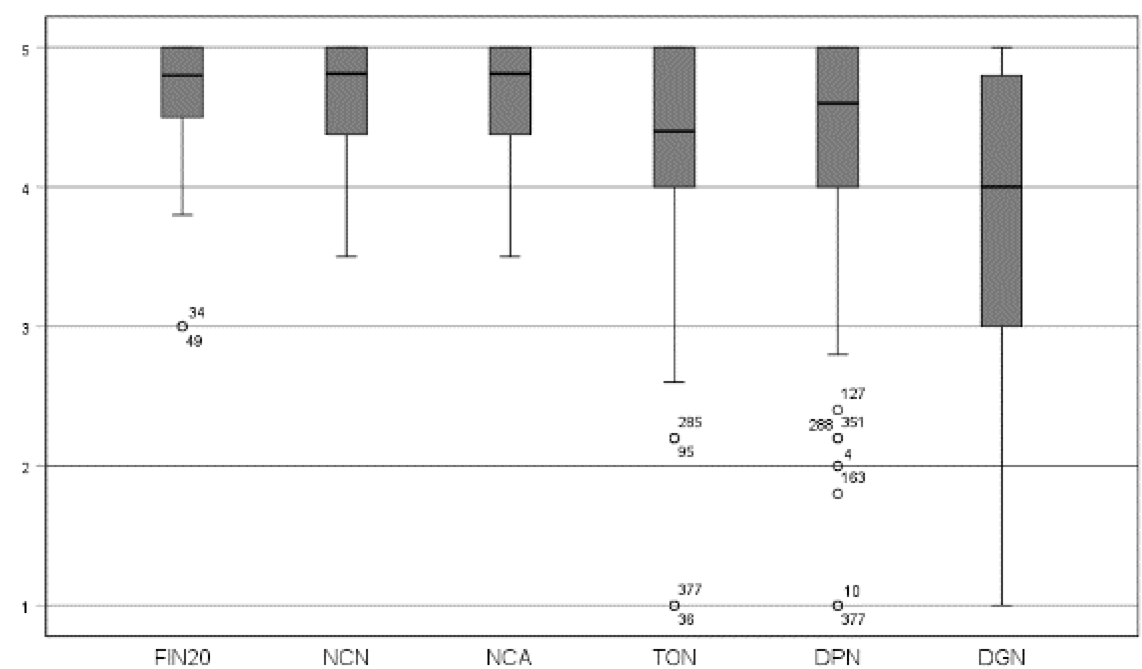

Figure E. 15: Boxplots - FIN20, NCN, NCA, TON, DPN, DGN

Model Summaries – Hypotheses with Interactions

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.511[b]	.261	.255	.66971	.257	73.504	2	423	<.001
3	.526[c]	.277	.270	.66312	.016	9.446	1	422	.002

a. Predictors: (Constant), IECC_recoded

b. Predictors: (Constant), IECC_recoded, mc_ATT, mc_FFM

c. Predictors: (Constant), IECC_recoded, mc_ATT, mc_FFM, int_ATT_FFM

d. Dependent Variable: INT

Table E. 13: Model Summary - H15

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.467[b]	.218	.213	.68857	.215	58.101	2	423	<.001
3	.488[c]	.239	.231	.68043	.020	11.184	1	422	<.001

a. Predictors: (Constant), IECC_recoded

b. Predictors: (Constant), IECC_recoded, mc_ATT, mc_PO

c. Predictors: (Constant), IECC_recoded, mc_ATT, mc_PO, int_ATT_PO

d. Dependent Variable: INT

Table E. 14: Model Summary - H15a-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.511[b]	.262	.256	.66927	.258	73.876	2	423	<.001
3	.511[c]	.262	.255	.67004	.000	.024	1	422	.877

a. Predictors: (Constant), IECC_recoded

b. Predictors: (Constant), IECC_recoded, mc_ATT, mc_PC

c. Predictors: (Constant), IECC_recoded, mc_ATT, mc_PC, int_ATT_PC

d. Dependent Variable: INT

Table E. 15: Model Summary - H15b

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.467[b]	.218	.213	.68864	.215	58.052	2	423	<.001
3	.481[c]	.231	.224	.68379	.013	7.021	1	422	.008

