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Understanding the Attitude-Behavior Gap for Renewable Energy Systems Using Behavioral Reasoning Theory

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Introduction

The mainstreaming of the green commodity discourse in developed countries suggests that consumers today are more eco-conscious than at the start of the millennium. More importantly, the ongoing discourse between societal actors (e.g. media, policy makers, nongovernmental organizations, businesses) has helped citizens to recognize their individual responsibility in the ecological crisis (Connolly and Prothero 2008) and has provided people with various rationales to “green” their lifestyles (Prothero and Fitchett 2000; Prothero et al. 2011). Indeed, it appears as if ecological concern is manifesting itself in a growing demand for ecological products, which are becoming an attractive expression of green lifestyle choices (Prothero, McDonagh, and Dobscha 2010). But despite the apparent shift in the dominant social paradigm (Kilbourne, McDonagh, and Prothero 1997), consumers’ ecological values and attitudes often fail to materialize in actual purchases of green products like renewable energies. The mismatch between consumers’ expressed preferences for green product alternatives and their actual (un-)willingness to purchase is commonly referred to as the *attitude-behavior gap* (e.g. Peattie 2001). Macromarketers have argued that the disconnect between ecological awareness and unwillingness to purchase green products constitutes a conundrum, which if left unaddressed, will continue to hinder the functioning of market systems (Prothero et al. 2011).

In this study we seek to empirically investigate the attitude-behavior gap in the context of renewable energy adoption. Households’ energy consumption accounts for a large proportion of adverse ecological impacts. For example, in the United States household energy consumption accounts for 27% of national energy requirements and for about 41% of energy-related CO₂ emissions (Bin and Dowlatabadi 2005). In Ireland, where this research was conducted, households account for about 25% of national energy consumption and 26% of CO₂ emissions

(O’Leary, Howley, and Ó Gallachóir 2008). In light of finite global resources and climate change, adoption of renewable energy technologies by a large consumer base thus provides one way to significantly reduce societies’ dependence on fossil fuels and greenhouse gas emissions. Yet, research shows that widespread adoption of renewable energy technologies is proving problematic, with current projections indicating that in 2030 the worldwide fuel mix will not be too different from today's (Yergin 2012). Thus, additional research is needed to understand consumers’ cognitions and reasons to adopt and, more importantly, not adopt renewable energy systems (Briggs, Peterson, and Gregory 2010; Prothero et al 2011; Westaby 2005).

Extant research around energy conservation has predominately focused on factors that explain renewable energy adoption, while reasons against adopting renewables have been widely neglected (e.g. Bang et al. 2000; Hansla et al. 2008; Kalafatis et al. 1999; Paladino and Baggiere 2008; Steg, Dreijerink, and Abrahamse 2005). However, research shows that reasons for and against a behavior differ qualitatively, and influence people’s decisions in different ways (Westaby, Probst, and Lee 2010). For example, consumers’ decision to adopt renewable energy has been widely explained by pro-environmental values and positive attitudes (e.g. Hansla et al. 2008). However, consumers’ decision to not adopt may not coincide with negative attitudes or low environmental values. Likewise, a person who adopts solar panels may have done so to save money on electricity, but it is unlikely that people who do not adopt solar panels do so because they want to waste money (Chazidakis and Lee 2013). Thus, by distinguishing between reasons for and reasons against behavior this study hopes to shed light on the attitude-behavior gap in the context of renewable energy. In particular, we investigate the relationship between attitudes and adoption intentions through the lens of a novel theoretical framework - Behavioral Reasoning Theory (BRT) (Westaby 2005). BRT distinguishes between reasons for and against performing

a behavior, and thus allows evaluating how consumers' reasoning affects the relationship between values, attitudes and adoption intentions towards renewable energies (e.g. Westaby 2005; Westaby, Probst, and Lee 2010).

The following sections review shortcoming of conventional behavioral intention frameworks in the green consumption literature. First, we discuss behavioral reasoning theory as a novel lens for investigating consumers' adoption of renewable energy decision, and formulate testable hypotheses. In a next step, the model is tested via structural equation modeling, using a consumer sample of 254 house owners in Ireland. Finally, the results of the empirical analysis are presented along with a discussion of the results' implications for marketing management decisions and for public policy.

Literature

For macromarketers and policy makers it is vital to understand the factors and psychological processes that currently intervene between consumers' positive attitudes and renewable energy adoption. Researchers have developed models that serve as heuristic devices to explore particular types of green consumer behavior and the factors that shape them.¹ The literature broadly distinguishes between *contextual* influences and *personal* factors that shape green behaviors (e.g. Jackson 2005; Lewin, Strutton, and Paswan 2011; Peattie 2010; Stern 2005). According to Jackson (2005) external conditions relate to factors like institutional constraints, social norms, or the availability of fiscal or regulatory incentives, which can either facilitate or constrain pro-environmental behaviors like renewable energy adoption. A term regularly used in this context is "lock-in," referring to the external conditions, which circumscribe consumers' options to exercise certain behavior (Press and Arnould 2009). This implies that external constraints can "leave little room for personal factors to affect behavior (Stern 2005, p. 10786)."

Personal influences on the other hand relate to attitudinal factors, personal capabilities and habits or routines (Stern 2005). They are of particular interest to policy makers and macromarketers when contextual factors cannot be changed and personal factors may provide the only variables that might affect behavior. Attitudes are generally seen as a key predictor of pro-environmental behavior like renewable energy adoption (Bruner and Kumar 2007; Cowles and Crosby 1990; Dabholkar 1996; Dabholkar and Bagozzi 2002). From a macro-perspective, consumers' attitudes are clearly influenced by the dominant social paradigm, i.e. the "values, metaphysical beliefs, institutions, habits, etc. that collectively provide social lenses through which individuals and groups interpret their social world" (Milbrath 1984, p.7). In this way, consumers' pro-environmental attitudes do not only constitute an important antecedent of green behavior, but also reflect societal change and a mainstreaming of the green commodity discourse (Prothero, McDonagh, and Dobscha 2010).

