Energy Saving within Households: How the Antecedents of our Behaviour Influence Energy Consumption

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Abstract

Household energy consumption has drastically increased within the last years, which considerably influences environmental degradation due to the required fossil-fuel burning. Half of the household energy consumption can be associated with direct energy use, meaning the application of electricity or gas. Hence, the antecedents for behaviours requiring direct energy use need to be investigated to construct suitable and tailored interventions to ultimately decrease energy consumption. The aim of the present study was to identify the antecedents that underlie energy-saving behaviour within households. Concretely, it will be investigated if and to what extent the constructs of pro-environmental attitudes, response efficacy, self-efficacy, household size, financial motives, political orientation, and environmental identity relate to energy-saving behaviour within households. For this, a quantitative questionnaire survey design was utilised. One hundred fifty-two participants completed the survey. The results of the regression analysis revealed that only the construct of environmental identity was a significant positive predictor of energy-saving behaviour within households. Although significant correlations have been found between all constructs, except for household size, they did not predict energy-saving behaviour. Lastly, the results have been discussed within existing literature, and future implications were given.

Keywords: Sustainability; Household energy conservation; Energy-saving behaviour; Pro-environmental behaviour; Determinants; Antecedents; Protection Motivation Theory; Response efficacy; Self-efficacy; Household size; Financial motives; Pro-environmental attitudes, Political orientation; Environmental identity.

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'The most intellectual creature to ever walk on planet earth is destroying its only home' (Goodall, as cited in Walker, 2015). Humans are gradually damaging their habitat by harming the earth's capacity to support life (Vesilind et al., 2013). Especially due to fossil-fuel burning, the levels of heat-trapping gases in the atmosphere rise, contributing to environmental pollution (Hill, 2020; Zandi & Haseeb, 2019). This also leads to global warming, extinction of animals, deforestation (Kumar et al., 2020), ozone layer depletion, loss of biodiversity (Chopra, 2016) and many more devastating impacts on earth. Besides the negative influences on nature, human health and well-being are negatively impacted as well (Chopra, 2016; Vesilind et al., 2013). Hence, an urgent need for action and behavioural changes becomes inevitable.

Within the past forty years, worldwide electricity consumption has more than tripled (Sönnichsen, 2021) and is forecasted to further increase in the upcoming years (Jaganmohan, 2021). To counteract the resulting environmental pollution, renewable energies have been developed. Renewable energy, also known as green energy, includes energy that has been acquired through eco-accommodating sources, such as wind, sun, woods, or water (Zandi & Haseeb, 2019). Its use has increased within the past years (Jaganmohan, 2021). In 2019, 19.7% of the energy used within the EU had been derived from renewable energies (Eurostat, n.d). The EU currently aims to decrease greenhouse gas emissions by 55% until 2030 (compared to 1990). To achieve this goal, the EU needs to further expand energy efficiency and increase the use of renewable energies, as stated by the European Commission (2020).

Concerning households, almost 30% of the total EU electricity consumption originates from private homes. Specifically, in the Netherlands, one-fifth of the total energy utilisation comes from the housing sector. This is most likely due to the increasing number of electric appliances at home (Papachristos, 2015). For instance, the amount of electronics (e.g., TVs) within households has increased lately, leading to a rise in human consumption of these devices and highly energy-intensive behaviour (Crosbie, 2008). For now, despite the improvements concerning energy efficiency, the increasing household energy consumption could not be counteracted (European Environmental Agency, 2019).

Due to COVID-19, people are spending more time at home, and thus, household energy consumption has increased even further (Cheshmehzangi, 2020), thereby threatening to overpower these existing renewable energy frameworks. Therefore, only focussing on more sustainable energy consumption is not sufficient. It must be investigated how household

energy use can be reduced as well. Within the Netherlands, almost 50% of household energy consumption can be associated with direct energy use, meaning the application of, for instance, electricity or gas (Kok, 2006). Hence, the antecedents for behaviours requiring direct energy use performed by humans need to be investigated to construct suitable and tailored interventions and, consequently, decrease energy consumption (Abrahamse et al., 2007). Accordingly, it is important to research why people reduce or increase their energy consumption within households.

Energy-saving behaviour within households include actions, which humans can execute on a daily basis within their home. The behaviours are often related to energy consumption in the form of the use of either electricity, water, or both. Examples would be the reduced consumption of electrical devices (e.g., computers, TVs, washing machines, dishwashers, etc.) or activities such as showering (Markle, 2013; Zierler et al., 2017).

Consequently, the aim of the present study is to identify the antecedents that underlie energy-saving behaviour within households. On this basis, the research question that is going to be addressed within this paper is: '*What are the antecedents of energy-saving behaviour within households?*'.

Theoretical framework

To explain or connect humans' perspectives towards their environment and energy-saving behaviour within households, various theories can be utilised. The Theory of Planned Behaviour can be used, as it conveys a rationale for humans' behaviour and is often applied by environmental psychologists. Especially the construct of attitude has been associated with pro-environmental behaviour. Past research also focused on the Protection Motivation Theory to describe pro-environmental behaviour (Steg & de Groot, 2018). Specifically, response and self-efficacy have been linked to energy-saving behaviour (Keshavarz & Karami, 2016). In addition, socio-demographic factors such as household size and financial motives have been connected to pro-environmental behaviour. Lastly, psychological determinants in the form of political orientation and identity can contribute to pro-environmental behaviour.

Previous research mainly focused on the identified factors and how they correlate with the overall construct of pro-environmental behaviour, whereas the present study will focus specifically on the factors' prediction of energy-saving behaviour within households. Further, this constellation of factors has not yet been studied together.

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) illustrates how a persons' attitude towards the behaviour, the subjective norm, as well as their perceived behavioural control (PBC) can

influence a persons' intentions and behaviour (Ajzen, 1991). It has been found to be effective in explaining environmental behaviour, as well (Steg & de Groot, 2018; Steg & Vlek, 2009). Thereby, the focus lies on conscious and planned behaviour (Lo et al., 2014). For example, the process of acquiring high-efficiency lights and energy-efficient appliances includes a conscious decision, which implies reasoned behaviour (Barr et al., 2015). In particular, the concepts of perceived behavioural control and attitude were effective in explaining pro-environmental behaviour (Steg & de Groot, 2018).

Perceived behavioural control reflects a person's perceived control and ability over their behaviour and can impact the intentions of the actions, as well as the immediate behaviour (Steg & de Groot, 2018). It has been defined as one of the critical factors in reducing or saving energy usage within households (Abrahamse & Steg, 2009). For instance, individuals with a higher income were found to engage in more energy-conserving actions in terms of buying energy-reducing appliances (Sardianou, 2007). This might be due to the fact that they have the financial capabilities to conduct the behaviour, which positively influences their perceived ability and intention to engage in an energy-saving manner.

A person's attitude towards engaging in energy-saving behaviour depends on the perceived advantages and disadvantages of the specific actions (Ajzen, 1991; Steg & de Groot, 2018). Concretely, positive consequences of energy-conserving practices can increase the likelihood of executing the behaviour. For instance, Vassileva and Campillo (2014) found that economic reasons are influential factors in encouraging participants to engage in energy-saving behaviour. Participants were more willing to engage in energy-conserving behaviour when they also saved money (Vassileva & Campillo, 2014). Also, an individual's choice to buy electric devices within the household (e.g., dishwasher, washing machines, etc.) mostly depends on their costs instead of their energy proficiency (Vassileva & Campillo, 2014).

Pro-Environmental Attitudes. Pro-environmental behaviour has been found to be rooted in corresponding pro-environmental attitudes in terms of goals and values (Thøgersen & Ölander, 2006). High environmental concern, especially, moral concern positively relates to pro-environmental behaviour (Ek & Söderholm, 2010; Poortinga et al., 2004). Moreover, knowledge in terms of consciousness of energy problems leads to energy-conserving behaviour (Sardianou, 2007).

Also, Lillemo (2014) found a positive association between environmental awareness and energy-saving behaviour within households (e.g. lowering heating). Environmental awareness implies people's concern for and comprehension of their practices on the environment, as well as their knowledge and insights about natural issues (Ramsey et

al.,1992). Consequently, environmentally-aware individuals, whose knowledge align with their behaviour, are also more likely to behave in an environmentally-friendly manner (Sekhokoane et al., 2017). Further, having the required skills to engage in pro-environmental behaviours can facilitate the process of pro-environmental actions (Thøgersen, 1999). Thus, it can be assumed that pro-environmental attitudes are positively associated with energy-saving behaviour within households.

