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Published in:
Energy Research & Social Science

DOI:
[10.1016/j.erss.2014.11.002](https://doi.org/10.1016/j.erss.2014.11.002)

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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2015

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

van der Werff, E., & Steg, L. (2015). One model to predict them all: Predicting energy behaviours with the norm activation model. *Energy Research & Social Science*, 6, 8-14.
<https://doi.org/10.1016/j.erss.2014.11.002>

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Original research article

One model to predict them all: Predicting energy behaviours with the norm activation model

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ARTICLE INFO

Article history:

Received 16 July 2014

Received in revised form 5 November 2014

Accepted 5 November 2014

Available online 27 November 2014

Keywords:

Norm activation model

Energy behaviour

Compatibility principle

ABSTRACT

One of the most influential models explaining how and which (normative) factors influence environmental behaviour is the norm activation model (NAM). In support of the compatibility principle, research revealed that the NAM predicts behaviour best when all variables are measured on the same level of specificity. Yet, at the same time such approaches imply that the predictive power of the NAM would be limited, as behaviour-specific conceptualisations of the NAM variables only predict the behaviour being studied, but not other, related behaviours. We propose that it is important to understand if a general conceptualisation of the NAM, focussing on energy use in general, predicts a range of different energy savings behaviours. We indeed found that NAM variables that focus on energy use in general predict a range of different energy behaviours in different domains, including energy use in the house, for transport and for food, which reflect direct as well indirect energy use. Our results have important implications for policy makers who aim to promote a wide range of energy-saving behaviours needed to effectively combat climate change.

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1. Introduction

We are facing important environmental problems. Concentrations of greenhouse gas emissions have increased, and as a consequence, the atmosphere and oceans have warmed, snow and ice have melted, and sea level has risen [1]. These increases in greenhouse gas concentrations in the atmosphere are one of the key factors demonstrating that humans influence the climate system [1]. The social sciences are needed to overcome these problems [2,3]. Household energy use is an important contributor to the emission of greenhouse gases [4]. Hence, to reduce environmental problems it is important that households reduce their energy consumption. In addition, social sciences can provide important insights into ways to increase the effects and acceptability of policies that aim to promote energy savings [5].

To develop effective strategies to encourage energy savings in households it is important to understand which factors influence household energy consumption. Reducing energy use often involves a conflict between one's own interests and the collective interest. For example, showering shorter is beneficial for the

environment, but may reduce comfort. Similarly, adopting an efficient driving style may be environmentally-friendly but can be a hassle or less pleasurable. What motivates people to reduce their energy consumption even if it is somewhat inconvenient? Studies have shown that normative considerations play an important role in predicting energy savings (e.g., [6,7]). Normative considerations imply that people prioritise collective interests over their self-interest. One of the most influential models that explains how and which normative considerations affect (environmental) behaviour is the norm activation model (NAM; [8]). According to the NAM, people are more likely to reduce their energy consumption when they feel morally obliged to do so, in other words, when they experience a strong personal norm to save energy. A strong personal norm implies that people are intrinsically motivated to act pro-environmentally, even though this may be somewhat costly, because doing so makes them feel good about themselves [9]. Yet, when behaviour is very difficult or costly, people are less likely to act upon their personal norms [47].

The NAM proposes that two factors affect whether personal norms are activated, which encourage energy saving actions. First, people should be aware of the environmental problems caused by energy use (awareness of consequences). That is, they should acknowledge that high energy consumption leads to environmental problems such as climate change. Second, people should have the feeling that they can help to reduce or solve these problems by

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changing their behaviour (outcome efficacy). That is, they should realise that environmental problems will decrease if they would reduce their energy consumption.¹

Experimental and correlational studies have shown that one should first be aware of environmental problems caused by energy consumption, and that a higher problem awareness in turn strengthens the extent to which one thinks one can successfully contribute to the solutions of these environmental problems. Such outcome efficacy in turn activates one's personal norms to reduce energy use. Finally, these feelings of moral obligation lead to energy saving actions [10,11]. This research suggests that policies aimed to promote energy savings should increase people's awareness of consequences of their energy behaviour and their outcome efficacy, which in turn should strengthen personal norms to act pro-environmental and thus promote energy saving actions [11].