However, Kaiser, Hubner and Bogner (2005, p. 2151) argue that "despite the diversity of the specific applications of its models and despite the heterogeneity of the scientific endeavors, attitude-related theorizing has converged into two frameworks for the understanding of conservation behavior [like renewable energy adoption]: (a) the value-belief-norm theory (Stern 1999); and (b) the theory of planned behavior (Ajzen 1991)."

While the former focuses on values and moral norms, the latter is grounded in self-interest-based and rational-choice-based deliberation.

According to value-belief-norm theory (VBN), moral and general altruistic considerations are the key explanatory variables of pro-environmental behavior. The framework builds upon earlier work of Schwartz's (1977) norm-activation theory, which has been applied to

various pro-environmental behaviors such as recycling (Chung and Leung 2007) or electric vehicle adoption (Jansson, Marell, and Nordlund 2011). VBN posits that altruistic values, together with other values, underlie an individual's personal norm i.e. sense of obligation. More importantly, making people understand the (adverse) consequences of their actions for things they value is likely to trigger their sense of obligation, which in turn can result in behavioral change. A good example is the recent wave of anti-nuclear protests, which followed the devastating Tsunami and subsequent nuclear catastrophe in Fukushima, Japan. In Germany, for example, the catastrophe revived the anti-nuclear debate, which resulted in a change of direction in policy and the government's commitment to phase-out nuclear power by 2022 (Siemens 2012). From a macro-perspective, this highlights how consumers' green values and individual actions (e.g. protest) are often steeped in the wider commodity discourse, driven by cataclysmic events and debates between societal actors like the media, NGO's and supranational organizations (Prothero, McDonagh, and Dobscha 2010).

However, the explanatory power of values might decline in situations where individuals are faced with strong external constraints (e.g. availability, social norms) or experience limited personal capabilities like financial resources, specific knowledge or ecological literacy (Stern 2005, p. 10788). Consequently, many researchers have utilized behavioral intention frameworks like the theory of planned behavior (TPB) (Ajzen 1991). Behavioral intention theories like TPB postulate that consumers' intentions are directly related to their subsequent (buying-) behavior. Although the relationship is imperfect, behavioral intentions are one of the most robust and widely applied predictors of consumer behavior (e.g. Ajzen 2001; Wanberg et al. 2005). According to TPB, behavioral intentions are influenced by people's attitudes, their subjective norms (i.e. perceived social pressure to engage in the behavior), and perceived behavioral control

(Ajzen 1991). Generally, TPB predicts that people, who have a positive attitude towards a green product, feel social pressure to adopt, and believe that adoption is easy are more likely to develop an intention to purchase a green product. Further, these global motives are in turn influenced by people's behavioral beliefs (i.e. about outcomes of behavior), normative beliefs (i.e. how relative others view the behavior) and control beliefs (i.e. how difficult the behavior is to perform), respectively. The influence of these factors on behavioral intentions has been demonstrated across a wide range of (green) behaviors, ranging from recycling (Kaiser, Hubner, and Bogner 2005) to adoption of water saving devices (Schwarz and Ernst 2008a).

Yet, in the context of green product adoption, the relationship between attitudes and behavioral intentions often seems to be missing or weak. Public opinion polls show that consumers are reporting positive attitudes towards renewable energies but in many countries renewables experience slow diffusion in consumer markets (Claudy, Michelsen, and O'Driscoll 2011; Eurobarometer 2005). Traditional models like the theory of planned behavior have so far failed to account for the attitude-behavior gap, raising critical questions about the usefulness of traditional behavioral intention theories (e.g. Peattie 2010).

Recent advances of behavioral intention models offer new perspectives and possible explanations for the attitude-behavior gap (Westaby 2005). Specifically, behavioral reasoning theory offers a useful extension of TPB by including *context-specific reasons*, which are posited to have an influence on attitude formation and decisions making (Westaby 2005). Previous frameworks have not accounted for the impact of reasons (against a behavior) on consumers' adoption decisions. Renewable energy systems are, however, costly, high-involvement products, and the adoption decision is likely to require consumers to rationally evaluate reasons for and against adoption. More importantly, comparative studies found that behavioral reasoning theory

explained variance in intention over and above that of traditional intention models (Westaby 2005; Westaby, Probst, and Lee 2010). By applying behavioral reasoning theory we thus expect to shed light on the attitude-behavior gap, and advance our understanding of attitude and intention formation in this important macromarketing context.

Conceptual Framework and Hypotheses

As noted earlier, behavioral reasoning theory belongs to the family of behavioral intention models. However, BRT posits to offer a more complete understanding of consumer decision-making by including context-specific reasons, which serve as important linkages between consumers' values, attitudes and behavioral intentions (Westaby 2005). Figure 1 presents a visual representation of the key relationships in behavioral reasoning theory.² In summary, BRT postulates that adoption intentions are key predictors of behavior. More importantly, intentions can be predicted by global motives like attitudes (H_1). However, unlike traditional intention models, BRT hypothesizes that reasons (both for and against behavior) predict attitudes ($H_{2a,b}$), presumptively "because they help individuals justify and defend their actions, which promotes and protects their self-worth" (Westaby 2005, p. 98). Additionally, reasons are expected to directly influence adoption intentions beyond that explained by global motives ($H_{3a,b}$). Yet, reasoning does not occur in isolation and is expected to be influenced by consumers' deep-rooted beliefs and values ($H_{4a,b}$). Finally, BRT theorizes that values and beliefs directly influence attitudes, which often results from consumers' desire for simplified information processing (H_5). The following sections discuss these relationships in greater detail.