Protection Motivation Theory

Another theory, which can be used to explain energy-saving behaviour, is the Protection Motivation Theory (PMT; Steg & de Groot, 2018). While TPB rather focuses on the attitudes and perceived behavioural control of a person as well as their environment towards an action (subjective norm), PMT complements this with a focus on the decision of executing the action. According to PMT, individuals consider the advantages and disadvantages of their actions (e.g., pro-environmental and earth destructive actions) when making decisions. It is assumed that individuals are bound to behave pro-environmentally when threat and coping appraisal are high (Rogers, 1983; Steg & de Groot, 2018). Threat appraisal includes the assessment of perceived advantages of pro-environmental actions, the associated severity of expected risks (risk perception), as well as one's vulnerability to these risks. Coping appraisal contains the belief to engage in pro-environmental activities that will decrease the threat, which depends on perceived response efficacy and self-efficacy.

Response and Self-Efficacy. Response efficacy describes the confidence that the pro-environmental behaviour will have a positive effect in decreasing environmental issues (Rogers, 1983; Steg & de Groot, 2018). In previous research, response efficacy has often been identified as an essential determinant of pro-environmental behaviour (Ellen et al., 1991; Izagirre-Olaizola et al., 2015; Kang et al., 2013; Meijers et al., 2019). Self-efficacy can be defined as the confidence to be able to conduct the behaviour (similar to perceived behavioural control from TPB; Rogers, 1983; Steg & de Groot, 2018) and can significantly affect pro-environmental behaviour (Abraham et al., 2015; Huang, 2016).

Keshavarz and Karami (2016) focused on the PMT model to identify the main determinants of pro-environmental behaviour of farmers. All four factors (i.e., severity, vulnerability, self-efficacy, response efficacy) were found to be influential. Response efficacy was the strongest predictor of pro-environmental behaviour. Further, it was found that self-efficacy had a mediator role between the social environment and pro-environmental behaviour (Keshavarz & Karami, 2016). Other researchers also found evidence of high levels of response, as well as self-efficacy, associated with pro-environmental behaviour (Emery,

2013). Thus, this study will focus on the predictor's response and self-efficacy of the PMT model. Further, due to the similarities between the constructs of perceived behavioural control and self-efficacy, it was decided to only focus on one of them. Self-efficacy was chosen as it has been found to better predict intention and behaviour compared to perceived behavioural control (Manstead, & Van Eekelen, 2006).

Household Size

Besides the theoretical implications, socio-demographic factors have also been linked to energy-saving behaviour. For instance, Karatasou et al. (2018) found that electricity usage increases with rising household members; thus, household size appears to be an essential determinant. Specifically, families with children are consuming significantly more electricity than families without children. This electricity usage increases further with the rising age of the children, as they are spending more time watching television or using gaming devices. Especially within teenagers, electricity consumption increases (Brounen et al., 2012).

In contrast, household size did not positively affect energy consumption (Karatasou et al., 2018), but instead reduction. Curtis et al. (1984) found out that household energy conservation was increased within a household size of two to four individuals. This might be due to the individual's perceptions since it has been reported that the higher the number of household members, the more individuals are thinking about energy conservation and the likelier it is that people will engage in energy-conserving behaviour (Sardianou, 2007). Lastly, household compositions play a crucial role as well. For instance, it has been shown that energy conservation behaviour of parents and adolescents is highly connected. It is assumed that adolescents are influenced by observing their parent's energy-saving behaviour. They conform to the family norms and then engage in similar energy-conserving patterns (Wallis, & Klöckner, 2020). Hence, household size might have a positive influence on energy-saving behaviour within households.

Financial Motives

As previously mentioned, financial aspects appear to also play a role in energy-saving behaviour. For example, individuals with a lower income were more aware of their energy consumption and tried to decrease their energy usage to reduce financial costs (Vassileva et al., 2012). In contrast, a higher income led to an increase in buying energy reducing appliances (Sardianou, 2007), but also to higher energy consumption (Karatasou et al., 2018).

In addition, financial motives play a role as well. Previous research found out that environmental beliefs can affect the view on the price of green products (Gadenne et al.,

2011). More concretely, environmental attitudes can positively influence the purchasing of energy-efficient products. Also, one's attitude to pay more money for an energy-efficient product is positively related to purchasing energy-efficient products (Zhang et al., 2020). Further, Barr et al. (2005) found an association between purchasing energy-efficient applications and other energy-saving behaviours (e.g., turning off the lights). Hence, individuals who purchased energy-effective items were also engaging in other pro-environmental behaviours. Thus, financial motives (including the general attitude towards paying for energy-efficient applications and the willingness to pay more money) might also positively affect the likelihood of energy-saving behaviours within households.

Political Orientation

Further, psychological factors such as a person's political orientation has been found to be connected to pro-environmental values and behaviour. Left-wing parties have been found to be more pro-environmental compared to right-wing parties (Neumayer, 2004). Further, left-wing political orientation is positively associated with pro-environmental actions (Rydzewski, 2013). This might be caused by principal differences between right-wing and left-wing parties' ideologies.

Left-wing parties put a particular emphasis on environmental protection (Neumayer, 2003), whereas right-wing parties were found to have a smaller focus on environmental threats and somewhat antagonistic to imply strategies on environmental change (Lockwood, 2018). Thus, it seems like right-wing parties do not sense environmental protection to be of that much importance, which also corresponds with the finding that denial of climate change is related to right-wing political orientation (Hornsey et al., 2016; Poortinga et al., 2011). People with a right-wing political orientation were also found to be engaging in less pro-environmental behaviour (Moyano-Díaz et al., 2019). Consequently, people with a right-wing political orientation might have less pro-environmental values, and therefore, are less likely to engage in pro-environmental actions, such as saving energy within households.

Environmental Identity

Lastly, another psychological factor such as identity also plays a considerable role in human action and affects both intentions and behaviour (Carfora et al., 2017). Especially environmental identity in terms of feeling connected to the natural world and perceiving the environment and environmental issues as important has been positively linked with pro-environmental behaviour (Clayton, 2003). This form of identity has also been positively associated with energy-saving behaviour (Dermody et al., 2018). To be in congruence with one's behaviour, the identity needs to match either the self-identity, social identity, or both

(Ozaki, 2011; Wang et al., 2021). Concerning pro-environmental behaviour, two constructs of identity have been defined, namely social identity and environmental self-identity.

According to Social Identity Theory, socially accessible categorisation, such as group membership, is unified with one's self-concept to give self-reference (Tajfel and Turner, 1986). These categories facilitate information processing, decrease uncertainty by recommending how to act and increase self-worth through empowering affirming experiences (Dütschke et al., 2018). For instance, perceiving oneself as being part of an environmentally-friendly group, and thus, being an environmentally-friendly individual, is associated with energy-saving practices. Likewise, support from significant others (e.g., parents) for behavioural actions can positively affect perceived self-worth and thus, increase energy conservation even further.

Further, environmental self-identity, defined as the degree to which one considers oneself to be an individual whose behaviours are environmentally-friendly (Van der Werff, 2014), has a considerable influence. Experiences play a major role in the process. This has also been supported by the Self-Perception Theory (Bem, 1972), according to which individuals' past behaviour influences their attitudes, emotions, and current behaviours (Dütschke et al., 2018). Consequently, it could be assumed that behaviour in this context is relatively stable to match the person's identity.

Thus, past energy-saving behaviour can also increase future savings. This has also been supported by research. For instance, concerning sufficiency behaviour, the application of new energy preserving products lead to a rise in energy conservation within the same domain (Seidl et al., 2017). An increase in energy conservation within a different domain is known as the positive spillover effect (Nash et al., 2017). Positive spillover effects are expected to increase if pro-environmental goals and values relate to the behaviour; skills, and knowledge are available; the behaviour is relevant to one's environmental identity; and increased self-efficacy is present (Thøgersen, 2012; Dütschke et al., 2018). Hence, especially environmental identity can play a significant role in energy-saving behaviour.

The Current Study

The current study aims to identify the antecedents that underlie energy-saving behaviour, specifically within households. Concretely, it will be investigated to what extent the constructs of pro-environmental attitudes, response efficacy, self-efficacy, household size, financial motives, right-wing political orientation, and environmental identity predict energy-saving behaviour within households (see Fig. 1). For this, six hypotheses are examined:

H1: The higher the individuals' pro-environmental attitudes, the greater their energy-saving behaviour within households.

H2: The higher the individuals' response and self-efficacy, the greater their energy-saving behaviour within households.

H3: The higher the individuals' household size, the greater their energy-saving behaviour within households.