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_ATT, mc_PE

c. Predictors: (Constant), TECC_recoded, mc_ATT, mc_PE, int_ATT_PE

d. Dependent Variable: INT

Table E. 16: Model Summary - H15c-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.468[b]	.219	.213	.68848	.215	58.174	2	423	<.001
3	.468[c]	.219	.211	.68929	.000	.004	1	422	.947

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PA, mc_ATT

c. Predictors: (Constant), TECC_recoded, mc_PA, mc_ATT, int_ATT_PA

d. Dependent Variable: INT

Table E. 17: Model Summary - H15d

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.443[b]	.197	.191	.69809	.193	50.799	2	423	<.001
3	.444[c]	.197	.189	.69881	.000	.128	1	422	.721

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_ATT, mc_PN

c. Predictors: (Constant), TECC_recoded, mc_ATT, mc_PN, int_ATT_PN

d. Dependent Variable: INT

Table E. 18: Model Summary - H15e-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.338[b]	.114	.108	.73304	.111	26.383	2	423	<.001
3	.340[c]	.115	.107	.73339	.001	.603	1	422	.438

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_FFM, mc_SNM

c. Predictors: (Constant), TECC_recoded, mc_FFM, mc_SNM, int_SNM_FFM

d. Dependent Variable: INT

Table E. 19: Model Summary - H16

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.476[b]	.226	.221	.68501	.223	60.913	2	423	<.001
3	.479[c]	.230	.223	.68429	.003	1.895	1	422	.169

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_FFM, mc_PMN

c. Predictors: (Constant), TECC_recoded, mc_FFM, mc_PMN, int_PMN_FFM

d. Dependent Variable: INT

Table E. 20: Model Summary - H18

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.466[b]	.218	.212	.68891	.214	57.835	2	423	<.001
3	.471[c]	.222	.215	.68783	.004	2.329	1	422	.128

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PBC, mc_FFM

c. Predictors: (Constant), TECC_recoded, mc_PBC, mc_FFM, int_PBC_FFM

d. Dependent Variable: INT

Table E. 21: Model Summary - H19

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.393[b]	.154	.148	.71624	.151	37.671	2	423	<.001
3	.420[c]	.176	.168	.70783	.022	11.119	1	422	<.001

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_FFM, mc_AFF

c. Predictors: (Constant), TECC_recoded, mc_FFM, mc_AFF, int_AFF_FFM

d. Dependent Variable: INT

Table E. 22: Model Summary - H20

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.331[b]	.110	.103	.73488	.106	25.197	2	423	<.001
3	.360[c]	.129	.121	.72755	.020	9.564	1	422	.002

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PO, mc_AFF

c. Predictors: (Constant), TECC_recoded, mc_PO, mc_AFF, int_AFF_PO

d. Dependent Variable: INT

Table E. 23: Model Summary - H20a-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.413[b]	.170	.165	.70939	.167	42.508	2	423	<.001
3	.418[c]	.175	.167	.70834	.004	2.256	1	422	.134

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_AFF, mc_PC

c. Predictors: (Constant), TECC_recoded, mc_AFF, mc_PC, int_AFF_PC

d. Dependent Variable: INT

Table E. 24: Model Summary - H20b

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.329[b]	.108	.102	.73541	.105	24.851	2	423	<.001
3	.350[c]	.122	.114	.73054	.014	6.664	1	422	.010

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PE, mc_AFF

c. Predictors: (Constant), TECC_recoded, mc_PE, mc_AFF, int_AFF_PE

d. Dependent Variable: INT

Table E. 25: Model Summary - H20c-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.358[b]	.128	.122	.72709	.125	30.291	2	423	<.001
3	.365[c]	.133	.125	.72604	.005	2.233	1	422	.136

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PA, mc_AFF

c. Predictors: (Constant), TECC_recoded, mc_PA, mc_AFF, int_AFF_PA

d. Dependent Variable: INT

Table E. 26: Model Summary - H20d

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.308[b]	.095	.089	.74094	.091	21.336	2	423	<.001
3	.309[c]	.096	.087	.74160	.001	.255	1	422	.614

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_AFF, mc_PN

c. Predictors: (Constant), TECC_recoded, mc_AFF, mc_PN, int_AFF_PN

d. Dependent Variable: INT

Table E. 27: Model Summary - H20e-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.450[b]	.203	.197	.69542	.199	52.820	2	423	<.001
3	.453[c]	.205	.198	.69524	.002	1.212	1	422	.271