[Insert Figure 1 about here]

Global Motives → *Intentions*

In line with related theory (Ajzen 1991; Ajzen 2001), BRT postulates that intentions are strong predictors of (consumer) behavior. Indeed, research shows that intentions are robust measures, which are regularly applied in consumer research because of their strong predictive validity (Ajzen 2001). Although the relationship between intentions and purchase behavior is not always perfect, findings suggest that the more consumers intend to adopt a new product, the more likely they are to actually purchase and use it in the future (Ajzen 2001). These findings also relate to research around goal pursuit, which show that “intentionality and goal striving plays a critical role in the execution and regulation of behavior over time” (Westaby, Probst, and Lee 2010, p. 482). In this study, adoption intentions serve as the dependent variable and proxy for renewable energy adoption.

More importantly, behavioral reasoning theory posits that attitudes are a key antecedent of consumers’ adoption intentions. That is, the higher consumers’ attitudes towards adopting renewable energies, the higher the likelihood consumers will form an intention and eventually adopt a renewable energy technology. Westaby (2005) classifies attitudes (as well as subjective norms and perceived behavioral control) as global constructs, because they constitute a broad concept with predictive validity across a wide range of behavioral contexts. In consumer behavior, attitudes are clearly one of the most significant predictors of adoption decisions (Ajzen 2002). In the context of renewable energy adoption, Wiser (2003) measured U.S households’ willingness to pay for green energy and found that including attitudinal factors improved the accuracy of predicting adoption significantly. In a survey of Swedish households, Hansla et al. (2008) found that positive attitudes were the main predictor of buying green electricity. Paladino and Baggiere (2007) also found that attitudes had a significant impact on Australian households’ intention to adopt electricity from a renewable energy source. Broadly in line with these

findings, a study conducted by Batley, Fleming, and Urwin (2000) suggested that willingness to pay more for green electricity in the UK could be explained by people's attitudes. In accordance with BRT, we make the following proposition:

H₁ = Consumers' attitudes (i.e. global motive) will positively influence adoption intentions.

Reasons → Global Motives, Intentions

The key distinction between behavioral reasoning theory and related theories clearly lies in the inclusion of context-specific reasons as predictors of behavioral decisions (Westaby 2005).

Reasons are generally defined "as the specific subjective factors people use to explain their anticipated behavior" and serve as an important predictor of global motives (i.e. attitudes) and intentions" (Westaby 2005, p. 100). Reasons are theorized to consist of two broad sub-dimensions, including reasons *for* and reasons *against* behavior. The reason concept in BRT relates to several other psychological concepts such as sense making (e.g. Thomas, Clark, and Gioia 1993), psychological coherence (e.g. Nowak et al. 2000) or functional theorizing (e.g. Snyder 1992), which broadly suggest that people use reasoning to support the acceptability of decision alternatives, defend and justify their actions and pursue particular goals.³ For example, consumers would be expected to search for the strongest set of reasons to justify and defend an anticipated purchase decision. Specifically, in high-involvement decision contexts like renewable energy adoption, consumers are likely to search for reasons that help resolve cognitive dissonance and make a purchasing decision with confidence (Westaby, Probst, and Lee 2010, p. 483). Like attitudes and values, consumers' reasoning can also be viewed from a macro-perspective in the sense that "when accounting for their decisions, individuals choose from a repertoire of available social, public, and cultural narratives or discourse" (Chazidakis and Lee

2013, Sage please enter p. #). In other words, consumers' reasons for and against adopting renewable energy are most likely influenced by the wider discourses between stakeholders in the energy sector (e.g. lobby groups, governments, research institutes, media). For example, in 2009 President Barack Obama signed into law the \$831 billion U.S. Recovery Act, of which about \$50 billion was directed towards energy efficiency and the development and diffusion of renewable energies. Under the stimulus act various support- and tax credit schemes were introduced, which sent a strong signal to the markets and provided additional reasons for businesses and consumers to adopt renewable energies (Council of Economic Advisers 2010, p. 19)

However, it needs to be noted that the reason concept varies from beliefs, which have been widely utilized as antecedents of global motives in previous frameworks like the theory of planned behavior (Ajzen 1991). The key difference is that reasons are context-specific cognitions, which are directly connected to a behavioral explanation. Beliefs, on the other hand, are more broadly construed and are not restricted to the context of the behavioral explanation (Westaby and Braithwaite 2003). In other words, beliefs constitute consumers' subjective probability that adoption could result in a *broad* spectrum of future outcomes. Reasons in comparison refer to the subjective probability that a *specific* aspect is part of consumers' behavioral explanation set, and need to be directly elicited in relation to the behavior in question (Westaby 2005, p. 100). In the context of solar panel adoption, for example, beliefs would reflect people's opinion about renewable energy in general, whereas reasons for/against adoption would constitute specific factors that influence the purchase decision.

In line with BRT, we expect reasons to influence adoption intentions directly and indirectly via global motives (i.e. attitudes). Regarding the latter, consumers' who have strong

reasons for (against) purchasing a renewable energy system will also have positive (negative) attitudes towards it. Accordingly, we make the following propositions in two parts:

H_{2a} = Consumers' reasons for adoption will positively influence their attitudes towards adoption; and

H_{2b} = Consumers' reasons against adoption will negatively influence their attitudes towards adoption.