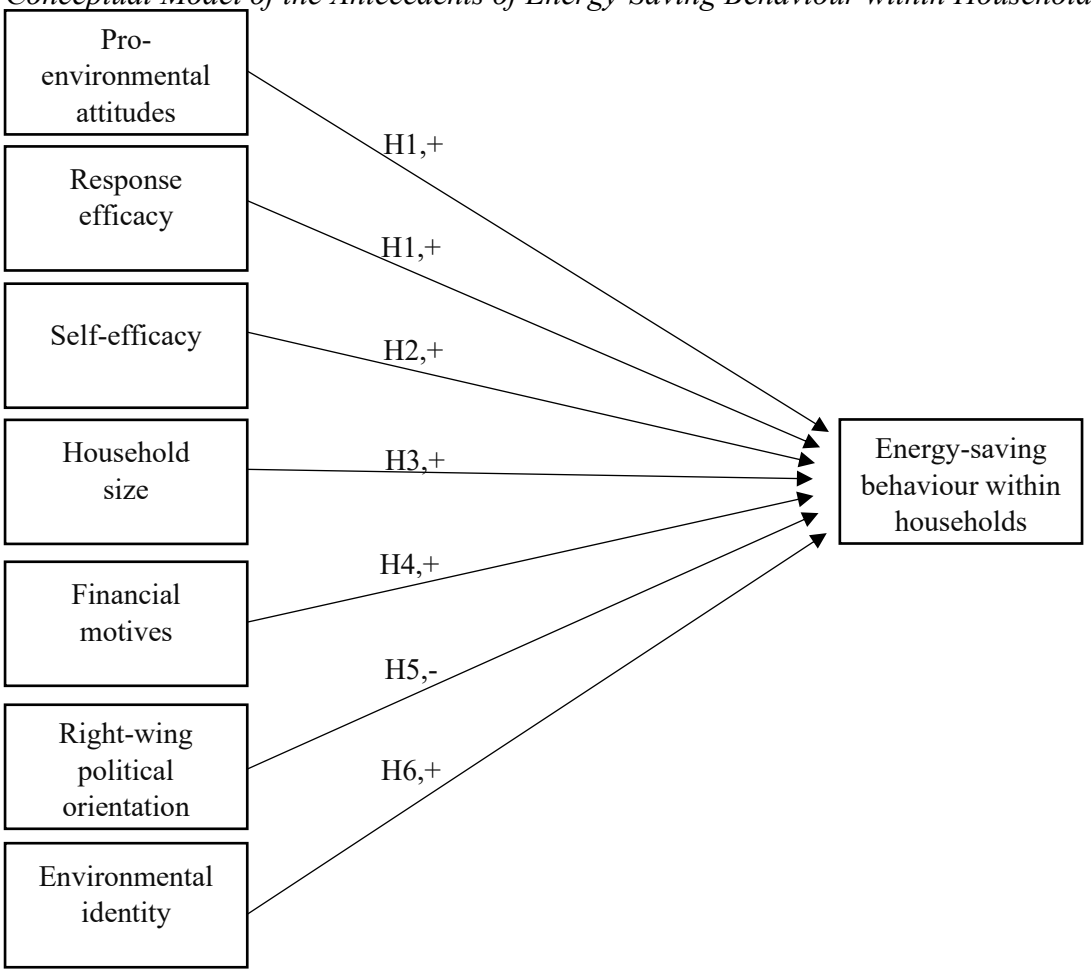
H4: The higher the individuals' financial motives, the greater their energy-saving behaviour within households.

H5: The higher the individuals' right-wing political orientation, the lower their energy-saving behaviour within households.

H6: The higher the individuals' environmental identity, the greater their energy-saving behaviour within households.

Figure 1

Conceptual Model of the Antecedents of Energy-Saving Behaviour within Households



Method

Participants and Design

A quantitative questionnaire survey design was utilised to examine the determinants of energy-saving behaviour within households.

To assess the necessary sample size for a multiple linear regression analysis (F-tests), using a fixed model, an a priori power analysis was conducted using G*Power3.1.9.7 (Faul et al., 2009). It was decided to conduct a test with a medium effect size (d = .15) and an alpha of .05. The number of predictors has been defined as seven because the aim was to find out whether the seven determinants, i.e., pro-environmental attitudes, response efficacy, self-efficacy, household size, financial motives, and environmental identity, are significant positive predictors and political orientation a significant negative predictor of energy-saving behaviour within households. Results demonstrated that a total sample of 103 participants was required to achieve a power of .80.

The participants were acquired using convenience and snowball sampling, as the questionnaire was shared via Social Media (e.g. WhatsApp groups and contacts). Further, the questionnaire was uploaded to SONA, where Psychology- and Communication Science students from the University of Twente (UT) signed up for the study. Students from the UT, who signed up through SONA, were granted credit points after successful participation. Apart from that, participants did not receive any incentive for finishing the questionnaire (e.g. money).

The total sample consisted of 202 participants. Incomplete responses with less than 95% complete were deleted. After this, the sample entailed 152 participants. The participants were composed of 100 females (65.8%) and 52 males (34.2%) between the ages of 18 and 65 (M = 30.16, SD = 11.95). Further, 82 German (53.9%), 55 Dutch (36.2%), and 14 participants (9.2%%) with different nationalities (e.g. American, Canadian, Finnish, Indian, Italian, Korean, Lithuanian, Romanian, Serbian) participated in the questionnaire (for more information see Table 1).

Table 1
Demographic Data of the Participants (N = 152)

Demographics	Frequency (%)
Household size	
1	24 (15.8%)
2	46 (30.3%)
3	34 (22.4%)
4	33 (21.7%)
5	8 (5.3%)
6 or more	6 (3.9%)
Household composition	
Single household	24 (15.8%)
Single parent	1 (0.7%)
Couple household with child(ren)	35 (23.0%)
Couple household without child(ren)	37 (24.3%)
Shared household with family	24 (15.8%)
Shared (student) household	30 (19.7%)
Level of education	
High school	54 (35.5 %)
Trade school	10 (6.6%)
Bachelor's degree	59 (38.8%)
Master's degree	25 (16.4%)
Ph.D. or higher	1 (0.7%)
Profession	
Student	75 (49.3%)
With a part-time job	42 (27.6%)
Without a part-time job	33 (21.7%)
Full-time working	53 (34.9%)
Part-time working	18 (11.8%)
Non-employed	5 (3.3%)

Note. For more information about the study programme and study year, see Table 6 in Appendix A.

Procedure

Prior to conducting the study, it was approved by the BMS Ethics Committee (EC) of the University of Twente on April 9th, 2021.

In total, the questionnaire took approximately 20 minutes to complete. The questionnaire was conducted via the website Qualtrics. To ensure the anonymity of the participants, the collection of the IP addresses within Qualtrics was turned off. All participants received a link to the questionnaire.

Measures

Informed Consent. First, the participants needed to fill in the informed consent. There, they were informed about the study, procedure, confidentiality, and anonymity of the participants' data, the contact details of the researchers, as well as of the ethical commission from the Behavioural, Management and Social Sciences (BMS) faculty of the UT (see Appendix D).

Demographics. Then, they were requested to indicate their demographics. The demographic part entailed questions about the participant's gender, age, nationality, level of education, occupation, household size and household composition (see Appendix E). The participants had the option to omit these questions.

Constructs. Lastly, the participants needed to answer questions about the various constructs (Appendix F). Twelve different constructs were measured: pro-environmental attitudes, risk perception (including threat[1] and coping appraisal), financial motives, political orientation, environmental identity, altruism[1], empathy[1], consumer effectiveness[1], collectivism[1], resistance to change[1], trust in science[1], and lastly, energy-saving behaviour. Regarding the last part of the study, students could not proceed to the next question if they had not answered the previous question. Thereby, it was ensured that everyone answered the questions needed for the analysis.

Most constructs were measured with a five-point Likert-type scale ranging from (1) 'Strongly disagree' to (5) 'Strongly agree'; except for the Pro-Environmental Behaviour Scale (PEBS), it was measured using a five-point Likert scale ranging from (1) 'Never' to (5) 'Always'.

***Pro-Environmental Attitudes*.** For the construct pro-environmental attitudes, three subscales were included. Firstly, a modified version of the pro-environmental value subscale (Zhang et al., 2020) has been used ($\alpha = .62$), which included three items, namely: (1) The use

[1] These constructs were part of the questionnaire but are not covered in the present study.

of energy-saving appliances contributes to the prevention of climate change. (2) The use of energy-saving appliances contributes to the reduction of environmental pollution. (3) Overall, energy-saving appliances are environmentally friendly.

Secondly, the personal importance subscale (Sloot et al., 2018) has been used (α = .78) and was composed of three items: (1) I find it important to be conscious about my energy behaviour. (2) I find it important to save energy. (3) I find it important to use more sustainable energy.

Lastly, the level of environmental awareness subscale (Lillemo, 2014) has been utilised (α = .79) and was composed of five items: (1) We must reduce energy consumption to solve climate problems. (2) I am very concerned about climate change. (3) I have a personal responsibility to help to solve environmental problems. (4) Everyone should do whatever they can to protect the environment. (5) I buy environmentally friendly products if possible.

To measure personal importance and environmental awareness, the individual items were combined into a total score (i.e., personal importance construct; environmental awareness construct). The pro-environmental value subscale had a Cronbach's alpha below .70, which is generally considered as not acceptable (Field, 2009). However, according to Taber (2018), a Cronbach's alpha of .61 to .65 can be labelled as moderate and still be accepted in research. In the present research, the subscale will still be used; however, the results will be interpreted with caution. The respective items of the pro-environmental value subscale were recoded into a pro-environmental value construct. Further, a pro-environmental attitudes scale was created out of all three subscales, which had sufficient internal consistency (α = .84).