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PBC, mc_FIN

c. Predictors: (Constant), TECC_recoded, mc_PBC, mc_FIN, int_PBC_FIN

d. Dependent Variable: INT

Table E. 28: Model Summary - H21

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.478[b]	.229	.223	.68399	.225	61.730	2	423	<.001
3	.478[c]	.229	.221	.68478	.000	.018	1	422	.895

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_ATT, mc_FIN

c. Predictors: (Constant), TECC_recoded, mc_ATT, mc_FIN, int_ATT_FIN

d. Dependent Variable: INT

Table E. 29: Model Summary - H22

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.375[b]	.140	.134	.72209	.137	33.651	2	423	<.001
3	.377[c]	.142	.134	.72221	.002	.865	1	422	.353

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PBC, DEM2_Age

c. Predictors: (Constant), TECC_recoded, mc_PBC, DEM2_Age, int_PBC_age

d. Dependent Variable: INT

Table E. 30: Model Summary - H23

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.443[b]	.197	.191	.69811	.193	50.786	2	423	<.001
3	.443[c]	.197	.189	.69890	.000	.036	1	422	.849

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PBC, mc_NTC

c. Predictors: (Constant), TECC_recoded, mc_PBC, mc_NTC, int_PBC_NTC

d. Dependent Variable: INT

Table E. 31: Model Summary - H24-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.487[b]	.238	.232	.68004	.234	64.907	2	423	<.001
3	.492[c]	.242	.235	.67901	.004	2.282	1	422	.132

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_ATT, mc_NTC

c. Predictors: (Constant), TECC_recoded, mc_ATT, mc_NTC, int_ATT_NTC

d. Dependent Variable: INT

Table E. 32: Model Summary - H25-

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.201[b]	.040	.033	.76303	.037	8.053	2	423	<.001
3	.204[c]	.042	.033	.76337	.001	.625	1	422	.430

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, DEM3_Gen, mc_SNM

c. Predictors: (Constant), TECC_recoded, DEM3_Gen, mc_SNM, int_SNM_gender

d. Dependent Variable: INT

Table E. 33: Model Summary - H26

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.449[b]	.202	.196	.69580	.198	52.526	2	423	<.001
3	.450[c]	.203	.195	.69619	.001	.533	1	422	.466

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PBC, mc_NCN

c. Predictors: (Constant), TECC_recoded, mc_PBC, mc_NCN, int_PBC_NCN

d. Dependent Variable: INT

Table E. 34: Model Summary - H27

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.437[b]	.191	.185	.70070	.187	48.851	2	423	<.001
3	.437[c]	.191	.183	.70149	.000	.044	1	422	.834

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_ATT, DEM4_Edu

c. Predictors: (Constant), TECC_recoded, mc_ATT, DEM4_Edu, int_ATT_education

d. Dependent Variable: INT

Table E. 35: Model Summary - H28

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.490[b]	.240	.235	.67893	.236	65.812	2	423	<.001
3	.509[c]	.259	.252	.67130	.019	10.679	1	422	.001

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_ATT, mc_HAB

c. Predictors: (Constant), TECC_recoded, mc_ATT, mc_HAB, int_ATT_HAB

d. Dependent Variable: INT

Table E. 36: Model Summary - H29

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.001	.77559	.004	1.560	1	425	.212
2	.438[b]	.192	.186	.70003	.188	49.346	2	423	<.001
3	.461[c]	.212	.205	.69210	.020	10.755	1	422	.001

a. Predictors: (Constant), TECC_recoded

b. Predictors: (Constant), TECC_recoded, mc_PBC, mc_HAB

c. Predictors: (Constant), TECC_recoded, mc_PBC, mc_HAB, int_PBC_HAB

d. Dependent Variable: INT

Table E. 37: Model Summary - H30

Ad-Hoc Analysis - SPSS Outputs

Ad-Hoc #1: Financial Incentives

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 1
    Y  : INT
    X  : FIN
    W  : HAB

Sample
Size:  427

**************************************************************************
OUTCOME VARIABLE:
 INT

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .4270      .1823      .4960    31.4341     3.0000   423.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     4.2684      .0342   124.8652      .0000     4.2012     4.3356
FIN           .2628      .0436     6.0221      .0000      .1770      .3485
HAB           .2323      .0354     6.5585      .0000      .1627      .3019
Int_1        -.0902      .0388    -2.3224      .0207     -.1665     -.0139