Attitudes thus partially mediate the effect of reasons on intentions. Yet, Westaby (2005) argues that reasons also directly influence (adoption-) intentions, without relying on the complete processing of global motives. In other words, reasons explain behavioral intentions over and above that explained by attitudes. This direct impact often results from consumers' strive to simplify decision making by using cognitive short cuts or heuristics (e.g. Tversky and Kahneman 1974). Consumers may not think through their global motives, but form an intention on the basis of a critical reason that is relevant to the adoption context. For example, consumers might hold very positive attitudes towards renewable energy systems, but might still decide against adoption because of a crucial reason like high upfront costs. We thus expect that

H_{3a} = Consumers' reasons for adoption will directly (positively) influence adoption intentions; and

H_{3b} = Consumers' reasons against adoption will directly (negatively) influence adoption intentions.

Values/Beliefs → Global Motives, Reasons

BRT further proposes that reasoning does not happen independently from people's beliefs and values. Frameworks like the value-belief-norm theory (Schwartz 1977) have long shown that consumers often activate cognitive processes like values and beliefs, which serve as an important

precursor to the reasons that people use to justify their behavior (Westaby 2005, p. 102). That is, people's processing of value information directly affects the reasoning for their anticipated behavior. In innovation studies, researchers have also argued that products will be adopted more rapidly when consumers perceive them as compatible or in line with their personal values (e.g. Garcia, Bardhi, and Friedrich 2007; Karahanna 2006; Kleijnen, Lee, and Wetzels 2009). For example, genetically modified (GM) foods often conflict with people's beliefs and values, and as a result, consumers associate adverse health and environmental impacts with GM foods (Klerck and Sweeney 2007). However, in societies where GM food is broadly in line with people's values, reported reasons for purchasing GM foods generally outweigh reasons against purchasing, and consequently adoption rates are high. Accordingly, we propose the following hypothesis:

H_{4a} = Consumer values that are more closely aligned with sustainable practices, will positively influence reasons for adoption; and

H_{4b} = Consumer values that are more closely aligned with sustainable practices, will negatively influence reasons against adoption.

However, values and beliefs can also have a direct, unmediated impact on consumers' attitudes. This is in line with BRT's general assumption that "people use different, distinct, and systematic psychological processes, or paths" in decision making (Westaby 2005, p. 103 quoting: Lee et al. 1999, p. 458). Theoretically, a direct link between values and attitudes can also stem from consumers' desire for simplified information processing and heuristic motives (e.g. Tversky and Kahneman 1982). That is, consumers' may activate their attitudes without fully processing the reasons that more deeply justify their anticipated behavior (Westaby 2005, p. 102). Accordingly, we propose the final hypothesis:

H₅ = Consumer values that are more closely aligned with sustainable practices, will positively influence attitudes towards adoption.

Finally, a recent meta-review of innovation studies suggests that sociodemographic differences have only minor influences on adoption (Arts et al. 2011). The green consumer behavior literature comes to a similar conclusion, showing that green consumption cannot be explained by demographic variables (Jackson 2005; Peattie 2010; Prothero et al. 2010). We thus propose no hypotheses and simply control for consumers' sociodemographic characteristics (i.e. gender and education). As mentioned above, BRT serves as the theoretical framework to better understand consumer intention to adopt solar panels and, more importantly, provide an explanation for the widely acknowledged attitude-behavior gap. In the following sections we describe the overall methodology and data analytical steps that were necessary to test the above defined hypotheses in the context of renewable energy adoption.

Methodology

Participants and Procedures

We collected data in two steps. First, an exploratory qualitative study was conducted to elicit specific reasons for and against adopting renewable energy systems. The findings were evaluated and converted into multi-item scales, which were initially pilot tested ($n=100$) and subsequently revised. In a second step, a professional market research company conducted a large-scale survey via a computer-assisted telephone survey with $n=254$ home owners in Ireland.

In this study we wanted to focus upon a renewable energy technology that would represent green products manifesting an attitude-behavior gap. Accordingly, photovoltaic panels, commonly known as solar panels, were chosen as the focal renewable energy technology

of the study. In Ireland about 80% of the population are aware of solar panels (Claudy et al. 2010) but less than .01% of the population have actually adopted them (SEAI 2010).

The final large-scale telephone survey was conducted with homeowners in the Republic of Ireland, who were aware of the technology in question and who were partly or fully responsible for making financial decisions regarding the house in which they currently live. The aim was to estimate homeowners' intention to purchase solar panels, understand their attitudes and reasons for and against adopting, as well as the influence of values. The study employed a quota-sampling approach to identify the respective group of homeowners within the overall population. The quotas were based on region, gender and age to ensure an overall approximation of the population (see Table 1).

[Insert Table 1 about here]

Measures

The measures were developed in line with previous BRT studies (Westaby 2005; Westaby, Probst, and Lee 2010). All items in the study used five-point Likert scales, ranging from strongly agree (1) to strongly disagree (5). The dependent variable, intention, was assessed via two measures, regularly used in behavioral intention frameworks (Fishbein and Ajzen 1975; Westaby, Probst, and Lee 2010): "I will install solar panels on my house in the next 12 months" and "I intend to install solar panels on my house in the next 12 months." The scale showed a high reliability ($\alpha = .90$). In line with related theory (Ajzen and Fishbein 1980), the global construct attitude was assessed with three items, asking respondents if they agreed or disagreed that installing solar panels on their house in the next 12 months would: "be very good," "offer a lot of advantages," and "add a lot of value." Reliability of the scale was established ($\alpha = .85$).

Further, in line with previous innovation studies we operationalized value alignment as *perceived value compatibility* (Karahanna 2006), asking home owners whether they believed that using solar panels would be: “in line with my own personal values,” “fits the way I view the world,” and “consistent with the way I think I should live my life.” Again, the scale showed high internal reliability ($\alpha = .88$).

