Saving energy at home: Exploring the role of behavior regulation and habit

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ABSTRACT

Global demand for energy, environmental concerns over power generation emissions, and rising household energy costs have heightened interest in exploring ways to reduce energy consumption. Numerous approaches have been adopted including those that build on the important recognition of consumer intentions as a predictor of behavior. However, literature reveals intentions only moderately explain behavior. Accordingly, there is a case for further research exploring how the intention to behavior relationship can be strengthened. In response, this study contributes to a better understanding of how to reduce household energy consumption, by investigating the direct, and moderating effects of both integrated regulation and external regulation, as well as habit, on the relationship between intention and behavior. The study draws upon a large sample of household energy consumers who completed online surveys two months apart. Findings reveal a strong indirect relationship between integrated regulation and behavior via intention, and a significant, direct, and negative relationship between external regulation and behavior. While external regulation moderated the positive relationship between intentions and behavior, the moderating effects of both integrated regulation and habit were non-significant. Furthermore, a direct effect for habit on behavior was found. These findings suggest that regulation types play different roles in affecting consumer intentions and behavior, and furthermore support the importance of habit as a predictor of energy consumption.

Keywords: Consumer, Energy, Environment, Habit, Behavior regulation

Saving Energy at Home: Exploring the role of behavior regulation and habit

1 INTRODUCTION

Human activity is the major source of CO^2 emissions that contribute to global climate change (Oskamp, 2000a, 2000b). The Sustainable Development Goals (SDG) were introduced by the United Nations (UN) in 2015 (United Nations Sustainable Development Goals, 2015). These 17 goals are designed to encourage a range of environmentally sustainable activities including the responsible use of energy to reduce CO^2 emissions, and thereby mitigate the likelihood of climate change. Despite attempts by many of the world's governments to reduce energy consumption, the trajectory continues upward (Global Energy Statistical Yearbook 2019). Globally, household energy consumption accounts for approximately 30% of total consumption, and 20% of CO^2 emissions (OECD, 2011). Finding ways to encourage people to reduce their energy consumption is therefore important.

Research into ways to change peoples' energy use behavior, has previously focused on both price-based (Sexton, Johnson & Konakayama, 1987), and non-price-based approaches (Nguyen et al., 2016; Asensio & Delmas, 2015; Goodhew et al., 2014). However, the effectiveness of these approaches has been mixed (Osbaldiston & Schott, 2012). In most cases only marginal or no behavior change was evident (Barkenbus, 2010; McMakin, Malone & Lundgren, 2002; Henryson, Håkansson & Pyrko, 2000; Katzev & Johnson, 1983). The reasons for mixed outcomes range from poor study design, to incomplete accounts about how to bring about a desired change in peoples' behavior.

To advance our understanding about how to achieve a desired change in behavior, it is necessary to recognize that some behaviors are performed habitually and, consequently, require little in the way of conscious planning and consideration, while others require more conscious planning and intention-setting prior to implementation. It is clear that a complex network of relationships exists between habitually-performed behaviors, intentions, and desired behaviors, which may or may not in themselves be habitual.

The positive relationship between intention and behavior is well established in the literature (Godin & Conner, 2008; Rhode & de Bruijn, 2013; Sheeran & Webb, 2016), as too is the recognition that it takes more than intention alone to bring about a desired behavior (Bagozzi, 1992). Indeed, in this regard the literature reveals intention accounting for only about 28% of the variance in behavior (Sheeran 2002). Accordingly, a clear need remains to explore ways to further strengthen the intentions-behavior relationship .

The study of motivations is considered important to understanding environmental behavior both generally (Osbaldiston & Sheldon, 2003; Lavergne, Sharp & Pelletier, 2010, Moser & Kleinhueckelkotten 2018; Baxter & Pelletier 2020), and for energy saving behavior more specifically (Webb et al, 2013; Sweeney et al., 2014; Li et al, 2017). To this end, Self-determination theory (SDT), a universal needs-motivation theory, is interested in understanding motivation from the perspective of the locus of behavior regulation, that is to say, whether a persons' behavior can be considered internally or externally regulated (Deci & Ryan, 2000).

Our search of the literature reveals that the role of the locus of behavior regulation in respect to the above complex network of relationships has to date only received scant attention. It would be logical to suggest that when a person feels autonomous i.e., more self-regulated, it is more likely

they would act on their intentions than would be the case when they feel externally controlled, a loss of self-regulation. Thus, it is plausible that the locus of behavioral regulation may serve to bridge the intentions-behavior gap. In response and drawing on SDT, this study examined the role different behavior regulation types play on the energy-saving intention and energy-saving behavior relationship.

Academically our study contributes in four ways: first, adopting a time-lagged study design we explore a way to potentially bridge the gap between intention and behavior (Orbell & Sheeran, 1998; Sheeran, 2002; Sheeran & Webb, 2016). Second, we investigate the role of behavior regulation in respect to the relationships between habit, intentions and behavior. Third, by more specifically investigating the moderating role of behavior regulation types on the intention to behavior relationship, and fourth; by advancing the work of van den Broek, Walker & Klöckner (2019) by additionally considering the role of habit in the relationship between intention and behavior. Overall, our study contributes to a better understanding of how to impact positively on human energy consumption behavior.

Beyond the above, we recognize that the identification of the existence of a moderating role for behavior regulation and habit would be of interest to decision-makers looking for ways to reduce energy consumption. These would include: marketing managers within energy providing firms, environmental policy makers at regional, national, and international levels, and likewise for consumers interested in learning how they can reduce their energy consumption. The existence of a moderating effect suggests ways to transform consumer intentions into behavior and, offers potential ways such groups might encourage desired energy consumption behaviors.

The overarching question guiding this study was:

How do behavior regulations and habit influence consumer intentions and subsequent engagement in energy saving behavior?

This rest of this paper is organized as follows. First, we discuss relevant published research and the theoretical background associated with the prediction of human behavior. Specifically, we use self-determination theory (SDT), a universal needs-motivation theory to study the effect of behavior regulation types on the relationship between intention and energy saving behavior. In addition, we build on an SDT derived model to consider the role habit plays in energy saving behavior. Our literature review highlighted the relevance of exploring both foundational as well as moderator relationships. This led to the development of six hypotheses suggesting an underlying model that was estimated using data obtained from a large panel of energy consumers who participated in a time-lagged study. These aspects are discussed in subsequent sections, after which the results are summarized and the findings and their implications for future research, policy and practice are discussed.