Risk Perception. To measure response efficacy and self-efficacy, the Risk behaviour diagnosis scale (Witte, 1996) has been used (α = .82; see Appendix F). The original items have been modified to match the scope of this study. Each subscale was composed of three items. For response efficacy (α = .73), the statements were: (1) Energy-saving within households prevents climate change. (2) Energy-saving within households works in stopping climate change. (3) Energy-saving within households is effective in fighting climate change.

For self-efficacy (α = .79), the statements were composed of: (1) I am able to save energy within my household. (2) It is easy to save energy within my household. (3) I can save energy within my household.

For both factors a combined scale was constructed (i.e., response efficacy scale and self-efficacy scale).

Financial Motives. For the assessment of financial motives, two subscales have been used. Firstly, the modified version of the willingness to pay a price premium subscale (Zhang et al., 2020) has been used (α = .85) and included three items: (1) I am willing to pay more money to purchase energy-saving appliances[2] as opposed to regular appliances. (2) For me, the purchase of an energy-saving device is worth it, despite the high price. (3) I am willing to purchase energy-saving appliances at a high price.

Lastly, the modified version of the attitude towards purchasing energy-saving appliances subscale (Zhang et al., 2020) was utilised (α = .77) and was composed of three items: (1) The purchase of energy-saving devices is of great importance. (2) Purchasing energy-saving appliances is a wise move. (3) Purchasing energy-saving appliances is pleasant.

The required items of both subscales were separately computed into a scale (i.e., willingness to pay construct; attitude towards paying construct). Further, an overall financial motives scale (α=.81) was created, using both scales.

Political Orientation. To measure whether participants are either left-wing or right-wing oriented, a single item has been used. Participants needed to indicate their political orientation on a scale from 1 (left) to 5 (right). Good test-retest reliability has been found by Watkins et al. (2016). A similar item was used by Kroh (2007) and Bauer et al. (2017).

Environmental identity. Two scales for assessing environmental identity have been used. To measure social identity as an environmentalist, the adapted 12-item version of the Social Identification Scale (Cameron, 2004; Prati et al., 2015) has been used (α = .86). Example items are: (1) I have a lot in common with other environmentalists. or (4) I don't feel a sense of being 'connected' with other environmentalists. The complete list of items as well as the indication of reverse items can be found in Table 7 (Appendix B).

For assessing self-identity, the environmental self-identity scale (Van der Werff, 2014) has been used (α = .88) and was composed of three items: (1) Acting environmentally-friendly is an important part of who I am. (2) I am the type of person who acts environmentally-friendly. (3) I see myself as an environmentally-friendly person.

The corresponding items of the scales were combined into a total score (i.e., social identity construct; environmental self-identity construct). Further, an overall environmenal identity scale (α = .89) was created using both scales.

[2] The term 'energy-saving appliance(s)/ device(s)' has been defined before participants needed to answer the items.

Energy-Saving Behaviour within Households. Lastly, to measure energy-saving behaviour within households, the Conservation subscale of the Pro-Environmental Behaviour Scale (PEBS) has been used (Markle, 2013). Further, the scale has been extended to include five more items based on the 'scale for current behaviour' (Zierler et al., 2017). Some items have been left out, as they either overlapped with the PEBS or were out of the scope of this study. For all items, except the last one, a five-point scale has been used from (1) 'never' to (5) 'always'. For the last item, a three-point scale has been used (1) 'hot', (2) 'warm', (3) 'cold' (Markle, 2013; Zierler et al., 2017). All items used in this study can be found in Table 2. Further, the original scales can be found in Appendix C.

Reliability analyses indicated that the reliability of the combined 12 items of the Conservation sub-scale of the PEBS and the 'scale for current behaviour' would be higher if the last item: 'At which temperature do you wash most of your clothes?' would be deleted. Thus, the item was deleted, and the remaining 11 items showed a reliability of .71. Consequently, all items of both scales were combined into an overall energy-saving behaviour construct.

Table 2

Energy-Saving Behaviour Scale

Statement
(1) How often do you turn off the lights when leaving a room?
(2) How often do you turn off computer monitors when you are not at your desk?
(3) How often do you turn off other non-essential electrical equipment?
(4) How often do you switch off standby modes of appliances or electronic devices?
(5) How often do you turn things off completely, rather than to a "standby" mode.
(6) How often do you cut down on heating or air conditioning to limit energy use?
(7) How often do you turn off the TV when leaving a room?
(8) How often do you limit your time in the shower in order to conserve water?
(9) How often do you wait until you have a full load to use the washing machine or dishwasher?
(10) How often do you discuss energy use in meetings?
(11) How often do you leave items plugged in, even when they've finished charging?
(12) At which temperature do you wash most of your clothes?

Debriefing. The survey ended with a final note (Appendix G), where the participants were informed about the purpose of the study, as well as thanked for their participation.

Results

Correlations

To get a better overview of the sample, descriptive analyses were conducted. Means, standard deviations and correlations for all constructs (i.e., pro-environmental attitudes, response efficacy, self-efficacy, financial motives, political orientation, and environmental identity), as well as the ordinal demographics, i.e., household size, age, education, and study year, can be found in Table 3. A one-sided test was used for the correlation analyses, as the alternative hypothesis is that the determinants' pro-environmental attitudes, response efficacy, self-efficacy, household size, financial motives, and environmental identity positively correlate with energy-saving behaviour within households. For the determinant political orientation, a negative correlation was expected. A Pearson's correlation analysis was conducted for all constructs (except household size). For the ordinal demographics, i.e., household size, age, education and study year, a Spearman's correlation analysis was done.

The results of the one-sided Pearson's correlation indicated significant associations between almost all constructs. Concretely, pro-environmental attitudes, response efficacy, self-efficacy, financial motives, and energy-saving behaviours within households were all significantly positively correlated with one another. Consequently, participants scoring high on pro-environmental attitudes, response efficacy, self-efficacy, financial motives, and environmental identity also report high levels of energy-saving behaviour within households. Political orientation was significantly negatively correlated with all constructs. Regarding energy-saving behaviour, this indicates that participants with a right-wing political orientation are reporting lower levels of energy-saving behaviour within households.

Concerning the demographics, the one-sided Spearman's correlation revealed no significant correlations between age, household size, education, or study year and the construct energy-saving behaviour within households. However, the demographics were all correlated with one another, e.g., age was significantly positively correlated with education, study year, and significantly negatively correlated with household size (for more exact correlations, see Table 3).

Table 3

Means (M), Standard Deviations (SD), Spearman Correlations (r_s) and Pearson Correlations (r) between the Demographics and Constructs(N=152).

	M	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	8.1.˟	8.2.˟	9.	9.1.˟	9.2.˟	9.3.˟	10.	11.	11.1.˟	11.2.˟
r/ r_s			r_s	r_s	r_s	r_s	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*
1. Age	30.16	11.95																		
2. Household size	2.82	1.31	-.16*																	
3. Education	2.39	1.16	**.46****	-.21**																
4. Study year[1]	3.27	1.37	**.68****	-.25**	**.71****															
5. Energy-saving behaviour	3.48	0.51	-.03	.07	-.11	-.05														
6. Response efficacy	3.63	0.76	.01	.22**	-.08	**-.34****	.20**													
7. Self-efficacy	3.83	0.63	.05	.07	-.04	.07	.24**	.17*												
8. Financial motives	3.68	0.57	.05	.09	.02	.10	**.38****	**.50****	**.32****											
8.1.˟ Willingness to pay	3.53	0.74	.04	.03	.09	.19	**.37****	.26**	**.32****	**.86****										
8.2.˟ Attitude to pay	3.84	0.63	.03	.16*	-.13	-.13	.26**	**.60****	.21**	**.80****	**.38****									
9. Pro-environmental attitudes	4.06	0.48	.07	.09	-.04	.01	**.40****	**.60****	**.40****	**.70****	**.56****	**.62****								
9.1.˟ Personal importance	4.23	0.57	.05	.04	.03	.04	**.41****	**.42****	**.34****	**.57****	**.46****	**.50****	**.81****							
9.2.˟ Environmental awareness	4.07	0.61	.07	.05	-.01	.03	**.34****	**.48****	**.30****	**.67****	**.55****	**.57****	**.91****	**.67****						
9.3.˟ Pro-environmental values	3.88	0.60	.03	.12	-.12	-.06	.20**	**.54****	**.34****	**.37****	.26**	**.37****	**.63****	.29**	**.33****					
10. Political orientation	2.45	0.87	.16*	.05	.02	.02	-.29**	-.23**	-.19*	**-.37****	**-.31****	**-.31****	**-.43****	**-.35****	**-.42****	-.22**				
11. Environmental identity	3.14	0.55	-.01	.12	-.05	-.01	**.51****	**.41****	.22**	**.63****	**.51****	**.54****	**.61****	**.55****	**.58****	.29**	**-.46****			
11.1.˟ Social identity	3.06	0.56	-.03	.15*	-.07	-.06	**.47****	**.41****	.19*	**.59****	**.45****	**.55****	**.59****	**.53****	**.55****	.28**	**-.44****	**.97****		
11.2.˟ Environmental self-identity	3.43	0.77	.07	-.02	.01	.12	**.44****	.27**	.24**	**.53****	**.52****	**.35****	**.49****	**.43****	**.48****	.22**	**-.35****	**.75****	**.58****	

Note. Bold font indicates correlation of .30 and higher. * $p < .05$ ** $p < .01$ (1-tailed). ˟ Subconstructs of the main scales. [1] This variable/analysis only included 75 participants (students).