Reasons, however, are context specific and were elicited via a series of semi-structured 30 minute interviews with a convenience sample of $n=20$ adult home owners in Ireland (Kvale 1996). The sample consisted of an almost equal number of men and woman and was spread across different age groups and income categories. During the interviews, consumers were asked to name reasons for and against adopting solar energy panels. Using similar procedures to Richins and Dawson (1992), the researchers transcribed the interviews and elicited the most frequently mentioned reasons. The findings clearly showed that *energy cost savings* ($n=17$), *environmental benefits* ($n=13$) and *independence from conventional energy sources* ($n=11$) were key reasons for home owners to adopt solar panels. The findings were broadly in line with previous research around high-involvement eco-innovation (e.g. Nyrud, Roos, and Sande 2008; Schwarz and Ernst 2008b). Main reasons against adopting a renewable energy system were *initial capital costs* ($n=19$), *perceived incompatibility with existing infrastructure* ($n=13$) and *uncertainty regarding the performance of renewable energies* ($n=12$). Again, these findings were in line with earlier studies around eco-innovation adoption (e.g. O’Doherty, Lyons, and Tol 2008; Schleich and Gruber 2008; Scott 1997).

However, unlike Westaby (2005) we did not “bundle” individual reasons into reasons for and reasons against adoption. In fact, reasons for and against adoption were modeled as second-order factor constructs, which are regularly used when seemingly distinct but related constructs

underlie a common higher order construct (e.g. Marsh and Hocevar 1985). This way, researchers could identify the relative influence of *specific* reasons on consumers' behavioral intentions and attitudes. This is in line with BRT, which suggests "individuals are often expected to have considerable variability in how they rate the different reasons explaining behavior" (Westaby 2005, p. 104). In other words, one reason could potentially account for most of the variance in attitudes and/or behavioral intentions. This approach is also in line with measurement theory, which suggests that second-order models should be applied when lower-order factors correlate with each other (see Table 1) and when a theoretically justifiable higher factor (i.e. reasoning for and against adoption) exists, which accounts for the relations among the lower order factors (i.e. specific reasons). This way, second-order factor models can provide a more parsimonious and interpretable model (e.g. Chen, Sousa, and West 2005).

Multi-item scales identified first-order constructs that in turn comprised second-order constructs in the final model representing "reasons for" and "reasons against" adoption of solar panels.⁴ After a pilot test (n=100), the scales for these first-order constructs received purification and revision according to the protocol provided by Gerbing and Anderson (1988).

During the main telephone survey (n=254) homeowners' were then asked to agree or disagree whether the respective reasons were relevant to them or not. Economic reasons (alpha =.86) for adoption were reflected by three measures, i.e. by installing solar panels on my house: "they would eventually pay off and make a profit," "allow me to spend more money on other things in life other than my energy bill," and "would reduce my monthly energy bill significantly." Independence (alpha =.86) was another reason for adoption, in that installing solar panels on the house would: "reduce my dependency on oil and gas," "make me self-sufficient," and "make me independent from national energy providers." Likewise,

environmental improvements (alpha =.86) were named by many consumers as a key reason in that adopting solar panels: “would improve my local environment” and “significantly reduce greenhouse gases.”

Reasons against adoption included initial costs of installing solar panels (alpha = .88) in that they “would be too high for me” and “I find them a financial strain.” Further, consumers posted general agreement about not intending to adopt solar panels because they were incompatible with their existing house (alpha =.77) with the following items: “they would not fit with the existing infrastructure of my house,” “in order to install them, I have to undertake some serious renovation,” and “they could only be installed on my house with major additional work.” Finally, uncertainty in regard to the performance of solar panels (alpha =.83) was a key reason for not adopting, with many home owners worrying that “solar panels would not provide the level of benefits I would be expecting,” “how much ongoing maintenance they would require,” and “how dependable and reliable they would be.”

In the following section we assess the hypotheses discussed above, using Gerbing and Anderson (1988) two-test approach. We first present the results from the confirmatory factor analysis and we then evaluate the structural links in the specified framework via structural equation modeling.

Results

Confirmatory Factor Analysis

As a first step, we conducted a confirmatory factor analysis to assess the properties of our measurement model. Table 2 presents the correlations, means and standard deviations of the latent variables as well as the lowest standardized factor loadings. In addition, Cronbach’s alpha (α) and average variance extracted (AVE) are presented in the diagonal. The findings show that

the scales exhibit good measurement properties, with α 's exceeding the critical value of .7 (Jöreskog 1971). The results from the CFA show that all path loadings are significant at $p = .05$ and exceed the critical threshold of .5. No cross-loadings could be detected. The fit statistics for the measurement model are good and provide additional evidence for reliability and validity of the measures (Bollen 1989).

[Insert Table 2 about here]

Further, the average variances extracted (AVE) exceed the .5 threshold, thus indicating the measures' convergent validity (Bagozzi and Yi 2012). However, to test the discriminant validity of the latent variables more thoroughly, we conducted three tests regularly used in the literature (e.g. Cannon et al. 2010). In the first test, we calculated the 95% confidence intervals around the estimated correlations between the latent constructs. The results were all significantly below 1.0 and thus provide evidence for the constructs' discriminant validity. Second, we conducted a number of nested model comparisons by constraining correlations between pairs of latent constructs to 1.0. Chi-square difference tests for each model of the pairs proved to be statistically significant at $p = .05$. These results provided further evidence for discriminant validity. Following a more rigorous test suggested by Fornell and Larcker (1981), we used the average variance extracted and found that it exceeded the squared correlation between all pairs of latent constructs. Overall, all pairs of constructs passed these tests providing strong evidence of discriminant validity of the latent variables (Gerbing and Anderson 1988).