Product terms key:
 Int_1    :        FIN      x        HAB

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0104     5.3936     1.0000   423.0000      .0207
----------
    Focal predict: FIN      (X)
          Mod var: HAB      (W)

Conditional effects of the focal predictor at values of the moderator(s):

        HAB     Effect         se          t          p       LLCI       ULCI
     -.9676      .3500      .0569     6.1557      .0000      .2383      .4618
      .0000      .2628      .0436     6.0221      .0000      .1770      .3485
      .9676      .1755      .0583     3.0102      .0028      .0609      .2901

There are no statistical significance transition points within the observed
range of the moderator found using the Johnson-Neyman method.

Conditional effect of focal predictor at values of the moderator:
        HAB     Effect         se          t          p       LLCI       ULCI
    -2.8628      .5210      .1184     4.3998      .0000      .2882      .7537
    -2.6723      .5038      .1116     4.5157      .0000      .2845      .7231
    -2.4818      .4866      .1048     4.6434      .0000      .2806      .6926
```

```
    -2.2913      .4694      .0981     4.7843      .0000      .2766      .6623
    -2.1009      .4523      .0916     4.9399      .0000      .2723      .6322
    -1.9104      .4351      .0851     5.1112      .0000      .2678      .6024
    -1.7199      .4179      .0789     5.2992      .0000      .2629      .5729
    -1.5294      .4007      .0728     5.5034      .0000      .2576      .5438
    -1.3390      .3835      .0670     5.7213      .0000      .2518      .5153
    -1.1485      .3664      .0616     5.9467      .0000      .2453      .4875
     -.9580      .3492      .0566     6.1664      .0000      .2379      .4605
     -.7675      .3320      .0522     6.3576      .0000      .2294      .4346
     -.5770      .3148      .0485     6.4846      .0000      .2194      .4102
     -.3866      .2976      .0458     6.5006      .0000      .2076      .3876
     -.1961      .2805      .0441     6.3589      .0000      .1938      .3671
     -.0056      .2633      .0436     6.0344      .0000      .1775      .3490
      .1849      .2461      .0444     5.5428      .0000      .1588      .3334
      .3753      .2289      .0464     4.9387      .0000      .1378      .3200
      .5658      .2117      .0493     4.2907      .0000      .1147      .3087
      .7563      .1946      .0532     3.6564      .0003      .0900      .2991
      .9468      .1774      .0578     3.0706      .0023      .0638      .2909
     1.1372      .1602      .0629     2.5483      .0112      .0366      .2838

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   FIN        HAB        INT        .
BEGIN DATA.
     -.7854     -.9676     3.7687
      .0000     -.9676     4.0436
      .6117     -.9676     4.2577
     -.7854      .0000     4.0620
      .0000      .0000     4.2684
      .6117      .0000     4.4291
     -.7854      .9676     4.3554
      .0000      .9676     4.4932
      .6117      .9676     4.6005
END DATA.
GRAPH/SCATTERPLOT=
 FIN      WITH     INT      BY       HAB      .