Hypotheses Testing

A multiple linear regression analysis was conducted to examine whether the model of this study could significantly predict participant's energy-saving behaviour. Energy-saving behaviour within households was treated as the dependent variable, and the individual determinants (i.e., pro-environmental attitudes, self-efficacy, response efficacy, household size, financial motives, political orientation, and environmental identity) were treated as the independent variables. Although the construct of household size was not normally distributed, it was still treated as a numerical variable to incorporate it within the analysis.

The results showed that the model explained 25% of the variance and that the model significantly predicted energy-saving behaviour within households, F (7, 144) = 8.15, p = <.01. Environmental identity significantly predicted energy-saving behaviour within households (b = 0.37; t = 4.91; p < .01). As this finding shows, the estimated increase in energy-saving behaviour within households is 0.37 by identity, which means that environmental identity is a strong predictor of energy-saving behaviour within households. Thus, participants scoring high on environmental identity are predicted to also have high values in energy-saving behaviour. Consequently, hypothesis 6 was accepted.

Pro-environmental attitudes (b = 0.11; t = 0.87; p = .39), response efficacy (b = -0.05; t = -0.86; p = .39), self-efficacy (b = 0.08; t = 1.26; p = .21), household size (b = 0.01; t = 0.49; p = .62), financial motives (b = 0.04; t = 0.39; p = .70), and political orientation (b = -0.03; t = -0.59; p = .56) did not significantly contribute to the model (see Table 4). Thus, hypothesis 1 to 5 were rejected.

Table 4
Multiple Linear Regression Analysis among Energy-Saving Behaviour and the Various Predictors (N= 152)

Predictors (Constant)	*b*	*SE*	*β*	*t*	*p*
Environmental identity	0.37**	0.09	0.40	4.01	< .01
Pro-environmental attitudes	0.11	0.13	0.10	0.87	.39
Response efficacy	-0.05	0.06	-0.08	-0.86	.39
Self-efficacy	0.08	0.06	0.10	1.26	.21
Household size	0.01	0.03	0.04	0.49	.62
Financial motives	0.04	0.10	0.04	0.39	.70
Political orientation	-0.03	0.05	-0.05	-0.59	.56

Note. Dependent variable: Energy-saving behaviour within households. Adjusted R^2: 0.25. ** p < .01

Another multiple linear regression analysis was conducted to investigate whether specific parts of the constructs significantly predict energy-saving behaviour. This was done using the scales of the subconstructs: personal importance, environmental awareness, pro-environmental values, willingness to pay, attitude to pay, social identity, environmental self-identity; and the overall constructs used earlier: household size, response-, and self-efficacy.

The analysis revealed similar results to the regression analysis with the overall constructs. 26% of the variance was explained by the model and the model significantly predicted energy-saving behaviour, F (11, 140) = 5.786, p = <.01. While social identity (b = 0.23; t = 2.38; p = .02), environmental self-identity (b = 0.13; t = 2.00; p = .05) and personal importance (b = 0.19; t = 2.04; p = .04) were significant predictors of energy-saving behaviours within households; response efficacy (b = -0.02; t = -0.28; p = .78), self-efficacy (b = 0.06; t = 0.86; p = .39), household size (b = 0.02; t = 0.65; p = .51), willingness to pay (b = 0.07; t = 1.03 p = .30), attitude to pay (b = -0.05; t = -0.67; p = .51), environmental awareness (b = -0.08; t = -0.82; p = .41), pro-environmental values (b = 0.03; t = 0.40; p = .69), and political orientation (b = -0.03; t = -0.72; p = .48) were not significant predictors (see Table 5). Thus, participants scoring high on social identity, environmental self-identity and personal importance are predicted to also have high values in energy-saving behaviour.

Table 5
Multiple Linear Regression Analysis among Energy-Saving Behaviour and the Various Predictors Using the Subscales (N=152)

Predictors (Constant)	*b*	*SE*	*β*	*t*	*p*
Personal importance	0.19*	0.09	0.21	2.04	.04
Environmental awareness	-0.08	0.09	-0.09	-0.82	.41
Pro-environmental values	0.03	0.07	0.03	0.40	.69
Response efficacy	-0.02	0.07	-0.03	-0.28	.78
Self-efficacy	0.06	0.06	0.07	0.86	.39
Household size	0.02	0.03	0.05	0.65	.51
Willingness to pay	0.07	0.06	0.10	1.03	.30
Attitude to pay	-0.05	0.08	-0.07	-0.67	.51
Political orientation	-0.03	0.05	-0.06	-0.72	.48
Social identity	0.23*	0.10	0.25	2.38	.02
Environmental self-identity	0.13*	0.06	0.19	2.00	.05

Note. Dependent variable: Energy-saving behaviour within households. Adjusted R^2: 0.26. * $p < .05$

Additional Analyses

An independent t-test was conducted to investigate whether the amount of energy-saving behaviour significantly differs within different household sizes. Results revealed that the scores did not differ significantly, $t(149) = -1.25$, $p = .21$. Another t-test was done to examine energy-saving behaviour within households for students versus workers. The results showed that there was no significant effect, $t(144) = 0.50$, $p = .62$.

However, marginally significant results have been found for education, $t(147) = 1.67$, $p < .10$. Participants who finished school (i.e., high school or trade school) reported higher scores of energy-saving behaviours within households ($M = 3.55$, $SD = .49$) compared to participants who finished higher education (i.e., Bachelor, Master, PhD; $M = 3.41$, $SD = .52$).

Discussion

Findings

The current study aimed to increase knowledge about the antecedents of energy-saving behaviour. It was explicitly investigated if and to what extent the constructs of pro-environmental attitudes, response efficacy, self-efficacy, household size, financial motives, political orientation, and environmental identity predict energy-saving behaviour within households. Regression analysis revealed that only the construct of environmental identity was a significant positive predictor of energy-saving behaviour within households. Although significant correlations have been found between all constructs, except for household size, they did not predict energy-saving behaviour.

Previous research also supported the findings of environmental identity as the main predictor of energy-saving behaviour (Dermody et al., 2018; Whitmarsh and O'Neill, 2010). In the present study, environmental identity was composed of environmental self-identity, as well as social identity, which both, separately and together, significantly positively predicted energy-saving behaviour within households. Van der Werff et al. (2013) also found proof for a relationship between environmental self-identity and environmental behaviours. A similar construct, 'green self-identity' was also found to have a substantial impact on energy-efficient behaviour (Neves & Oliveira, 2021). These findings are also in line with research on self-perception theory (Bem, 1972; Dütschke et al., 2018). Further, the present study showed that participants scoring high on social identity also showed high levels of energy-saving behaviour. This finding corresponds to the results found by Lede et al. (2019) and aligns with social identity theory (Dütschke et al., 2018; Tajfel and Turner, 1986).

Contrary to the finding of Thøgersen and Ölander (2006), pro-environmental attitudes were not a significant predictor of energy-saving behaviour within households. However, the subscale personal importance was a significant positive predictor of energy-saving behaviour, which supports the findings of Slot et al. (2018). Whereas, no significant results were found for the subscales environmental awareness and pro-environmental values, contrary to Lillemo (2014) and Thøgersen and Ölander (2006). The missing prediction of pro-environmental attitudes on energy-saving behaviours within households could be due to the construct of environmental identity. Werff et al. (2013) found that environmental self-identity mediates the relationship between values and behaviours. However, mediation effects for environmental self-identity on pro-environmental values and behaviours have not been examined in the present research. Thus, Werff et al. (2013) findings cannot be confirmed but could explain why pro-environmental values did not turn out to be a significant predictor of energy-saving behaviour.

Furthermore, self-, and response efficacy did not significantly predict energy-saving behaviour, contrary to previous research (Keshavarz & Karami, 2016). However, significant correlations between response and self-efficacy and energy-saving behaviour within households have been found in the present study, which is also in line with Emery's (2013) findings. Further, Bradley et al. (2020) found a positive relationship between green self-identity and response efficacy, which has also been found in the present study. Hence, it could be assumed that in the present study, response efficacy acted as a mediator between environmental identity and energy-saving behaviour. This could possibly explain why response efficacy did not turn out to be a significant predictor.