2 THEORETICAL BACKGROUND

The suggestion that intention is an important predictor of behavior can be examined from several theoretical perspectives. These include the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980), the theory of planned behavior (TPB) (Ajzen, 1985; 1991), protection motivation theory (PMT) (Maddux & Rogers, 1983), Triandis's (1980) model of interpersonal behavior (MIP), and Stern's (2000) value-belief-norm theory (VBN). Intentions capture the factors that influence behavior (Ajzen, 1991). However, as Bagozzi noted (1992, p. 178), they are, "alone not a sufficient impetus for action." Nevertheless, intentions have generally predicted an array of behaviors in many contexts (Sheeran, 2002). In relation to environmental behavior, and specifically energy-

saving behavior, the importance of intentions continues to receive wide acknowledgement (e.g., Bell et al., 2016; Gao et al., 2017; Park & Kwon, 2017; Wang et al., 2018; Yue et al., 2020).

In turn, many studies have advanced theoretical understanding of the predictors of intentions, such as might relate to energy saving (e., Gao et al., 2017; Wang et al., 2018; Ru, Wang & Yan, 2018; Li et al., 2017; Liu et al., 2020). However, in the context of energy-saving, less research has explored the behavioral consequences of intentions. A notable exception was Park and Kwon's (2017) study, which found a significant and positive relationship between intentions and energy saving behavior. By comparison, Zhang et al., (2018) found only a moderate relationship between intentions and energy saving behavior, while based on a study in urban China, Yue et al (2020) offered a cautionary note on the intention-behavior relationship in the absence of any supporting external policy.

Despite the above cautionary note, conceptually it makes sense that the stronger a person's formed intention to engage in a behavior, the more likely it is that they will engage in it. We accept the strength of the relationship may be greater in some contexts and under some conditions than perhaps in others. However, in respect to household energy saving, we see few obstacles preventing people from both possessing the intention to engage in household energy saving activities and from carrying them out. Accordingly, the following hypothesis is suggested:

H1. Consumers' intention to engage in energy saving behavior is positively related to their subsequent engagement in energy saving behavior.

Aside from this hypothesized relationship, prior research reveals consumers may hold strong intentions and yet fail to translate these into action (Grimmer & Miles, 2017; Harris & Hagger, 2007). Proverbs such as, "the smallest good deed is better than the grandest intentions," highlight society's understanding of this notion, and may suggest why meta-analytic studies have found

intentions accounting on average for just 28% of the variance in behavior (Sheeran, 2002). Although this is a sizeable proportion, clearly much variance remains to be explained by other factors, with some of these having yet to receive consideration. Consequently, identifying the factors that might increase the likelihood intentions translate into action would be valuable in the development of behavioral change initiatives.

Some researchers have investigated the conditions under which the intentions-behavior relationship is strengthened or weakened (Webb & Sheeran, 2006). Attention has also been given to the role played by constraining variables such as knowledge (e.g., about energy-saving practices and technology), income, energy costs and barriers in relation to influencing energy consumption (Niemeyer, 2010). In addition, practice-based models (Sweeney et al., 2013) have explored how social and cultural factors, such as knowledge, norms, technologies, and situational factors, interact with motivational factors, such as costs, barriers, and support, to influence energy-saving behaviors. Further, with motivation strongly linked to pro-environmental behaviors (De Groot & Steg, 2010; Green-Demers, Pelletier & Ménard, 1997), and recognizing the connection between motivation and the regulation of behavior (Ryan & Deci, 2000), we turn now to consider the role of different behavior regulation types in respect to behavior.

2.1 Behavior regulation

Motivation acts as a mechanism for changing or sustaining behavior. Ryan and Deci (2000) suggest motivation moves people to do something, and this can happen through different enacting forces. A person can be motivated to act because of some external controlling influence or, alternatively, through more inwardly endorsed motives, such as personal interest or personal values. These examples represent the distinction between more externally regulated motivation

types, and more internally regulated motivation types that are a central aspect of SDT (Deci & Ryan, 1985). Research suggests that people are intrinsically motivated when they do something because it is more inherently interesting and/or enjoyable, and they are extrinsically motivated when a separable outcome is involved (Ryan & Deci, 2000). In SDT, extrinsic motivation is represented by four behavior regulation types differing in the extent to which they are personally internalized. Thus, regulation types are often presented along a self-determination continuum according to level of internalization (Deci & Ryan, 2000). This is illustrated in Figure 1.

INSERT FIGURE 1 ABOUT HERE

The greater the internalization, the more self-regulated a behavior. The most self-regulated type of extrinsic motivation is *integrated regulation*, which reflects behaviors congruent with personally endorsed values, goals and needs that already form a part of the self (Ryan & Deci, 2002). Thus, integrated regulation is about internalizing the value of an activity and incorporating it into a sense of self (e.g., "this is me"). The least self-regulated type of extrinsic motivation is *external regulation*, which reflects behaviors fully carried out to satisfy external demands or reward contingencies (Ryan & Deci, 2002). Accordingly, with external regulation there is no internalization.

The behaviors associated with saving energy at home are not necessarily those that many would describe as interesting, and/or enjoyable (e.g., switching lights off or putting an extra sweater on to keep warm). Thus, intrinsic regulation is less relevant in energy saving contexts. However, the behaviors associated with actions to save energy could reflect those many consider internally consistent with their self-concept (i.e., where the regulation of behavior is integrated into a sense of self that is consistent with the action of saving energy). For others, these behaviors

might be carried out to gain a reward (e.g., a reduced energy bill), or avoid punishment (e.g., an increased energy bill), suggesting external regulation. Emphasizing the most and least self-regulated forms of extrinsic motivation, this study explores both integrated regulation and external regulation and their effect on the intention-behavior relationship.