*********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
          HAB      FIN

------ END MATRIX -----
```

Ad-Hoc #2: Need for Thermal Comfort

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.2 ****************
```

```
          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 1
    Y  : INT
    X  : NTC
    W  : FFM

Sample
Size:  427

**************************************************************************
OUTCOME VARIABLE:
 INT

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .4703      .2212      .4724    40.0422     3.0000   423.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     4.2611      .0333   128.0843      .0000     4.1957     4.3265
NTC          -.3011      .0372    -8.0998      .0000     -.3742     -.2280
FFM           .5955      .0813     7.3255      .0000      .4357      .7553
Int_1         .1720      .0893     1.9252      .0549     -.0036      .3476

Product terms key:
 Int_1    :        NTC      x        FFM

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0068     3.7063     1.0000   423.0000      .0549
----------
    Focal predict: NTC      (X)
          Mod var: FFM      (W)

Conditional effects of the focal predictor at values of the moderator(s):

        FFM     Effect         se          t          p       LLCI       ULCI
     -.4100     -.3716      .0520    -7.1408      .0000     -.4739     -.2693
      .0000     -.3011      .0372    -8.0998      .0000     -.3742     -.2280
      .4100     -.2306      .0523    -4.4070      .0000     -.3335     -.1278

Moderator value(s) defining Johnson-Neyman significance region(s):
      Value    % below    % above
      .8147    98.1265     1.8735

Conditional effect of focal predictor at values of the moderator:
        FFM     Effect         se          t          p       LLCI       ULCI
    -1.5390     -.5658      .1422    -3.9783      .0001     -.8453     -.2862
    -1.3990     -.5417      .1302    -4.1609      .0000     -.7976     -.2858
    -1.2590     -.5176      .1183    -4.3772      .0000     -.7501     -.2852
    -1.1190     -.4936      .1065    -4.6362      .0000     -.7028     -.2843
     -.9790     -.4695      .0948    -4.9503      .0000     -.6559     -.2831
     -.8390     -.4454      .0835    -5.3356      .0000     -.6095     -.2813
     -.6990     -.4213      .0725    -5.8119      .0000     -.5638     -.2788
     -.5590     -.3972      .0621    -6.3981      .0000     -.5193     -.2752
     -.4190     -.3732      .0526    -7.0935      .0000     -.4766     -.2698
     -.2790     -.3491      .0446    -7.8198      .0000     -.4368     -.2613
     -.1390     -.3250      .0391    -8.3062      .0000     -.4019     -.2481
```

```
      .0010     -.3009      .0372    -8.0948      .0000     -.3740     -.2279
      .1410     -.2769      .0393    -7.0414      .0000     -.3541     -.1996
      .2810     -.2528      .0450    -5.6206      .0000     -.3412     -.1644
      .4210     -.2287      .0530    -4.3128      .0000     -.3329     -.1245
      .5610     -.2046      .0626    -3.2706      .0012     -.3276     -.0816
      .7010     -.1805      .0730    -2.4731      .0138     -.3240     -.0371
      .8147     -.1610      .0819    -1.9656      .0500     -.3220      .0000
      .8410     -.1565      .0840    -1.8625      .0632     -.3216      .0087
      .9810     -.1324      .0954    -1.3880      .1659     -.3199      .0551
     1.1210     -.1083      .1070    -1.0122      .3120     -.3187      .1020
     1.2610     -.0842      .1188     -.7090      .4787     -.3178      .1493

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   NTC        FFM        INT        .
BEGIN DATA.
     -.8960     -.4100     4.3500
      .0000     -.4100     4.0170
      .8960     -.4100     3.6840
     -.8960      .0000     4.5309
      .0000      .0000     4.2611
      .8960      .0000     3.9913
     -.8960      .4100     4.7119
      .0000      .4100     4.5053
      .8960      .4100     4.2986
END DATA.
GRAPH/SCATTERPLOT=
 NTC      WITH     INT      BY       FFM      .

*********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
          FFM      NTC

------ END MATRIX -----
```

Ad-Hoc #3: Notification Channel (Smartphone App)

Moderation: Degree of Personalization in Notification (DPN)

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 1
    Y  : INT
```

```
    X  : NCA
    W  : DPN

Sample
Size:  167

**************************************************************************
OUTCOME VARIABLE:
 INT

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .5058      .2558      .2731    18.6749     3.0000   163.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     4.3774      .0418   104.7242      .0000     4.2949     4.4599
NCA           .7821      .1050     7.4517      .0000      .5748      .9893
DPN          -.0853      .0451    -1.8941      .0600     -.1743      .0036
Int_1         .3742      .0816     4.5855      .0000      .2131      .5354

Product terms key:
 Int_1    :        NCA      x        DPN

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0960    21.0272     1.0000   163.0000      .0000
----------
    Focal predict: NCA      (X)
          Mod var: DPN      (W)

Conditional effects of the focal predictor at values of the moderator(s):

        DPN     Effect         se          t          p       LLCI       ULCI
     -.9405      .4301      .0905     4.7538      .0000      .2515      .6088
      .0000      .7821      .1050     7.4517      .0000      .5748      .9893
      .7605     1.0667      .1480     7.2051      .0000      .7743     1.3590

Moderator value(s) defining Johnson-Neyman significance region(s):
      Value    % below    % above
    -1.5076     9.5808    90.4192