Moreover, household size did not significantly predict energy-saving behaviour. This is partly in line with previous research. Although some researchers found out that household size positively affects energy-conserving behaviour (Sardianou, 2007) or the purchasing of energy-saving appliances (Yu et al., 2013), others have found out that household size does not relate to energy-saving activities (Sardianou, 2007; Wang et al., 2014). Also, additional analyses revealed no significant difference in energy-saving behaviour between single or multiple households. Moreover, none of the demographic variables used in the present study have significantly correlated with energy-saving behaviour. Other research also supports these findings (Gatersleben et al., 2002; Olli et al., 2001).

Further, no significant effect of financial motives on energy-conserving behaviour within households was revealed. These findings can only be partly compared with existing literature, as this topic has not yet been researched in detail. Previous research identified a

positive association between willingness to pay more money and purchasing energy-efficient appliances (Zhang et al., 2020); as well as other energy-saving behaviours (Barr et al., 2005). On this basis, it was assumed that financial motives might positively affect the likelihood of engaging in energy-saving behaviours; however, no significant regression was found. This could be due to rebound effects, which illustrate a rise in energy consumption after the application of new energy preserving products (Frondel et al.,2008). For instance, people are willing to pay more money for an energy-efficient heating system, but at the same time are using their heating more often. Thus, the purchase led to an increase in energy consumption behaviour.

The multiple linear regression analysis showed that right-wing political orientation did not significantly negatively predict energy-saving behaviour. However, the correlation analysis showed a significant negative association between political orientation and energy-saving behaviour within households, indicating that people with a right-wing political orientation are scoring lower on energy-saving behaviour. This has also been supported by Lockwood (2018).

Additional analyses revealed a significantly higher score for energy-saving behaviour within households for participants who completed lower education compared to higher education. Lower education included participants who finished either high school or trade school, whereas higher education implied participants with either a bachelor's, master's, or Ph.D. degree. A possible explanation for this difference might be the 'Fridays For Future' (FFF) movement, where school students are refusing to go to school on Fridays to demonstrate for climate protection (Wahlström et al., 2019; Wallis & Loy, 2021). These worldwide school strikes also take place in the Netherlands and Germany (Kühne, 2019). As most participants in the present study were either German or Dutch, it can be assumed that the higher score for energy-saving behaviour within households of participants who finished lower education might have been due to the FFF movement. Most likely, some participants were still in school at the start of the movement, and thus, might have consciously dealt with the topic within the last few years, even though this is speculative.

Lastly, concerning the adjusted R-squared, a low value was found. Even though in social sciences, a low R-squared is relatively common (Moksony & Heged, 1990), it remains unclear why the R-squared was only .25 in the present study. A possible explanation would be that important predictors of energy-saving behaviour were missing. A potential predictor of energy-saving behaviour could have been the social norm from the TPB. It was decided to omit this variable because Steg and de Groot (2018) identified perceived behavioural control

and attitude to be most effective in explaining pro-environmental behaviour. However, according to Costanzo et al. (1986), social impact from family, friends, and other interpersonal networks promote energy saving.

Further, it was decided to focus on the construct of self-efficacy, as it has been identified to better predict behaviour compared to perceived behavioural control (Manstead, & Van Eekelen, 2006). Even though these constructs are relatively similar, it still might be the case that when using perceived behavioural control, a significant prediction, as well as a higher R-squared, would be found. For example, Abrahamse and Steg (2009) also identified perceived behavioural control to be an essential determinant of energy-saving behaviour.

Limitations and Strengths

The utilised sampling techniques included snowball and convenience sampling. Thus, the participants were fairly similar (e.g., many students, who most likely attended the UT; social environment of the researchers, i.e., colleagues/ friends). This non-random sample technique influenced the representativeness of the sample, as the participants were not equally distributed. This may have prompted an over-representation of young German female students from social sciences and might have affected the results of this study. For example, young people are often more open to new things and are often very environmentally conscious by themselves (Árnadóttir et al., 2019; Hassan et al., 2010). Thus, they might also be very conscious of their energy-saving behaviour within households. Further, it needs to be acknowledged that the different household sizes were not equally distributed within the sample. The majority was living together with others, and only a small part of the sample indicated to be living on their own. This might explain why household size did not turn out to be a significant predictor of energy-saving behaviour.

Besides the limitations concerning the representativeness of the sample, a strong point would be the size of the sample. An a priori power analysis was conducted to examine the required sample size for a power of .80. On this basis, enough participants were acquired.

A few limitations exist concerning the scales. As previously mentioned, political orientation was measured with only one item. Future research should aim to incorporate the multidimensionality of political orientation and thus, include more items. Moreover, as mentioned before, the results of the pro-environmental values scale need to be considered with caution. Even though the Cronbach's alpha of the total pro-environmental attitudes scale was acceptable, the Cronbach's alpha of the subconstruct: pro-environmental values (Zhang et al., 2020) was not acceptable (α =.62), indicating a low internal consistency.

In contrast, also a strong point can be made concerning the scales. To examine pro-environmental attitudes, three existing scales have been adjusted and combined into one overall construct. The newly established scale had a high internal consistency and can be used by future researchers to assess pro-environmental attitudes. Similarly, the financial motives scale was composed out of two modified scales and was also found to have a high Cronbach's alpha. Further, two existing scales have been adapted to establish the overall energy-saving behaviour scale. This new scale also had good internal consistency. Consequently, three new reliable scales, i.e., pro-environmental attitudes, financial motives and energy-saving behaviour within households can be used by future researchers.

Lastly, most inquiries were about intentions of behaviour rather than actual behaviour. Intentions and concrete behaviour are not always in accordance with one another. Despite the inconsistency among intentions and behaviours, self-reports can be valuable indicators of behavioural conduct (Fujii et al., 1985). Further, a benefit of an online self-report study is the high amount of anonymity. Thus, the odds may be higher that the participants answered the questions truthfully, as the outcomes cannot be associated with the distinctive individual, and subsequently, no social desirability exists.

Implications and Future Recommendations

The present study identified environmental identity to be a strong predictor of energy-saving behaviour within households. This could potentially have positive implications for other pro-environmental behaviours. For instance, the increase in pro-environmental behaviours within other domains, also known as positive spillover effects. These have been found to increase if the behaviour is related to pro-environmental goals/values, self-efficacy, and one's identity (Thøgersen, 2012; Dütschke et al., 2018). Although pro-environmental goals/values and self-efficacy were not significant predictors of energy-saving behaviour, they positively correlated with each other as well as with energy-saving behaviour. Concerning environmental identity, it can be expected that participants who save energy within their household also engage in other pro-environmental behaviours (e.g., taking the bus or bike instead of the car, buying second-hand clothes, reducing food waste etc.).

Further, negative spillover effects are less likely to occur when the behaviour is in line with one's identity (Dütschke et al., 2018). Negative spillover effects include the rise in energy consumption within a different domain (Chitnis et al., 2014; Nash et al., 2017). Thus, people are saving energy in one area and are increasing their consumption in a different area. A clarification of this effect would be moral licensing, which is the cognitive process by which past moral behaviour prompts individuals to engage in immoral actions (Effron and

Conway, 2015). However, moral licensing is also less likely to happen if the effectiveness is perceived as closely related to self-identity and -worth and/or is in accordance with pro-environmental values and goals (Dütschke et al., 2018). Consequently, the construct of environmental identity has major implications for future research; it increases the likelihood of pro-environmental actions in other domains but also decreases the number of immoral or environmental destructive behaviours.

These insights could be useful when establishing governmental policies. Concretely, policymakers should concentrate on increasing positive spillover effects in the light of pro-environmental identity to increase pro-environmental actions. This has also been suggested by previous research, which focused on household waste separation (Xu et al., 2018).

Regarding specific energy-saving behaviour, future research could focus on establishing interventions tailored to consumers environmental identity to increase energy conservation within households. Also, interventions could be created to match the environmental identity of energy suppliers to increase their awareness and knowledge about this topic. Hence, leading them to provide and sell green energy. Subsequently, it can be ensured that people are using sustainable sources for their energy consumption within their households.

Further, the individual constructs measured in this study, which have not been significant predictors of energy-saving behaviour (i.e., pro-environmental attitudes, response efficacy, self-efficacy, household size, financial motives, and political orientation), could be further investigated as previous researchers identified them as significant determinants. Additionally, mediation effects could be researched to further examine the relationship between the various constructs. As previously mentioned, response efficacy might act as a mediator between environmental identity and energy-saving behaviour. Further, environmental identity might mediate the relationship between pro-environmental attitudes and energy-saving behaviour.