2.2 The effects of integrated and external regulation on energy saving intentions and behavior

Prior research highlights the role behavior regulation plays as a predictor of behavioral intentions (Bagozzi, 1992). Osbaldiston and Sheldon (2003) found a significant and positive relationship between integrated regulation and future intentions to engage in environmental goals. Standage, Duda and Ntoumanis (2003) found a positive relationship between 'self-determined motivation' (their label for a combination of intrinsic regulation and integrated regulation) and leisure-time physical activity intentions. Ferguson et al. (2015) also found a positive relationship between integrated regulation, external regulation and online and offline charitable event support intentions, with a stronger positive relationship between integrated regulation and charitable event support intentions. Conversely, Gardner and Lally (2013) found strong significant positive relationships between intrinsic regulation and physical activity intentions, but weak and non-significant, albeit negative, relationships between external regulation and physical activity intentions.

Commitment is important to intentions. For example, studies have shown that the more a person is committed to a pro-environmental action the more willing they are to make sacrifices for the environment (Rahman & Reynolds, 2016). Further, Thøgersen (2000) found that individual willingness to make sacrifices for the environment positively influenced the attention paid to an eco-labelled product, and in turn to pro-environmental behavior intentions. Accordingly, when the

source of commitment is internalized, as in the case where the locus of regulation is integrated, the stronger will be an individual's resolve and intention. Alternatively, when the origin of the source defining commitment is externally regulated, it will likely be at a lesser level, even though some positive intention to act may exist.

In summary, prior research and our reasoning suggest the effects of both integrated regulation and external regulation on energy saving intentions will be positive and, moreover, that it will be stronger in the case of integrated regulation than in the case of external regulation. This suggests the following hypotheses:

H2a. There is a positive relationship between integrated regulation and energy saving behavior intention.

H2b. There is a positive relationship between external regulation and energy saving behavior intention.

H2c. The relationship between behavior regulation and energy saving intention is weaker for external regulation than it is for integrated regulation.

The research findings relating to the relationship between behavior regulation and behavior is mixed. For example, studies have found significant positive relations between integrated regulation and energy saving (Sweeney et al., 2014; Vallerand & Ratelle, 2002). Similar findings have also been found between engagement in environmental product purchase behavior and environmental self-education and activism behavior (Green-Demers, Pelletier & Ménard, 1997; Seguin, Pelletier, & Hunsley, 1998), as well as more difficult curb-side recycling and recycling away from home behaviors (Green-Demers, Pelletier & Ménard, 1997).

However, prior studies have also found a significant positive relationship between external regulation and the frequency of pro-environmental behaviors (Lavergne et al., 2010). Also, a positive, although non-significant, relationship has been found between external regulation and environmental self-education (Green-Demers, Pelletier & Ménard, 1997), and a negative, although non-significant relationship, between external regulation and engagement in recycling and environmental product purchase behavior (Green-Demers, Pelletier & Ménard, 1997).

When a person's motivation to engage in a behavior is internally regulated, the likelihood of implementation is stronger not only because it is carried out with greater autonomy (Deci & Ryan, 2000), but also because the person has internalized the behavior. In addition, we can also imagine that when a person's motivation toward a particular behavior is externally regulated (e.g., gaining a price discount on the energy bill) there will also be a positive relationship. However, in the latter case, the relationship is likely to be weaker because integrated regulation is generally associated with greater persistence, positive affect, enhanced or more frequent performance and greater psychological well-being, than is the case for external regulation (Deci & Ryan, 2008). This suggests the following hypotheses:

H3a. There is a positive relationship between integrated regulation and energy saving behavior.

H3b. There is a positive relationship between external regulation and energy saving behavior.

H3c. The relationship between behavior regulations and energy saving behavior is weaker for external regulation than it is for integrated regulation.

Logically, a person's intention to engage in an identified behavior and their engagement in that behavior are influenced by a variety of factors, including the reasons why they intend to engage in the behavior. Asking both *whether* and *why* consumers intend to engage in behavior may be a better way to predict their behavior than asking whether they intend to engage in a behavior. The rationale behind such a proposition can be explained through reference to self-regulation. For example, Muraven, Rosman and Gagné (2007) found self-regulation requires more effort when people are in a 'less self-determined motivation' state than when they are in a 'more self-determined motivation' state. As energy-saving behaviors require some degree of self-regulation, it is likely the self-regulation of energy-saving behaviors will be more successful when the regulation of behavior is more internalized (i.e., integrated). It is also likely the completion of intentions will be subject to fewer barriers for such consumers than for those whose behavior is externally regulated. Thus, intentions are more likely to lead to behaviors when the locus of regulation is integrated than when consumers are externally regulated.

Providing support for this argument, Webb and Sheeran (2006) suggested moderators of the intention-behavior relationship fall into three classes (conceptual factors, measurement features and study characteristics). Of relevance here is the recognition that conceptual factors are "theoretically specified variables that are predicted to affect how well intentions are realized in behavior" (Webb & Sheeran, 2006, p. 252). Of these, *volitional control*, which is associated with the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980), seems to be important in the prediction of behavior through intentions. It is worth noting that, while "the theory of reasoned action was designed to predict volitional behaviors, or behaviors over which an individual has a good deal of control" (Webb & Sheeran, 2006, p. 249), not all behaviors are volitional.

Sheeran, Norman and Orbell (1999) drew a parallel between Ryan et al.'s (1996) autonomous (self-regulated) motivations and controlled (externally regulated) motivations and Trafimov and Finlay's (1996) distinction between attitudinally and normatively controlled participants. Sheeran, Norman and Orbell (1999) argued attitudinally controlled intentions have an internal locus of causality (i.e., they are self-chosen or autonomous). Consequently, they should be better predictors of behavior than normatively controlled intentions that arise from pressures external to the self (i.e., have an external locus of causality). Consistent with their argument, Sheeran, Norman, and Orbell (1999) found stronger intention-behavior correlations among attitudinally than normatively controlled participants.

Despite this evidence, other studies examining the moderating role of behavior regulations are less conclusive, which may be explained by methodological, rather than conceptual, reasons. For example, although Chatzisarantis and Biddle (1998) found no evidence to suggest behavior regulations moderate the intention-behavior link, their finding may be due to those authors using the Relative Autonomy Index (Connell & Ryan, 1985), which confuses the origin of regulation by combining them to form an index (Howard, Gagné & Bureau 2017, Howard et al., 2020).