Conditional effect of focal predictor at values of the moderator:
        DPN     Effect         se          t          p       LLCI       ULCI
    -3.2395     -.4302      .2256    -1.9073      .0582     -.8756      .0152
    -3.0395     -.3554      .2106    -1.6871      .0935     -.7713      .0606
    -2.8395     -.2805      .1959    -1.4317      .1541     -.6674      .1064
    -2.6395     -.2057      .1815    -1.1331      .2588     -.5641      .1527
    -2.4395     -.1308      .1674     -.7814      .4357     -.4615      .1998
    -2.2395     -.0560      .1538     -.3640      .7163     -.3597      .2477
    -2.0395      .0189      .1408      .1340      .8936     -.2591      .2968
    -1.8395      .0937      .1284      .7295      .4667     -.1599      .3473
    -1.6395      .1685      .1171     1.4390      .1521     -.0627      .3998
    -1.5076      .2179      .1103     1.9746      .0500      .0000      .4358
    -1.4395      .2434      .1071     2.2724      .0244      .0319      .4549
    -1.2395      .3182      .0988     3.2217      .0015      .1232      .5133
    -1.0395      .3931      .0926     4.2447      .0000      .2102      .5759
     -.8395      .4679      .0890     5.2557      .0000      .2921      .6437
     -.6395      .5428      .0884     6.1414      .0000      .3682      .7173
     -.4395      .6176      .0907     6.8090      .0000      .4385      .7967
     -.2395      .6924      .0958     7.2283      .0000      .5033      .8816
```

```
     -.0395      .7673      .1032     7.4318      .0000      .5634      .9712
      .1605      .8421      .1126     7.4803      .0000      .6198     1.0644
      .3605      .9170      .1234     7.4322      .0000      .6734     1.1606
      .5605      .9918      .1353     7.3311      .0000      .7247     1.2590
      .7605     1.0667      .1480     7.2051      .0000      .7743     1.3590

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   NCA        DPN        INT        .
BEGIN DATA.
     -.4800     -.9405     4.2512
      .0000     -.9405     4.4577
      .3885     -.9405     4.6248
     -.4800      .0000     4.0020
      .0000      .0000     4.3774
      .3885      .0000     4.6812
     -.4800      .7605     3.8005
      .0000      .7605     4.3125
      .3885      .7605     4.7269
END DATA.
GRAPH/SCATTERPLOT=
 NCA      WITH     INT      BY       DPN      .

*********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

W values in conditional tables are 1 SD below the mean, the mean, and the
maximum.

NOTE: One SD above the mean is above the maximum observed in the data for W,
      so the maximum measurement for W is used for conditioning instead.

NOTE: The following variables were mean centered prior to analysis:
          DPN      NCA

------ END MATRIX -----
```

Moderation: Degree of Gamification in Notification (DGN)

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 1
    Y  : INT
    X  : NCA
    W  : DGN
```

```
Sample
Size:  167

**************************************************************************
OUTCOME VARIABLE:
 INT

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .4096      .1677      .3054    10.9501     3.0000   163.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     4.4059      .0437   100.7699      .0000     4.3196     4.4923
NCA           .5667      .1020     5.5554      .0000      .3653      .7682
DGN         -.0041      .0374     -.1101      .9125     -.0781      .0698
Int_1         .1852      .0844     2.1950      .0296      .0186      .3517

Product terms key:
 Int_1    :        NCA      x        DGN

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0246     4.8180     1.0000   163.0000      .0296
----------
    Focal predict: NCA      (X)
          Mod var: DGN      (W)

Conditional effects of the focal predictor at values of the moderator(s):

        DGN     Effect         se          t          p       LLCI       ULCI
    -1.1948      .3455      .1062     3.2547      .0014      .1359      .5552
      .0000      .5667      .1020     5.5554      .0000      .3653      .7682
     1.1948      .7880      .1728     4.5600      .0000      .4468     1.1292

Moderator value(s) defining Johnson-Neyman significance region(s):
      Value    % below    % above
    -1.6638    14.3713    85.6287

Conditional effect of focal predictor at values of the moderator:
        DGN     Effect         se          t          p       LLCI       ULCI
    -2.7281      .0616      .2053      .3002      .7644     -.3437      .4670
    -2.5281      .0987      .1903      .5184      .6049     -.2771      .4744
    -2.3281      .1357      .1757      .7723      .4410     -.2112      .4826
    -2.1281      .1727      .1615     1.0696      .2864     -.1462      .4916
    -1.9281      .2097      .1479     1.4186      .1579     -.0822      .5017
    -1.7281      .2468      .1350     1.8286      .0693     -.0197      .5133
    -1.6638      .2587      .1310     1.9746      .0500      .0000      .5174
    -1.5281      .2838      .1230     2.3069      .0223      .0409      .5267
    -1.3281      .3208      .1124     2.8552      .0049      .0990      .5427
    -1.1281      .3579      .1034     3.4618      .0007      .1537      .5620
     -.9281      .3949      .0965     4.0913      .0001      .2043      .5855
     -.7281      .4319      .0923     4.6807      .0000      .2497      .6141
     -.5281      .4690      .0910     5.1526      .0000      .2892      .6487
     -.3281      .5060      .0928     5.4496      .0000      .3226      .6893
     -.1281      .5430      .0976     5.5632      .0000      .3503      .7358
      .0719      .5801      .1049     5.5297      .0000      .3729      .7872
      .2719      .6171      .1142     5.4021      .0000      .3915      .8426
      .4719      .6541      .1252     5.2266      .0000      .4070      .9012
      .6719      .6911      .1373     5.0345      .0000      .4201      .9622
      .8719      .7282      .1503     4.8439      .0000      .4313     1.0250
```

```
     1.0719      .7652      .1641     4.6637      .0000      .4412     1.0892
     1.2719      .8022      .1784     4.4979      .0000      .4500     1.1544

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   NCA        DGN        INT        .
BEGIN DATA.
     -.4800    -1.1948     4.2450
      .0000    -1.1948     4.4109
      .3885    -1.1948     4.5451
     -.4800      .0000     4.1339
      .0000      .0000     4.4059
      .3885      .0000     4.6261
     -.4800     1.1948     4.0228
      .0000     1.1948     4.4010
      .3885     1.1948     4.7071
END DATA.
GRAPH/SCATTERPLOT=
 NCA      WITH     INT      BY       DGN      .

*********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
          DGN      NCA

------ END MATRIX -----
```