Finally, we tested for common method variance by comparing our measurement model to a one-factor model. The one-factor model shows significantly inferior fit statistics in comparison to our measurement model ($\Delta\chi^2 = p < .05$), with CFI = .37; TLI = .32; RMSEA = .18; $\chi^2/df = 2,523.3/276$. These results suggest that the likelihood of common method variance is low.

Hypothesized Model

The above specified hypotheses about the linkages among consumers' values, reasons, attitudes and intentions were tested via structural equation modeling in AMOS 18 (Bollen 1989). As discussed above, the pattern of structural relationships between the latent constructs were developed according to behavioral reasoning theory. The structural model, including the results of the hypothesized paths and significant paths are presented in Figure 2. Overall, the findings suggests that the specified structural model fits the data well and that the overall model fit was good with CFI=0.97; TLI = 0.97; RMSEA=0.04; $\chi^2/df = 365.7/261 = 1.40$.

[Insert Figure 2 about here]

As expected, the results suggest that attitudes have a significant influence on consumers' adoption intentions (.28; $p < .01$), providing support for H₁. The results also suggest that reasoning influences people's attitudes and adoption intentions. Reasons for adoption have a positive influence on consumers' attitudes (.69; $p < .01$), but no influence on adoption intentions that is statistically significant at $p = .05$. In this way, the study found support for H_{2a}, but not for H_{3a}. Conversely, the study found that reasons against adoption had a statistically significant negative influence on adoption intentions (-.27; $p < .01$), but no statistically significant effect on attitude toward solar panels. In this way, the study found support for H_{3b}, but not for H_{2b}. Further, the study found that values that are aligned with sustainability practices significantly reinforced reasoning both for (.58; $p < .01$) and against adoption (-.27; $p < .01$). These findings provide support for H_{4a} and H_{4b}. Finally, the study found no evidence for any influence of value alignment on attitude toward solar panels. In this way, H₅ was not supported.

[Insert Table 3 about here]

Overall, our results support the general pattern of proposed linkages between types of constructs in the model. The standardized path coefficients for five of the eight proposed structural linkages between constructs in the model posted p-values less than .01. For example, attitudes toward solar panels influence adoption intentions (H_1), reasons for adoption influence attitudes toward solar panels (H_{2a}) and intentions (H_{3b}), and value alignment influences reasons for and against adoption (H_{4a} , H_{4b}). On the other hand, reasons against adoption appear to have no influence on attitudes (H_{2b}), while reasons for adoption have no direct influence on intentions (H_{3a}).

However, BRT allows for distinct psychological processes, or paths in behavioral decision-making (Westaby 2005, p. 103). Specifically, when reasons against adoption are included in a model of adoption, the countervailing influence of reasons for and reasons against adoption becomes apparent.

[Insert Table 4 about here]

Table 4 shows the total effects of reasons on adoption intentions. The results indicate that reasons against behavior (.27) have a relatively stronger influence on purchase intentions, compared to reasons for behavior (.19), which influence intentions only indirectly via attitudes. This finding might be attributable to the lock-in effect (see discussion above) in that (external) reasons against behavior circumscribe consumers' option to act on their positive attitudes and adopt solar panels. This also seems to be supported by referring back to the actual (second-order) reasons, which show that consumers' consumption choice seems to be limited by the high costs, risks, and incompatibility with existing infrastructure. In this way, a more complex picture emerges that seems to suggest that an explanation for the attitude-behavior gap can be attributed to consumers' reasoning.

Test for Mediation & Moderation

To better understand the role of constructs in the model that are proposed to be mediators, we conducted a series of tests for mediation as prescribed by Baron and Kenny (1986). These tests compare a model featuring an unmediated relationship with a model with a mediated relationship. For example, to evaluate the mediating role of attitude towards solar panels between reasons for behavior and adoption intentions, the mediated model ($df = 262$) was estimated with linkages to attitude toward solar panels from both reasons for behavior, as well as reasons against behavior ($\chi^2 = 371.9$; $df=262$). Additionally, an unmediated model was estimated with no linkages to attitude toward solar panels from either reasons for behavior, or reasons against behavior ($\chi^2 = 417.3$ with $df=262$). The χ^2 differences suggest that the final model of this study offers superior results when compared to the mediated and unmediated models. This can be seen in Table 5. Importantly, the final model suggests that attitude toward solar panels plays a mediating role for reasons for behavior, but not for reasons against behavior.

[Insert Table 5 about here]

Finally, we tested for moderating effects of socioeconomic variables i.e. gender and education. However, results from the multi-group analyses and chi-square difference tests did not confirm the moderating influence of these variables.

Test for Attenuation in the Model

To evaluate the robustness of the model, we re-estimated the model with the following two post-hoc modifications. First, we dropped the adoption construct from a revised model and evaluated path estimates reasons and attitudes. Second, we returned to the original model and removed attitude from the model to see what the path estimates were between reasons and adoption. The standardized path coefficients in the revised models were almost identical to the corresponding

paths in the original model. Using chi-square difference testing, none of these modeling revisions showed any statistically significant differences from the original model. In sum, the original model proved to be robust suggesting that the results of the original model were not an artifact of attenuation in which the stronger influences crowded out the weaker influences in the model.