Although Chatzisarantis and Biddle (1998) found no evidence of a moderating role, their argument about the importance of the stability (the continuity of task engagement) of intentions in respect to behavior, offers some support for Sheeran, Norman and Orbell's (1999) suggestion. Specifically, Chatzisarantis and Biddle (1998, p. 318) argued that, "under controlling forms of behavior regulation (i.e., normatively controlled, external regulation), intention is less likely to predict behavior because intentions may be unstable (*discontinuous* – added by current authors). The reason for this is because controlling events contributing to intention motivate individuals to act in an unstable (*discontinuous*) manner. In contrast, under non-controlling forms of behavior

regulation, thus when attitudinally controlled (self-regulated and autonomous), intention is more likely to be stable because the informational factors contributing to intention formation reflect an ongoing motivational sequence". This suggests the following hypotheses:

H4a. The higher a person's integrated regulation, the stronger will be the relationship between intention and energy-saving behavior.

H4b. The stronger a person's external regulation, the weaker will be the relationship between intention and energy-saving behavior.

There is also considerable evidence to suggest intention realization, which is the extent to which behavior can be described as habitual, might create a form of automaticity as people repeat activities under stable conditions (Verplanken & Wood, 2006; Gardner, 2012), in which the need to form or keep explicit intentions to act and the expenditure of self-regulation capacities is reduced. However, as Sheeran (2002) notes, not all frequently performed behaviors become habitual. Indeed, Ouellette and Wood's (1998) meta-analysis suggests the more unstable the context, the better intentions predict behavior.

Wood, Quinn and Kashy, (2002) also note the importance of context stability; an issue examined by Webb and Sheeran (2006, p. 257), who found that, "intention change had less impact on behavior change when circumstances supported the development of habits as compared to when circumstances did not support habit formation." De Bruijn et al. (2007) also found habit has a significant negative moderating effect on the intention-behavior relationship, with the strongest relationship between intention and behavior being exhibited by a low habit group, the next strongest by a medium habit group while the relationship for the high habit group was non-significant. This finding has received support in more recent research (e.g., Jing, Zhi-cai & Lin-

jie, 2014). Intention and habit also seem to have a direct and significant positive impact on behavior (Klöckner & Oppedal 2011; Klöckner 2013). Sweeney et al. (2013) noted the importance of habit in an energy savings context, and Lo et al. (2014) found habit was the strongest predictor of some energy saving behaviors. This research suggests the following hypotheses:

H5. Habit is positively related to energy-saving behavior.

H6. The stronger the habit, the weaker the relation between intention and behavior.

Hypothesized relationships are depicted in Figure 2.

INSERT FIGURE 2 ABOUT HERE

3 METHOD

In approaching this research, consideration was given to measurement and design issues that may have detrimentally impacted other reported studies. These included conflicting evidence about the efficacy of the RAI measurement approach (Howard et al, 2020; Sheldon et al., 2017), and the use of cross-sectional designs when exploring the intention-behavior relationship (Webb & Sheeran, 2006). Consequently, the present study used independent measures of integrated regulation and external regulation and adopted a time-lagged design in which data were collected over two time periods spaced two months apart.

3.1 The sample

An initial targeted population of 2,000 Australian energy users from different households were contacted through two online panel providers and invited to participate in an online study about household energy saving. A total of 510 people agreed to participate (initial response rate = 26%).

Of these, 433 (overall response rate = 22%) completed the survey over two time periods spaced two months apart, representing an 85% retention rate from period 1 to period 2. Although the sample was primarily female (71%), most (88%) were responsible for paying the electricity bill in their household. This suggests they were the appropriate respondents for this study. Each survey followed the same structure and asked about participants' intentions with respect to energy saving at home, the locus of behavior regulation and habits with respect to energy saving and their energy-saving behaviors.

3.2 The measures

The measures used have previously demonstrated acceptable measurement properties. However, some minimal changes to item wording were necessary to fit this study's energy saving context. The full list of items used is provided in the Appendix and, unless otherwise noted, all were measured using a Likert-type scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*),

Both integrated regulation and external regulation were measured at time 1 using items adapted from Pelletier et al.'s (1998) Motivation toward the Environment Scale (MTES). External regulation was measured through two items, while integrated regulation was measured through three items. *Habit* was measured at time 1 through four items adapted from Verplanken and Orbell's (2003) self-reported index of habit strength scale. *Energy-saving intentions* for the coming two months were measured at time 1 by three items adapted from Perugini and Bagozzi's (2001) scale. *Behavior* was measured at time 2 (2 months later) through four items that reflected specific activities an Australian energy utility provider suggested are important in reducing household energy consumption (Synergy, 2020). In this case, participants rated the extent to which they performed these behaviors on a scale that ranged from 1 *(Never)* to 7 *(Always).*

3.3 An overview of the analysis

The data analysis was undertaken in several ways using the Statistical Package for the Social Sciences (SPSS). As the model would have potentially been unidentified had a covariance-based approach been used (Hess, 2001; Bollen, 1989), it was decided to use a partial least squares (PLS) approach to estimate the model. In this case, the PLS linear regression procedure contained in the WARP-PLS 7.0 software program (Kock, 2020) was used. PLS is a particularly useful statistical program in such a situation and uses a bootstrapping approach that reduces concerns about the distributional properties of the data being used to estimate a model (Kock, 2010; Garson, 2014).

4 RESULTS

Prior to examining the hypothesized relationships, some preliminary descriptive statistics are provided. Table 1 shows the means, standard deviations, composite reliabilities, AVE scores and inter-correlations for the constructs included in the model. The mean scores suggested that, on average, respondents were not very externally regulated, as the mean was well below the midpoint of the seven-point scale. Further, on average, respondents had high integrated regulation, positive intentions, good energy-saving behavior, and habit, as all these means were well above the midpoint of the scale. This may reflect the fact that respondents volunteered to participate in a time-lagged study about household energy saving behavior. Such individuals had to make a significant time commitment to the study, and we would expect many to be interested in the research or value energy conservation.

INSERT TABLE 1 ABOUT HERE

All constructs had reasonable standard deviations (ranging from 0.87 to 1.63), suggesting there was enough variation in the data to make it useful to estimate the suggested model. In addition, all the scales were reliable, as the CR scores were all above 0.80 and all the constructs had convergent validity, as the AVE scores all exceeded 0.50 (Fornell & Larcker, 1981). Further, all constructs had discriminant validity, as the AVE scores for each pair of the multiple-item scales were all greater than the squared correlations between them (Fornell & Larcker, 1981) and all the HTMT ratios were well below the suggested 0.85 level (ranging from 0.05 to 0.63) (Henseler, Ringle & Sarstedt, 2015). Furthermore, the full collinearity VIF scores were all well below the recommended maximum of 3.3 (ranging from 1.10 10 1.83) suggesting the model can be considered free of common method bias (Kock, 2015). Consequently, the constructs all had good measurement properties and could be used with confidence in estimating the hypothesized model.