Moderation: Timeliness of Notification (TON)

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 1
    Y  : INT
    X  : NCA
    W  : TON

Sample
Size:  167

**************************************************************************
OUTCOME VARIABLE:
 INT

Model Summary
          R       R-sq        MSE          F        df1        df2          p
```

```
      .4213      .1775      .3018    11.7260     3.0000   163.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     4.4067      .0432   101.9536      .0000     4.3213     4.4920
NCA           .5826      .1055     5.5230      .0000      .3743      .7909
TON           .0481      .0560      .8581      .3921     -.0625      .1586
Int_1         .2238      .0908     2.4647      .0148      .0445      .4030

Product terms key:
 Int_1    :        NCA      x        TON

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0307     6.0745     1.0000   163.0000      .0148
----------
    Focal predict: NCA      (X)
          Mod var: TON      (W)

Conditional effects of the focal predictor at values of the moderator(s):

        TON     Effect         se          t          p       LLCI       ULCI
     -.7829      .4074      .0931     4.3778      .0000      .2237      .5912
      .0000      .5826      .1055     5.5230      .0000      .3743      .7909
      .7820      .7576      .1539     4.9234      .0000      .4538     1.0615

Moderator value(s) defining Johnson-Neyman significance region(s):
      Value    % below    % above
    -1.5087     5.9880    94.0120

Conditional effect of focal predictor at values of the moderator:
        TON     Effect         se          t          p       LLCI       ULCI
    -3.2180     -.1374      .2561     -.5366      .5922     -.6431      .3682
    -3.0180     -.0927      .2392     -.3874      .6989     -.5650      .3797
    -2.8180     -.0479      .2225     -.2153      .8298     -.4873      .3915
    -2.6180     -.0032      .2061     -.0154      .9878     -.4101      .4038
    -2.4180      .0416      .1900      .2189      .8270     -.3336      .4167
    -2.2180      .0863      .1743      .4954      .6210     -.2578      .4305
    -2.0180      .1311      .1591      .8239      .4112     -.1831      .4453
    -1.8180      .1758      .1446     1.2160      .2258     -.1097      .4614
    -1.6180      .2206      .1310     1.6836      .0942     -.0381      .4793
    -1.5087      .2450      .1241     1.9746      .0500      .0000      .4901
    -1.4180      .2653      .1187     2.2359      .0267      .0310      .4997
    -1.2180      .3101      .1080     2.8719      .0046      .0969      .5233
    -1.0180      .3548      .0995     3.5675      .0005      .1584      .5513
     -.8180      .3996      .0937     4.2626      .0000      .2145      .5847
     -.6180      .4443      .0913     4.8652      .0000      .2640      .6247
     -.4180      .4891      .0925     5.2881      .0000      .3065      .6717
     -.2180      .5339      .0971     5.4984      .0000      .3421      .7256
     -.0180      .5786      .1047     5.5272      .0000      .3719      .7853
      .1820      .6234      .1147     5.4360      .0000      .3969      .8498
      .3820      .6681      .1265     5.2818      .0000      .4183      .9179
      .5820      .7129      .1397     5.1036      .0000      .4370      .9887
      .7820      .7576      .1539     4.9234      .0000      .4538     1.0615