Lastly, the present study mainly focused on habitual behaviour. Habits are automatic actions caused by regular encounters with a particular setting. These settings can trigger unconscious decisions, feelings, and behaviours (Wood & Neal, 2009). An example of a habitual behaviour could be switching off the lights upon leaving the room, which most likely happens unconsciously. However, leaving the lights on when leaving the room can also be classified as a habit (de Vries et al., 2011). Thus, it might be the case that when consciously thinking about the action, participants turn off the lights upon leaving the room and also indicate this within the questionnaire. However, when caught up in their daily life, their habit

is to leave the lights on. Consequently, future research should conduct field experiments to examine habitual behaviours (i.e., checking whether consumers are indeed saving energy within their households), as well as conscious behaviours (i.e., purchasing energy-efficient applications, and thus, willingness to pay more money for eco-friendly devices).

Conclusion

To conclude, this study was able to identify one antecedent of energy-saving behaviour, namely environmental identity. Environmental identity was found to be a great predictor of energy-saving behaviour within households. The other constructs, i.e., pro-environmental attitudes, self-efficacy, response efficacy, financial motives, pro-environmental attitudes, and political orientation, did not significantly predict energy-saving behaviour. However, positive correlations were found for self-efficacy, response efficacy, financial motives, pro-environmental attitudes, environmental identity, and energy-saving behaviour. Further, political orientation was negatively correlated with energy-saving behaviour. More information regarding energy-saving behaviour is required to establish interventions aimed at increasing positive spillover effects and, in general, pro-environmental behaviour. Nevertheless, future research can already make use of the present finding in terms of including specifically environmental identity to increase sustainability among households.

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Appendices

Appendix A: Extended Demographics

Table 6

Specific Demographic Data of the Students. (N = 75)

Demographics	Frequency (%)
Study Programme	
Business studies and Public Policy	10 (6.6%)
Engineering and Technology	6 (3.9%)
Information Technology	2 (1.3%)
Life Sciences and Medicine	7 (4.6%)
Natural Sciences	4 (2.6%)
Social Sciences	43 (28.3%)
Study Year	
1st year Bachelor	10 (6.6%)
2nd year bachelor	7 (4.6%)
3rd year Bachelor	30 (19.7%)
Pre-Master	2 (1.4%)
Master	22 (14.5%)

Appendix B: Social Identity Scale

Table 7

Social Identity Scale

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
(1) I have a lot in common with other environmentalists.					
(2) I feel strong ties to other environmentalists.					
(3) I find it difficult to form a bond with other environmentalists. *(R*)*					
(4) I don't feel a sense of being 'connected' with other environmentalists. *(R*)*					
(5) I often think about the fact that I am an environmentalist.					
(6) Overall, being an environmentalist has very little to do with how I feel about myself. *(R*)*					
(7) In general, being an environmentalist is an important part of my self-image.					
(8) The fact that I am an environmentalist rarely enters my mind. *(R*)*					
(9) In general, I'm glad to be an environmentalist.					
(10) I often regret that I am an environmentalist. *(R*)*					
(11) I don't feel good about being an environmentalist. *(R*)*					
(12) Generally, I feel good when I think about myself as an environmentalist.					

*Note. R** indicates reverse items.

Appendix C: Energy-Saving Behaviour within Households Scale

Table 8

Conservation subscale of the Pro-Environmental Behaviour Scale (PEBS)

Statement	Never	Rarely	Sometimes	Usually	Always
(1) How often do you turn off the lights when leaving a room?					
(2) How often do you switch off standby modes of appliances or electronic devices?					
(3) How often do you cut down on heating or air conditioning to limit energy use?					
(4) How often do you turn off the TV when leaving a room?					
(5) How often do you limit your time in the shower in order to conserve water?					
(6) How often do you wait until you have a full load to use the washing machine or dishwasher?					

Statement	Hot	Warm	Cold
(7) At which temperature do you wash most of your clothes?			

Table 9

Frequency-scale behaviour questions: "How often do you do the following things, approximately?

Statement	Never	Rarely	Sometimes	Usually	Always
(1) How often do you turn off computer monitors when you are not at your desk?					
(2) How often do you turn off other non-essential electrical equipment?					
(3) How often do you turn things off completely, rather than to a "standby" mode?					
(4) How often do you discuss energy use in meetings?					
(5) How often do you leave items plugged in, even when they've finished charging?					

Appendix D: Informed Consent

You are being invited to participate in a research study about **household energy consumption**. This study is being done by Sophie Weigandt, Milou Poort and Elena Niehoff from the Faculty of Behavioural, Management and Social Sciences at the **University of Twente**.

The purpose of this research study is to study household energy behaviour and will take you **approximately 20 minutes** to complete.

Your participation in this study is entirely **voluntary** and you can **withdraw at any time**. You are free to omit any question. Further, there are no right or wrong answers. Just choose the answer option that you believe fits you the best. The questionnaire is not regarding judging the amount of energy you consume, but rather to get an indication of the perception regarding household energy usage.

We believe that there are no known risks associated with this research study. Your data will be treated **confidentially**. We will minimise any risks by using anonymized data, which means it is not possible to trace the answers to yourself. The anonymous data will be used for research purposes only and will not be shared with any third parties.

Contact details of the **researchers** for further information: Elena Niehoff: e.niehoff@student.utwente.nl; Sophie Weigandt: s.weigandt@student.utwente.nl; Milou Poort: m.h.j.poort@student.utwente.nl.

Contact details for **complaints** about the research: Dr. Lyan Kamphuis-Blikman: l.j.m.blikman@utwente.nl.

Thank you for considering participation in this study!

If you click on the button below, you consent that you agree with the information stated above and that you are at least 18 years of age.

- **I agree.**

Appendix E: Demographic Questions

Q2: What gender do you identify as?

- Female
- Male
- Other
- Prefer not to say

Q3: How old are you?

- Blank space

Q4: What is your nationality?

- Dutch
- German
- Other
- Prefer not to say

Q5: What is the highest degree or level of education you have completed?

- High school
- Trade school
- Bachelor's degree
- Master's degree
- Ph.D. or higher
- Prefer not to say

Q6: What is your current employment status?

- I’m a student with a part-time job
- I’m a student without a part-time job
- I’m working part-time
- I’m working full-time
- I’m non-employed
- Prefer not to say

Q7: Which study-programme are you following?

- Business studies and Public Policy
- Engineering and Technology
- Information Technology
- Life Sciences and Medicine
- Natural Sciences
- Social Sciences
- Prefer not to say

➔ Display This Question:

- If: What is your current employment status?
  - I'm a student with a part-time job- is selected
  - I'm a student without a part-time job- is selected

Q8: Which year are you in?

- 1st year Bachelor
- 2nd year bachelor
- 3rd year Bachelor
- Pre-Master
- Master
- Prefer not to say

➔ Display This Question:

- If: What is your current employment status?
  - I'm a student with a part-time job- is selected
  - I'm a student without a part-time job- is selected

Q9: Including yourself, how many people currently live in your household?

- 1
- 2
- 3
- 4
- 5
- 6 or more
- Prefer not to say

Q10: How is your current household composition?

- Single household
- Single parent with child(ren)
- Couple household with child(ren)
- Couple household without child(ren)
- Shared household with family (including parents and/or siblings)
- Shared (student) household
- Prefer not to say

Appendix F: Constructs within Questionnaire

(1) Below you will be given some statements about attitudes regarding energy-saving in your household, please indicate your corresponding agreement.
Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.
***Energy-saving appliances** include devices, such as energy-efficient washing machines, dishwashers, refrigerators, thermostats, etc. within the household.

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
(1) The use of energy-saving appliances* contributes to the prevention of climate change.					
(2) The use of energy-saving appliances* contributes to the reduction of environmental pollution.					
(3) Overall, energy-saving appliances* are environmentally friendly.					
(4) I find it important to be conscious about my energy behaviour.					
(5) I find it important to save energy.					
(6) I find it important to use more sustainable energy.					
(7) We must reduce energy consumption to solve climate problems.					
(8) I am very concerned about climate change.					
(9) I have a personal responsibility to help to					

solve environmental problems.					
(10) Everyone should do whatever they can to protect the environment.					
(11) I buy environmentally friendly products if possible.					

(2) Below you will be given some statements about financial attitudes regarding energy-saving in your household, please indicate your corresponding agreement.

Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

***Energy-saving appliances** include devices, such as energy-efficient washing machines, dishwashers, refrigerators, thermostats, etc. within the household.

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
(1) I am willing to pay more money to purchase energy-saving appliances* as opposed to regular appliances.					
(2) For me, the purchase of an energy-saving device* is worth it, despite the high price.					
(3) I am willing to purchase energy-saving appliances* at a high price.					
(4) The purchase of energy-saving devices* is of great importance.					
(5) Purchasing energy-saving appliances* is a wise move.					
(6) Purchasing energy-saving appliances* is pleasant.					

(3) Below you will be given some statements about altruistic behaviour, please indicate your corresponding agreement.

Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Never	Once	More than once	Often	Very often
(1) I have helped push a stranger's car out of the snow.					
(2) I have given directions to a stranger.					
(3) I have made a change for a stranger.					
(4) I have given money to charity.					
(5) I have given money to a stranger who needed it (or asked me for it).					
(6) I have donated goods or clothes to a charity.					
(7) I have done volunteer work for a charity.					
(8) I have donated blood.					
(9) I have helped carry a stranger’s belongings (books, parcels, etc.).					
(10) I have delayed an elevator and held the door open for a stranger.					
(11) I have allowed someone to go ahead for me in a lineup (at Xerox machine, in the supermarket).					
(12) I have given a stranger a lift in my car.					
(13) I have pointed out a clerk’s error (in a bank, at the supermarket) in undercharging me for an item.					

(14) I have let a neighbour whom I didn't know too well borrow an item of some value to me (e.g. a dish, tools, etc.)
(15) I have bought 'charity' Christmas cards deliberately because I knew it was a good cause.
(16) I have helped a classmate who I did not know that well with a homework assignment when my knowledge was greater than his or hers.
(17) I have before being asked, voluntarily looked after a neighbour's pets or children without being paid for it.
(18) I have offered to help a handicapped or elderly stranger across a street.
(19) I have offered my seat on a bus or train to a stranger who was standing.
(20) I have helped an acquaintance to move households.

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(4) Below you will be given some statements about empathic behaviour, please indicate your corresponding agreement.
Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Never	Rarely	Sometimes	Often	Always
(1) When someone else is feeling excited, I tend to get excited too.					

(2) Other people's misfortunes do not disturb me a great deal.
(3) It upsets me to see someone being treated disrespectfully.
(4) I remain unaffected when someone close to me is happy.
(5) I enjoy making other people feel better.
(6) I have tender, concerned feelings for people less fortunate than me.
(7) When a friend starts to talk about their problems, I try to steer the conversation towards something else.
(8) I can tell when others are sad even when they do not say anything.
(9) I find that I am "in tune" with other people's moods.
(10) I do not feel sympathy for people who cause their own serious illnesses.
(11) I become irritated when someone cries.
(12) I am not really interested in how other people feel.
(13) I get a strong urge to help when I see someone who is upset.
(14) When I see someone being treated unfairly, I do

not feel very much pity for them.					
(15) I find it silly for people to cry out of happiness.					
(16) When I see someone being taken advantage of, I feel kind of protective towards them.					

(5) Below you will be given some statements about risk behaviour regarding energy-saving in your household, please indicate your corresponding agreement.
Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
(1) Energy-saving within households prevents climate change.					
(2) Energy-saving within households works in stopping climate change.					
(3) Energy-saving within households is effective in fighting climate change.					
(4) I am able to save energy within my household.					
(5) It is easy to save energy within my household.					
(6) I can save energy within my household.					
(7) I am at risk because of climate change.					
(8) It is possible that I will experience the					

effects of climate change.
(9) I think I will experience side-effects of climate change.
(10) Climate change has severe negative consequences.
(11) Climate change is extremely harmful.
(12) Climate change is a severe threat.

(6) Below you will be given some statements about perceived competence regarding energy-saving in your household, please indicate your corresponding agreement.

Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1) Each person's behaviour can have a positive effect on society by signing a petition in support of promoting the environment.					
(2) I feel I can help solve natural resource problems by conserving water and energy.					
(3) I can protect the environment by buying products that are environmentally friendly.					
(4) I feel capable of helping solve environmental problems.					

(7) Below you will be given some statements about the extent of collectivism that you feel, please indicate your corresponding agreement.

Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1) Working hard for the goals of my group, even if it does not result in personal recognition is important to me.					

(2) Being a co-operative participant in group activities is important to me.					
(3) Readily helping others in need of help is important to me.					

(8) Below you will be given some statements about changing and changes, please indicate your corresponding agreement.

Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1) I generally consider changes to be a negative thing.					
(2) I'll take a routine day over a day full of unexpected events any time.					
(3) I like to do the same old things rather than try new and different ones.					
(4) Whenever my life forms a stable routine, I look for ways to change it.					
(5) I'd rather be bored than surprised.					
(6) If I were to be informed that there's going to be a significant change regarding the way things are done at school/work, I would probably feel stressed.					
(7) When I am informed of a change of plans, I tense up a bit.					
(8) When things don't go according to plans, it stresses me out.					
(9) Often, I feel a bit uncomfortable even about changes that may potentially improve my life.					
(10) When someone pressures me to change something, I tend to resist it even if I think the change may ultimately benefit me.					
(11) I sometimes find myself avoiding changes that I know will be good for me.					
(12) I often change my mind.					
(13) I don’t change my mind easily.					
(14) Once I’ve come to a conclusion, I’m not likely to change my mind.					
(15) My views are very consistent over time.					

(9) Below you will be given some statements about trust in scientists, please indicate your corresponding agreement.

Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1) When scientists change their mind about a scientific idea it diminishes my trust in their work.					
(2) Scientists ignore evidence that goes against their work.					
(3) Scientific theories are weak explanations.					
(4) Scientists intentionally keep their work secret.					
(5) We can trust scientists to share their discoveries even if they don't like their findings.					
(6) Scientists don't value the ideas of others.					
(7) I trust the work of scientists to make life better for people.					
(8) Scientists don't care if non-scientists understand their work.					
(9) We should trust the work of scientists.					
(10) We should trust that scientists are being honest in their work.					
(11) We should trust that scientists are being ethical in their work.					
(12) Scientific theories are trustworthy.					
(13) When scientists form a hypothesis they are just guessing.					
(14) People who understand science more have more trust in science.					
(15) We can trust science to find the answers that explain the natural world.					
(16) I trust scientists can find solutions to our major technological problems.					
(17) We cannot trust scientists because they are biased in their perspectives*.					
(18) Scientists will protect each other even when they are wrong.					

(19) We cannot trust scientists to consider ideas that contradict their own*.	
(20) Today's scientists will sacrifice the well being of others to advance their research.	
(21) We cannot trust science because it moves too slowly.*	

(10) Below you will be given some statements about how your energy-saving behaviour, please indicate your likelihood of conducting this behaviour.

Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Never	Rarely	Sometimes	Usually	Always
(1) How often do you turn off the lights when leaving a room?					
(2) How often do you turn off computer monitors when you are not at your desk?					
(3) How often do you turn off other non-essential electrical equipment?					
(4) How often do you switch off standby modes of appliances or electronic devices?					
(5) How often do you turn things off completely, rather than to a "standby" mode.					
(6) How often do you cut down on heating or air conditioning to limit energy use?					
(7) How often do you turn off the TV when leaving a room?					
(8) How often do you limit your time in the shower in order to conserve water?					
(9) How often do you wait until you have a full load to use the washing machine or dishwasher?					
(10) How often do you discuss energy use in meetings?					

(11) How often do you leave items plugged in, even when they've finished charging?	

Statement	Hot	Warm	Cold
(12) At which temperature do you wash most of your clothes?			

(11) Below you will be given some statements about how you perceive yourself concerning the environment, please indicate your corresponding agreement.
Remember: There are no right or wrong answers. Please ask yourself critically, what choice fits you best. Be as honest as you can.

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
(1) I have a lot in common with other environmentalists.					
(2) I feel strong ties to other environmentalists.					
(3) I find it difficult to form a bond with other environmentalists.					
(4) I don’t feel a sense of being ‘connected’ with other environmentalists.					
(5) I often think about the fact that I am an environmentalist.					
(6) Overall, being an environmentalist has very little to do with how I feel about myself.					
(7) In general, being an environmentalist is an important part of my self-image.					
(8) The fact that I am an environmentalist rarely enters my mind.					

(9) In general, I'm glad to be an environmentalist.
(10) I often regret that I am an environmentalist.
(11) I don't feel good about being an environmentalist.
(12) Generally, I feel good when I think about myself as an environmentalist.
(13) Acting environmentally-friendly is an important part of who I am.
(14) I am the type of person who acts environmentally-friendly.
(15) I see myself as an environmentally-friendly person.

(12) Below you will be given a statement about political orientation, please indicate your corresponding agreement.
Remember: There is no right or wrong answer. Please ask yourself critically, what choice fits you best. Be as honest as you can.

In political matters, people talk of 'the left' and 'the right'. How would you place your views on this scale, generally speaking?

- On a five-point Likert-scale (1 = left, 5 = right)

Appendix G: Debriefing and Final Message

Thank you for your time and participation!

The aim of the study was to find possible underlying factors of energy-saving behaviour. These underlying factors were: pro-environmental attitudes; financial concerns; altruism; empathy; risk perception (PMT); consumer effectiveness; collectivism; resistance to change; trust in science; identity; and lastly, political orientation.

If you have any further questions or are interested in the results of the study, feel free to send an email to Elena Niehoff: e.niehoff@student.utwente.nl, Sophie Weigandt: s.weigandt@student.utwente.nl or Milou Poort: m.h.j.poort@student.utwente.nl.

Contact details for complaints about the research: Dr. Lyan Kamphuis-Blikman: l.j.m.blikman@utwente.nl.

Please share the link with others! Thank you very much!

Your response has been recorded.