4.1 Examining the hypotheses

As can be seen in Table 1, there was strong support for H1, as there was a significant positive relationship between consumer intentions to engage in energy saving behavior and subsequent engagement in such behavior. Strong support was also found for H2a, as integrated regulation positively influenced intentions to engage in energy-saving behavior. However, the relationship between external regulation and intentions to engage in energy-saving behavior while positive as expected was not significant. Thus, H2b was not supported. The difference between the two correlations was assessed using Fisher's r-to-z transformation, which was 5.30 in this case, suggesting integrated regulation did indeed have a stronger relationship with intention than did external integration, providing support for H2c.

While H3a, which tested the direct positive relationship between integrated regulation and energy-saving behavior, was supported, this was not the case for H3b, which tested the direct positive relationship between external regulation and energy-saving behavior. The difference between the two correlations was again assessed using Fisher's r-to-z transformation, which was 5.10 in this case, suggesting integrated regulation also had a stronger relationship with behavior than did external regulation, providing support for H3c.

The moderating effects suggested in subsequent hypotheses were examined by estimating the model informed by the various hypotheses. As the constructs were all measured using several items, a variance-based structural equation approach (partial least squares) was used within the WarpPLS statistical software program. PLS models do not generally have the range of goodness of fit measures suggested for covariance-based procedures. However, Tenenhaus, et al., (2005) have suggested a goodness of fit (GOF) index, which is computed as the square root of the average variance extracted score for the model's constructs and the average R-squared for all the endogenous constructs. Wetzels, Odekerken-Schroder and Van Oppen (2009) suggest a GOF value of 0.36 implies there are large effect sizes in the model and that it is performing well. In this case the GOF was 0.44, suggesting it was worth examining the model in detail, especially as the proposed model explained 24% of the variation in respondents' behavior. The results of this analysis can be seen in Table 2.

INSERT TABLE 2 ABOUT HERE

A significant moderating effect was only found for external regulation, as the suggested moderating effects for integrated regulation and habit were not significant. However, the finding of a moderating effect for external regulation in respect to intentions and behavior was in the

opposite direction to our initial conceptualization (Figure 3), and thus, H4a, H4b and H6 were not supported. Finally, H5 was supported as there was a strong positive relationship between habit and energy-saving behavior.

INSERT FIGURE 3 ABOUT HERE

5 DISCUSSION

This study explored several relationships between the included constructs. To provide a foundation, the relationship between consumer intentions to engage in energy saving behavior and subsequent energy-saving behavior was explored. The study also investigated the roles of integrated and external regulation and that of habit in influencing consumers to engage in energy saving behavior. Six hypotheses were suggested to examine the guiding question, which led to the estimated research model, which in turn led to five main findings.

First, this study found a positive relationship between intentions to engage in energy-saving behavior and subsequent behavior. This finding supports the influential role of intentions as a predictor of energy saving behavior (Webb et al., 2013; Gao et al., 2017). This is helpful as it reinforces the importance of obtaining consumers' commitment to the behavior of saving energy, as well as indeed highlighting the usefulness of providing consumers with opportunities to plan, an expression of commitment, how they might go about reducing their energy consumption. The importance of planning as an important self-regulatory mechanism supporting energy saving behavior has elsewhere been well supported (Gollwitzer & Sheeran, 2009; Bell et al., 2016).

Second, and consistent with expectations, the direct relationship between integrated regulation and energy-saving behavior was positive and significant. This supports the important role of self-

regulation in achieving a desired behavior (Deci & Ryan, 2000). However, the direct relationship between external regulation and energy-saving behavior was negative and non-significant. This does not support our hypothesis. This suggests that when the locus of a person's regulation is external, behaviors are less self-regulated than they would be under conditions of greater internalization. What this means is that, while people may be guided by external factors in their energy saving behavior, desired behaviors can best be supported when the value of such behavior is internalized as would be the case when self-determined.

Third, a strong positive relationship was found between integrated regulation and energy-saving behavior through intentions. However, the same indirect relationship was not significant for external regulation. Indeed, Satterthwaite's (1946) test suggested the path to intentions was stronger for integrated regulation than for external regulation. This suggests intentions to engage in energy-saving behavior are better supported by greater self-regulation and, that the more self-regulated consumers are, the more committed they are to engage in purposeful energy planning i.e., to form intentions about their energy-saving behavior.

Fourth, the relationship between habit and energy saving behavior was positive and significant. This is consistent with the findings of Sweeney et al. (2013) and Lo et al. (2014). It suggests that the more consumers perceived their energy saving behavior to be habitual, the more likely they were to subsequently engage in such behaviors. While at first glance this statement may appear tautological, the identification of a positive habit to behavior relationship reinforces for all actors involved in the provision of energy services, that finding ways to support the habituation of desired pro-environmental behaviors, such as saving energy, is indeed valuable. In this regard, and building on SDT as a framework, it seems self-regulated energy saving behaviors are more likely to be sustained over the long-run (Green-Demers, Pelletier & Ménard, 1997; Moller, Ryan & Deci,

2006). In other words, finding ways to reinforce the internalization of energy saving behavior would again be advantageous, and would follow on from the implementation of desired behaviors directly and indirectly via habit reinforcement.

Fifth, while external regulation had a positive moderating effect on the energy-saving intentions-behavior link (i.e., the relationship between intention and behavior was stronger for consumers who were more externally regulated), this was not the case for integrated regulation nor was it the case for habit. Therefore, while integrated regulation is critical to intentions, and intentions are critical to energy saving behavior, external regulation can increase the effect intentions have on behavior.

Even though our hypothesis about the effect external regulation had on the relationship between intentions and energy-saving behavior was not supported, on reflection, our finding of a moderation effect is in line with something else that could be expected. For example, when intentions are low, adding incentives may not help. Indeed, it could make things worse. Thus, if a person's locus of regulation is primarily external i.e., if they don't intend to engage in energy-saving, they won't. However, if the level of external regulation is low, and if they have some intention to engage in energy-saving behavior, they still might.