Discussion of Findings

A key underlying premise of behavioral reasoning theory is that people use different and distinct psychological processes when making behavioral decisions (Westaby 2005, p. 103). In the context of renewable energy adoption, empirical studies to date have shown a strong influence of values and/or attitudes on consumers' adoption intentions (e.g. Hansla et al. 2008; Paladino and Baggiere 2007; Steg, Dreijerink, and Abrahamse 2005). On a societal level, macromarketers have argued that consumers' values and attitudes are changing, partly as a result of a green commodity discourse, which is taking hold "as part of a wider moral green reflexivity and questioning of systems and morals by individuals" (Prothero, McDonagh, and Dobscha 2010, p. 155). However, the widely acknowledged attitude-behavior gap raises the question whether "ecological enlightenment" by itself is likely to trigger consumers' intentions to adopt renewable energy systems.

The results of this study partly confirm previous green consumption research suggesting that attitudes have an influence on consumers' adoption intentions (H_1). However, BRT allows for a more nuanced evaluation of psychological processes underlying adoption intentions by distinguishing between reasons for and reasons against behavior. Our findings suggest that both types of reasons are strong antecedents of consumers' attitudes and adoption intentions, providing additional explanatory power over traditional intention models.

Specifically, findings suggest that reasons for adoption influence attitudes (H_{2a}), which in turn influence intentions (H_1). But unlike as is suggested in the model, reasons for adoption do not influence intentions directly (H_{3a}). BRT recognizes that some linkages in behavioral intention models may not be activated in certain circumstances (Davis, Bagozzi, and Warshaw 1989; Westaby 2005). In the context of solar panel adoption, one explanation for this non-significant link might lie in consumers' tendency to take cognitive short cuts and engage in "one-reason decision making" (Westaby, Probst, and Lee 2010, p. 101 quoted in Gigerenzer and Goldstein 1996). In other words, intentions might be primarily influenced by particular reasons (against) adoption.

This seems to be supported by another finding, which shows that reasons against adoption have a direct (negative) influence on consumers' adoption intentions (H_{3b}), but not on their attitudes (H_{2b}). As discussed earlier, reasons are strong justification mechanisms, which allow consumers to rationally defend their anticipated adoption decision. More importantly, Westaby (2005, p. 101) argues that reasons can directly influence adoption, even if global motives are not perfectly aligned with intentions. That is, reasons can provide context-specific justifications that are unaccounted for by global constructs like attitudes. For example, a parent might have good reasons for disciplining his or her child, even though the parent does not have a positive attitude towards taking such disciplinary action. A reverse logic applies to solar panel adoption: consumers' have a positive attitude towards solar panels, but have good reasons for not adopting them. The findings thus suggest that consumers simplify their decisions by not adopting solar panels on the basis of salient reasons against adoption. This way, reasoning appears to provide a possible explanation for the attitude-behavior gap. In order to diffuse solar panels further throughout consumer markets, marketing communications and policy

interventions will need to address consumers' reasons against adoption and/or overcome dissonance by providing better reasons for adoption (see discussion below).

Finally, these two effects are amplified by consumers' value alignment. Value-information serves as an important precursor to attitude formation and reasoning (Fishbein and Ajzen 1975; Karahanna 2006). In the context of green energy for example, recent findings show that utilitarian environmental benefits can enhance attitudes towards green energy products and ultimately increase purchase intentions (Hartmann and Apaolaza-Ibáñez 2011). Our findings show that values influence attitudes indirectly via reasoning (H_{4a}; H_{4b}). According to Westaby (2005, p. 102) this reflects a deeper level of cognitive processing, which allows consumers to better justify their decisions. It also suggests that previous research might have over-simplified consumers' renewable energy adoption decision by modeling a more heuristic processing route i.e. values → attitudes (H₅). In the following we discuss the implications of our findings for marketing management decisions and public policy interventions.

Implications for Marketing and Public Policy

Macromarketers have argued that the apparent disconnect between consumers' positive attitudes and unwillingness to purchase constitutes a conundrum, which if left unaddressed, will continue to inhibit the functioning of renewable energy market systems (Prothero et al. 2011). The findings of this research provide several angles for marketing campaigns and public policy intervention to foster adoption of solar panels in consumer markets. In particular, marketers and policy makers can (i) provide additional reasons for adoption (ii) reduce reasons against adoption, and (iii) continue to reinforce the green commodity discourse and thereby encourage more consumers to develop personal values related to protecting the natural environment.

Reasons for adoption could be enhanced by improving the efficiency of solar panels and/or having the cost-effectiveness of rival energies decline. In the first instance, continuous technological improvements and economies of scale resulting from mass production are likely to improve the value proposition of solar panels in the medium- to long-term. Further, policymakers can tax other energy sources to boost reasons for adopting solar panels. Evidence shows that public policy support has been a key factor for the diffusion of solar panels in countries such as Germany, Denmark and Spain (e.g. Sijm 2002). A policy instrument that has proved most successful in raising the financial attractiveness of solar panels is the so-called renewable energy feed-in tariff (REFIT). REFITs provide consumers with access to electricity grids and guarantee a (fixed) price for the electricity produced by household solar panels over a specified period of time. The premium price for each kilowatt-hour of electricity produced this way is usually paid by regional or national utility companies, who are legally obliged to buy back the electricity provided by homeowners. Guaranteed access to the grid and, more importantly, guaranteed prices for electricity produced are strong reasons for solar panel adoption because these significantly increase the financial attractiveness to become owners. Worldwide REFITs have been introduced in more than 63 jurisdictions and were referred to by the European Commission and the International Energy Agency as the most efficient and effective instrument to promote the diffusion of renewable energy (European Commission 2008; IEA 2008).