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   NCA        TON        INT        .
BEGIN DATA.
```

```
     -.4800     -.7829     4.1735
      .0000     -.7829     4.3691
      .3885     -.7829     4.5273
     -.4800      .0000     4.1270
      .0000      .0000     4.4067
      .3885      .0000     4.6330
     -.4800      .7820     4.0806
      .0000      .7820     4.4443
      .3885      .7820     4.7386
END DATA.
GRAPH/SCATTERPLOT=
 NCA      WITH     INT      BY       TON      .

********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

W values in conditional tables are 1 SD below the mean, the mean, and the
maximum.

NOTE: One SD above the mean is above the maximum observed in the data for W,
      so the maximum measurement for W is used for conditioning instead.

NOTE: The following variables were mean centered prior to analysis:
          TON      NCA

------ END MATRIX -----
```

Ad-Hoc #4: Habits

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	INT[b]	.	Enter

a. Dependent Variable: HAB

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.317[a]	.100	.098	.91889	.100	47.407	1	425	<.001

a. Predictors: (Constant), INT

b. Dependent Variable: HAB

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40.028	1	40.028	47.407	<.001[b]
	Residual	358.850	425	.844		
	Total	398.878	426			

a. Dependent Variable: HAB

b. Predictors: (Constant), INT

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	2.179	.249		8.769	<.001	1.691	2.668		
	INT	.395	.057	.317	6.885	<.001	.282	.508	1.000	1.000

a. Dependent Variable: HAB

VITA.

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2004-2006	Program Manager (AT&T Account) TruePosition, Philadelphia, PA, USA
2006-2009	Senior Product Manager Comcast, Philadelphia, PA, USA
2007-2009	M.B.A., Business Administration and Management Drexel University, Philadelphia, PA, USA
2009	Certificate, Global Capital Leadership University of Pennsylvania, The Wharton School Philadelphia, PA, USA
2009-2014	Program Manager & Consultant Sensus, USA (multiple utility locations)
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2021-2024	D.B.A., Doctor of Business Administration Florida International University, Miami, FL, USA
2024	Higher Education Teaching Certificate Harvard University, The Derek BOK Center for Teaching and Learning, Cambridge, MA, USA
2024-Present	Adjunct Instructor Florida Gulf Coast University - Daveler & Kauanui School of Entrepreneurship, Fort Myers, FL, USA

PUBLICATIONS AND PRESENTATIONS

Academy of Business Research, Fall 2023 International Conference, Education / Management / MIS / Accounting Category - Best Paper Award, *A Latté Challenges: Strategic Adjustments amongst a Global Pandemic, Local Shutdown Orders, and Fiscal Pressures.*

The Fall 2023 International Conference Academy of Business Research Conference, Biloxi, Mississippi, USA, November 15 - November 17, 2023. *A Latté Challenges: Strategic Adjustments amongst a Global Pandemic, Local Shutdown Orders, and Fiscal Pressures*

The 13th Annual Engaged Management Scholarship Conference Doctoral Consortium - Reimagining the Future of Business through Engaged Management Scholarship, Haskayne School of Business, University of Calgary, Alberta, Calgary, Canada, September 7 - September 9, 2023. *Power to the Players: Exploring the Determinants of Acceptance of a Technology-Enabled Gamified Energy Efficiency Smartphone Application – a Scenario-Based Factorial Experiment Study*

Ferguson, I. J., & Desrosiers, G. A. J. (1998). Monitoring Winter Freezing in a Silt Soil in Southern Manitoba, Canada Using Surface DC Resistivity Soundings. Journal of Environmental and Engineering Geophysics, 3(2), 49–61. https://doi.org/10.4133/JEEG3.2.49 (Ferguson & Desrosiers, 1998)