In summary, this study's findings suggest all actors involved in the provision of energy services should identify ways to reinforce the internalization of desired behaviors by consumers. This can be achieved by creating a personal identity around the behavior (e.g., by enabling personifications such as "I'm an energy saver", "I'm a conservationist"), as well as finding ways to connect with like-minded others. At the same time, recognizing that external regulation has a role to play in reinforcing the intentions to behavior relationship, it can also be suggested

consumers motivated by external factors should not be ignored in provider-to-consumer communications content.

5.1 Practical and theoretical implications

Considered together with existing knowledge, our findings have implications for practice and theory. From a practical perspective, government agencies, energy utilities and others seeking to promote more sustainable energy-consumption practices could consider developing strategies targeted to both regulation types, as integrated regulation enhances energy saving behaviors through intentions and external regulation positively enhances the effect intentions have on behaviors. Thus, both types of regulation have positive effects on energy saving behaviors, although in different ways. The contribution of this finding is significant in that it potentially provides an opportunity for practitioners and policy makers to be guided more pointedly in respect to activity decisions across behavior regulation types. This begs the question, what might such strategies involve?

5.1.1 External regulation – economic considerations

External regulation may be influenced by a sense of reward that could come from receiving a reduced energy bill through discounts or rebates, or through avoiding an infringement notice for consuming energy during restricted periods. Emphasizing potential cost savings accrued by following more energy-consumption saving behaviors, with examples of the most financially efficient and, indeed, the individual and collective benefits associated with consuming energy during non-peak periods, are examples of this general idea. However, household income is likely to play a role in determining whether some consumers engage in energy saving and the purchase of low-energy consumption appliances. For example, Cayla, Maizi and Marchand (2011) found

low-income households did not have the financial resources to invest in more energy efficient household devices.

By comparison, higher income households often lack the incentive based on economic factors alone to change behavior. For this higher income group, Cayla, et al., (2011) suggest appealing to non-economic attributes, such as simplicity, comfort, and aesthetics, to encourage behavior change. This is consistent with OECD (2011) research that suggests high income households are less likely to trade comfort and time for energy savings or to invest in more energy efficient technologies to achieve savings. Ultimately, it is important that external regulation sources, such as price and government policy, are promoted together with integrated regulation sources, given the interactive nature of external regulation and intentions on behaviors and the strong connection between integrated regulation and intentions. This may include emphasizing wider environmental issues to promote integrated regulation and underlie such information with messages about cost and government policy.

5.1.2 Integrated regulation – environmental considerations

The strong correlation between integrated regulation and habit (0.59, Table 1), suggests integrated regulation may reflect the path taken toward a behavior becoming habitual, that is, no longer requiring self-regulation. Integrated regulation describes the enactment of a behavior, which becomes assimilated into a consumers' sense of self, and therefore a part of their ongoing identity (Howard et al., 2020). Therefore, to extend energy-saving behavior, interested actors such as government agencies and utility providers would be advised to explore ways for consumers to engage with other like-minded consumers. This would likely serve to reinforce a person's own energy-saving behavior. Social media forums focusing on environmental or cost-saving behavior

either managed or sponsored by government agencies or energy utilities represents one such approach consistent with this idea (Webb et al., 2013; Sweeney et al., (2014).

Consistent with Sweeney et al. (2014) suggestions, this might include establishing an internet-platform through which consumers could engage with other consumers on energy-saving topics. Indeed, in conversations with consumers actively seeking ways to save energy at home, we heard of the inspiring example of a mother, who having interacted with other consumers online, had invented a game in which her children enjoyed competing to see who could identify the most ways to save energy. This was an innovative motivating way of engaging children in energy-saving behavior, which supported the internalization of energy saving values. Other examples globally, of consumers working together with other consumers to save energy can be witnessed in a variety of neighborhood initiatives, many of which build on induced competition (Swann, 2019) and social norm message development (Burchell, Rettie & Roberts, 2016). Indeed, as Jachinowicz et al (2019) argued: 'people use less energy when they think their neighbors care about the environment'.

5.1.3 Reducing barriers to behavior change and habit formation

Government agencies and energy utilities also need to find and implement ways to minimize the barriers consumers experience when engaging in desired pro-environmental behaviors as well as support the habituation of such behaviors (Green-Demers, Pelletier & Ménard 1997). In a household energy-saving context, this could include reducing the complexity associated with performing a recommended energy-saving behavior. An example might include recommending to electricians that power-point wall socket placement not be located so access is physically challenging.

Press and Arnould (2009) suggest government regulators and energy utilities have a role to play not only in encouraging household energy consumption through pricing mechanisms, such as rebates for energy efficient devices, but also for marketing campaigns that position energy saving as a socially, culturally, environmentally, and economically responsible behavior. The results from our study support these suggestions.

5.1.4 Understanding pro-environmental behavioral regulation

In addition to these contributions to policy and practice, our findings also contribute to the theoretical knowledge base in the field of SDT research. In SDT research, behavior regulation is often conceptualized on a continuum (Figure 1). Previous studies have often operationalized behavior regulation by subtracting controlled types of regulation from more self-regulated types. Our results concur with Howard et al.'s (2020) results, by demonstrating the importance of treating the different regulations independently as they affected energy saving behaviors in different ways. Thus, while integrated regulation was indirectly related to behavior through intentions, external regulation moderated the relationship between intentions and behavior.

5.2 Study limitations and directions for future research

Although the design of this study offered several improvements over previous studies, it is not without its limitations. First, the self-report nature of the survey-design may have allowed social desirability response bias to affect responses. However, given the variability in the data, we suspect the presence of response bias to be minimal. However, to minimize possible response bias in respect to reported energy-saving behavior, future researchers might use actual energy

consumption data. We acknowledge this is not easy, as it requires consumers providing access to their power bills, which our experience suggests not all consumers retain. Alternatively, it requires consumers to give permission to the utility provider to make such information available for research purposes, which raises a few information-privacy challenges.

In addition, the use of self-report variables may raise concerns about common method bias, although obtaining data at different time points, as we did, can mitigate this problem (Podsakoff et al., 2003). Indeed, as mentioned in the method section, all the VIF scores in this study were well below the recommended maximum, suggesting common method bias was not an issue.