However, our findings indicate that the attitude-behavior gap can also be addressed by reducing reasons against adoption, thus allowing consumers to act upon their positive attitudes. By reducing high initial costs as well as uncertainty and incompatibility barriers, adoption intentions would likely rise, according to the results of this study. With regard to costs, energy

performance contracting, supported by so-called energy service companies, has become a worthwhile business strategy to assist property owners in the commercial and public sectors to overcome the financial and uncertainty barriers to improving the energy performance of their buildings (Yik and Lee 2004). In return for initial investments by the energy service contractors into energy-saving measures, these contractors then share the energy cost savings in a win-win contractual arrangement with the building owners. Such an approach could be replicated in the domestic housing sector, thus reducing vital reasons against adoption.

Further, our results suggest that consumers delay adoption of solar panels because they see them as incompatible with their house. In order to overcome this reason against adoption, producers of solar panels need to more clearly communicate the ease of installation. However, solar panels are primarily diffused via tradesmen and architects, who represent important agents of change because they have potential contact with homeowners on a daily basis. Companies should thus focus their marketing efforts on B2B markets and effectively educate people in the sector, for example, by developing and providing relevant training schemes. A worthwhile B2B initiative is the European Commission's 'EU Build Up Skills' scheme. This approach seeks to identify and to upgrade the competency and skills of tradesmen in the building industry regarding insulation, renewable energy installation and green/sustainable buildings. This pan-European initiative is one measure of the European Commission's energy efficiency plan, which aims to increase the number of qualified workers in Europe's building workforce. Again providers of solar panels could potentially role out similar schemes to effectively overcome incompatibility perceptions in consumer markets.

Finally, in line with previous findings, our results seem to suggest that (ecological) values function as important precursors, which influence consumers' attitudes and ultimately adoption

intentions. But the results also suggest that this effect is mediated by context specific reasons. The activation and processing of reasons suggests that consumers use deeper cognitive processing to justify and to support their adoption decisions. Advertisements that simply communicate “feel good while doing good” messages might be too limited to increase purchase intentions of high-involvement products like solar panels (Hartmann and Apaolaza-Ibáñez 2011). Marketing communications need to effectively appeal to consumers’ greening values, while providing sufficiently detailed information about benefits that reinforce reasons for adoption. A good example is the Toyota Prius “The planet’s favorite hybrid” advertisement, which depicts the car in a green, natural environment, while informing consumers’ about benefits like fuel efficiency, reduced CO₂ emission, and other reasons that influence purchase decisions. In this way, Toyota allows consumers to effectively align green values with context specific reasons for adoption.

Conclusions and Future Research

Our research contributes to the macromarketing literature by applying behavioral reasoning theory to explore the frequently observed attitude-behavior gap that has prevented better understanding for how the marketing system for renewable energy provision is profoundly influenced by consumer behavior. The study presents evidence for two mediated paths in the cognitive processing of adoption intentions of solar energy panels: reasons for and reasons against adoption. These findings offer a plausible explanation for the attitude-behavior gap for green technologies. Whereas previous research focused predominantly on attitudes and adoption intentions, the current study offers evidence for the direct influence of context specific reasons on intentions over and above that of attitudes. In particular, researchers can now better understand the countervailing influence of reasons against adoption that would not be evident

when focusing only on an attitude-behavior linkage because the effect of reasons against adoption on intention would not be mediated by attitudes toward adoption.

Reducing reasons against adoption will be an important way to increase adoption of solar panels and possibly other renewable energy technologies in the future. However, marketers and policy makers need to look beyond consumers' individual decision making, as reasons against adoption reflect significant shortcomings of renewable energy provision on the macro level. Some of these reasons result from external constraints, which circumscribe consumers' ability to act on their positive attitudes and adopt renewable energies. These reasons can result from dis-functioning market systems, as well as the wider societal discourse between key stakeholders in the energy sector. For example, the relatively high cost of renewable energy partly results from governments' direct and indirect subsidization of conventional energy sources. Likewise, consumers' perceptions of costs are likely be influenced by discussions between government, lobby groups, renewable energy companies and researchers around the financial payback time of renewable energy investment decisions. This way, the study highlights the importance of consumers' psychology in the functioning of marketing systems of products that are likely to have far reaching societal and environmental consequences.

However, the study has limitations, which offer several avenues for further research. First, the empirical study is exploratory, focusing on a single renewable energy. Future studies could apply behavioral reasoning theory in alternative consumption contexts, such as for adopting wind turbines or alternative fuel vehicles. It would also be interesting to compare the influence of reasons on attitudes and intentions in high- and low- involvement contexts. Future research should also investigate how different personal values (such as benevolence or achievement) influence reasoning and attitudes (Briggs, Peterson, and Gregory 2009). Finally,

subsequent studies could apply BRT to investigate how different personality traits such as innovativeness (e.g. Roehrich 2004) or variety seeking (e.g. McAlister and Pessemier 1982) moderate the relationship between reasoning, attitudes and adoption of renewable energies.

Notes

¹ For another comprehensive overview of the (green) consumer behavior literature see Jackson (2005) among many others.

² This ordering mirrors past theoretical presentations (e.g., Ajzen 1991; Harrison 1995; Westaby 2005).

³ For a more comprehensive discussion of reasons see: Westaby 2005

⁴ Reasons for behavior, and reasons against behavior manifest themselves when respondents were asked for their ratings about the related measures of these constructs. For example, to measure the latent construct reasons for behavior, questions were posed to respondents about (1) economic benefits, (2) environmental benefits, and (3) independence benefits of adopting solar panels. We did not create a benefit index, determined by objective measurement of physical attributes, such as money in bank accounts, CO² footprint, or amount of energy consumed. We used scales to gauge the subjective ratings of reasons for and against a behavior – adoption of solar panels. In sum, reasons for and against a behavior reside in the minds of the respondents. This reflective approach to measurement is in line with almost all measurement in business scholarship and related methodological texts on scale development (Coltman et al, 2008).

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