While a prospective design was used, this study did not measure energy-saving behavior in Time period 1, which limits causality inferences. Moreover, this study did not measure intentions and behavior regulation in Time period 2, precluding cross-lagged analyses to test alternative models of inferred causality. Other relationships could have been tested with data on all variables at all time-points. For example, some studies have suggested high self-regulation may lead to higher intentions to act (e.g., Lin, 2007; Pelletier et al., 1995). With appropriate time-differentiated data it would be useful to explore the relationships between behavior regulation and future intentions.

Also, although the influence of energy cost was not investigated, it is possible consumers may be differently motivated when the cost of energy is more tangible and perhaps of greater personal financial importance, as might be expected in a private household setting in which consumers are personally responsible for the costs of energy consumed. Further, given high workplace energy consumption, it would be useful to extend this study to organizational settings in which energy costs are often not an individual's direct responsibility. It would also be useful to include a range

of socio-economic and demographic variables to investigate the presence of consumer clusters. In addition, alternative variables, and approaches (e.g., experimental studies focused on communication strategies or technology/apps helping to engage in energy saving behaviors) may likewise provide additional guidance on how to help reduce energy consumption.[1]

Our study is among the few to explore the potential moderating role of behavior regulations on the intentions to pro-environmental behavior relationship. In this regard we only explored two: integrated and external regulations. Accordingly, further research to validate our findings and to explore the presence of a moderating effect for other regulation types (intrinsic, identified and introjected regulation) on the intentions to behavior relationship would be insightful. Moreover, given that our findings reveal a different relationship existing between both integrated and external behavior regulation and energy-saving behavior, not only does this suggest a need to explore the relationships discussed in this pro-environmental area with the other regulation types, but moreover, it reinforces the need for further research to explore the potentially differentiated impacts of all behavior regulation types across the wide variety of context areas of interest to SDT scholars.

Finally, given Green-Demers, Pelletier & Ménard (1997) findings about behavior complexity, it would be useful to explore how any revealed effects change across a range of behaviors differentiated by complexity.

6 CONCLUSIONS

[1] We thank an anonymous reviewer for this suggestion.

Despite its limitations, this study makes several meaningful contributions. First, it highlights the different roles integrated and external regulation play in influencing consumer energy-saving behavior. While these findings suggest external regulation moderates the intentions-behavior link, the direct relationship between external regulation and energy-saving behavior was negative. Second, the strongest path from behavior regulation to energy-saving behavior was for integrated regulation through intentions. This suggests consumers who are more self-regulated form stronger intentions about future energy-saving behavior than those who are more externally regulated. This finding is particularly relevant, as it highlights the importance of supporting more autonomous forms of decision-making that would include, among others, removing perceived barriers to saving energy.

Third, the strong positive path between habit and energy-saving behavior, while not surprising, reinforces the importance of using a communication style that supports the repetition of desired behavior. Of course, for such repetition to take place, potential barriers to action need to be removed and energy consumers need to feel more self-determined in their energy-saving behavior. Overall, equipped with this new knowledge, energy utilities, government bodies and other interested actors should be able to better craft the ways they communicate with consumers to change their energy-saving behavior in the desired direction over the long-term.

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FIGURES

Figure 1 - Self-determination continuum: Motivation types, their regulatory styles, and the nature of their regulations (Deci and Ryan, 2000)

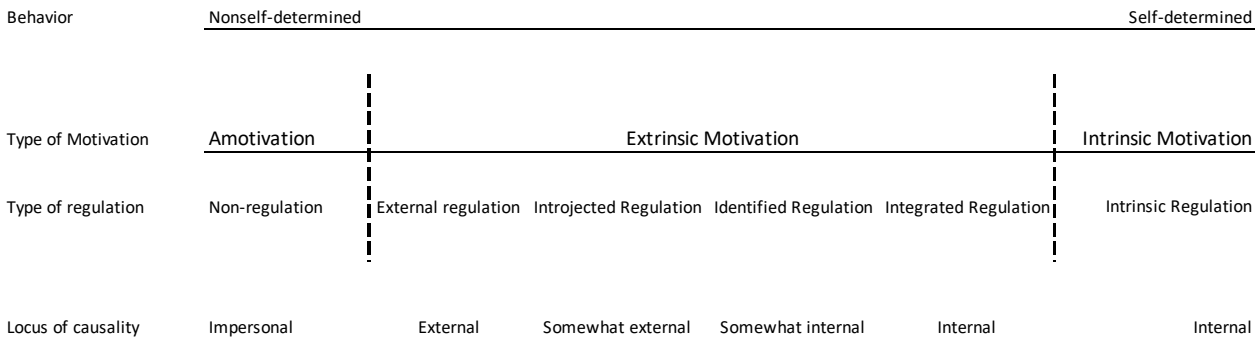
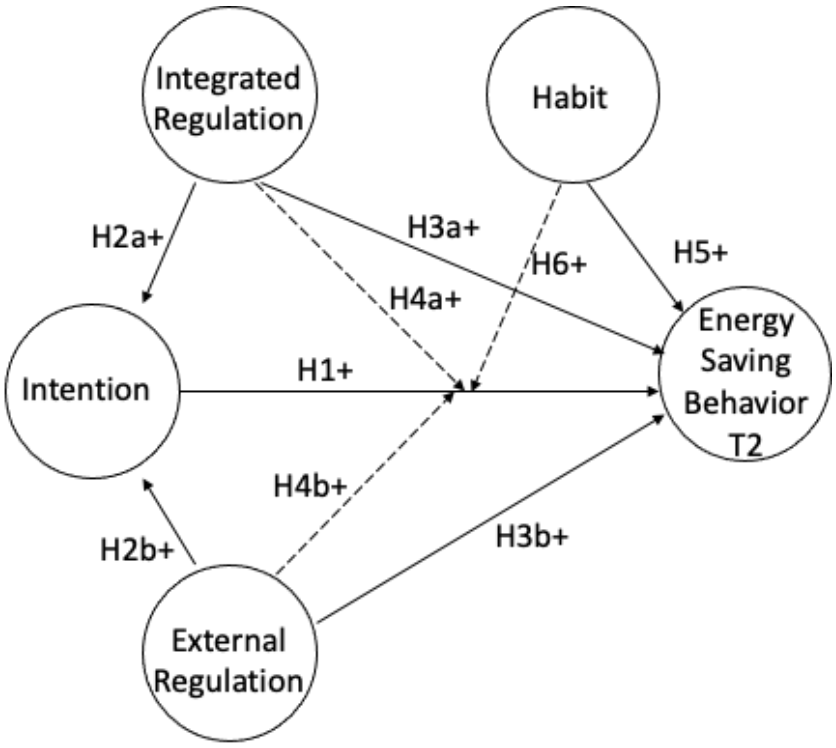


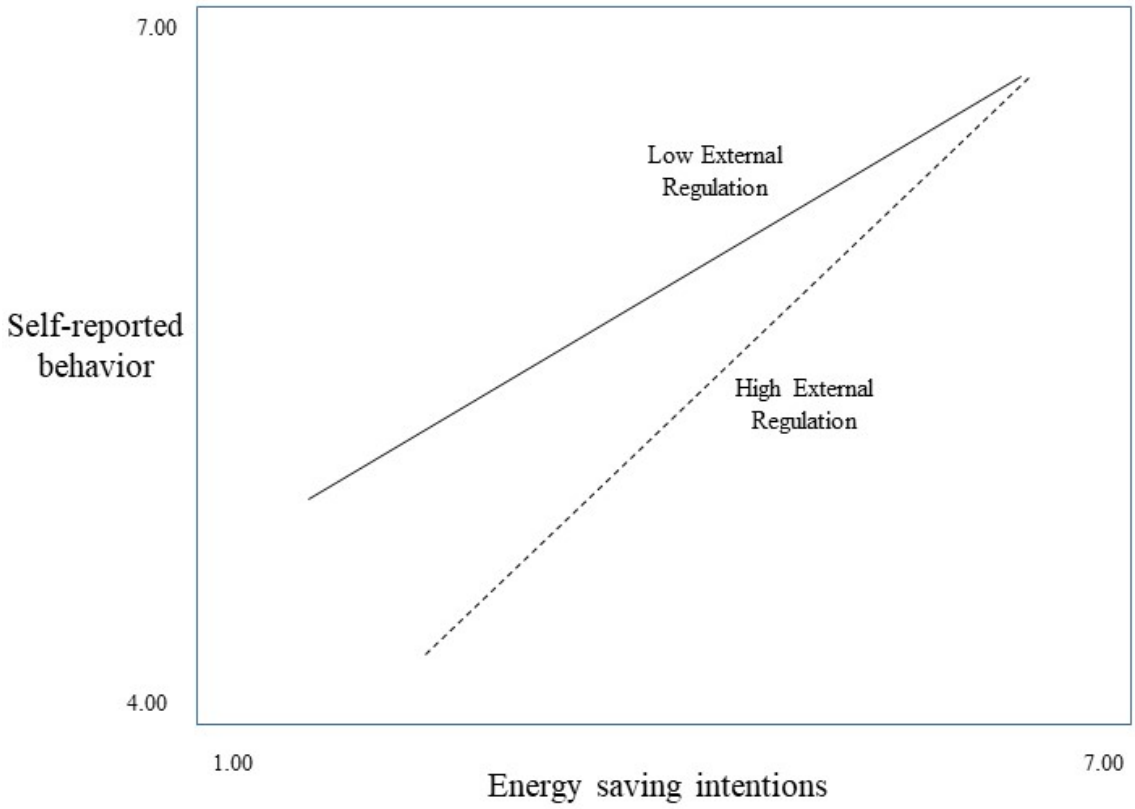
Figure 2: Hypothesized relationships



Key:

- Solid arrows reflect direct relationships
- Dotted arrows reflect moderating relationships

Figure 3: Interaction



TABLES

Table 1: Descriptive Statistics

Variable	M	SD	CR	AVE	ER	IR	INT	HAB	BEH
External Regulation (ER)	2.15	1.39	0.97	0.94	**0.97**				
Integrated Regulation (IR)	4.68	1.63	0.97	0.95	0.14*	**0.97**			
Intention (INT)	5.38	1.23	0.96	0.94	0.05	0.39*	**0.97**		
Habit (HAB)	5.63	1.19	0.96	0.87	0	0.59*	0.44*	**0. 93**	
Behavior (BEH) T2	5.88	0.87	0.81	0.52	-0.06	0.28*	0.36*	0.43*	**0.72**

Square root of AVE scores is shown in bold along the diagonal; Significance * = <0.01
BEH = Time 2 (T2)

Table 2: Model Estimates

		β	Prob.
H1	Intention → Behavior	0.24	< 0.01
H2a	Integrated regulation → Intention	0.40	< 0.01
H2b	External regulation → Intention	-0.01	0.41
H3a	Integrated regulation → Behavior	0.01	0.40
H3b	External regulation → Behavior	-0.09	0.02
H4a	Integrated regulation *Intention → Behavior	-0.01	0.41
H4b	External regulation *Intention → Behavior	0.10	0.01
H5	Habit → Behavior	0.32	< 0.01
H6	Habit*Intention → Behavior	-0.06	0.12
	R^2 for Behavior	0.24	

APPENDIX:

ITEMS

Behavior regulation (1 = strongly disagree, 7 = strongly agree)

I want to save energy at home:

Because other people will be upset if I don't (External)

To avoid being criticized (External)

Because it has become a fundamental part of who I am (Integrated)

Because it is part of the way I have chosen to live my life (Integrated)

Because it is an integral part of my life (Integrated)

Habit (1 = strongly disagree, 7 = strongly agree)

Saving energy at home is something…

I do frequently

I do automatically

That belongs to my daily routine

I have been doing for a long time

Intentions to engage in energy-saving behavior (1 = strongly disagree, 7 = strongly agree)

I plan to reduce the amount of energy I use over the next two months

I intend to reduce the amount of energy I use over the next two months

I will make an effort to reduce the amount of energy I use during the next two months

Behavior (Measured at time 2) (1 = never, 7 = always)

How often do you:

Turn off the lights when not in the room

Keep the doors closed between rooms

Close curtains and/or blinds to prevent heat loss in winter and heat gain in summer

Set the temperature when heating and cooling the house to energy efficient levels