Typically, studies measure the variables of the NAM on the same level of specificity as the dependent variable. For example, Harland and colleagues [12] found that awareness of negative environmental consequences of not closing the faucet, feeling responsible for environmental problems due to not closing the faucet, and a felt moral obligation to close the faucet predicted one's intention to close the faucet. Similarly, behaviour-specific conceptualisations of the NAM variables have been found to predict yard burning [13], recycling [14,15], subway use [16], the acceptability of travel demand management measures aimed to reduce private car use [17], using other modes of transport than the car [12], acceptability of energy policies, acceptability of transport pricing policies, willingness to take action to reduce emission of particulates in the city [11], car use [18], the intention to reduce car use and the acceptability of policies aimed at doubling of costs of car use [19], and electricity saving at work [46]. Measuring the variables of the NAM at the same level of specificity as the dependent variables is in line with the compatibility principle [20], which states that variables predict behaviour best when they are all measured on the same level of generality or specificity (see also [11]).

Yet, from a practical point of view, one may not only be interested in which behaviour specific factors predict specific behaviours, but practitioners would like to know whether we can identify general factors influencing many specific behaviours at once. After all, to effectively mitigate climate change, people would need to engage in a wide range of energy saving behaviours that together would substantially reduce CO₂ emissions. Behaviour-specific approaches would imply that policies should aim at increasing awareness of consequences and outcome efficacy with regard to all specific behaviours one aims to change. For example, if the aim is to reduce car use, people should be made aware of the environmental problems caused by car use to increase their awareness of consequences of these problems. Also, they should be informed about how they can contribute to reducing these problems as to increase their feelings of outcome efficacy. However, although such a campaign may be successful in reducing car use, it is not likely to influence other energy saving actions that are needed to substantially reduce energy-related problems such as global climate change as well. If one would also like to promote, for example, shorter showering times, a new campaign needs to be developed to increase people's awareness of consequences

and outcome efficacy with regard to showering. Although modern technologies may make it possible to design many different campaigns that address each energy saving action separately, and tailored information can be provided to somewhat reduce information overload among individuals and households [21], people may lose interest and no longer pay attention to campaigns when they encounter different campaigns targeting different behaviours over and over again. Consumers may experience information overload and therefore no longer pay attention to the information (e.g., [22,23]). Another potential disadvantage of behaviour specific campaigns may be that they are less likely to spread to other, related, behaviours. For example, a campaign calling for people to switch off their lights may be effective in doing so [24], but would it also influence other energy saving behaviours such as reducing showering time or car use? It can be expected that spreading to other behaviours will be more likely to occur when campaigns address general motivational factors underlying a range of energy saving actions (cf. [25,26]).

Hence, from a practical point of view, it is important to examine whether general factors influencing energy saving behaviours can be identified. These general factors could then be targeted to promote the adoption of a wide range of energy saving actions needed to substantially reduce significant environmental problems caused by energy use, including global climate change. Is it possible to identify key factors that may influence a range of energy saving actions at the same time? Will the NAM still be predictive of specific energy use behaviours when the key variables are conceptualised at a more general level, reflecting awareness of environmental problems due to energy consumption in general and the extent to which people feel they can help solve these problems by saving energy (i.e., outcome efficacy)?

A few studies conceptualised the NAM on a general level, but in this case the dependent variable was an aggregate measure of pro-environmental or energy use behaviour rather than specific behaviours. Again, this is in line with the compatibility principle, with the NAM and the dependent variable conceptualised on a general level. For example, it was found that general awareness of the consequences of environmental pollution and general personal norm to relieve environmental problems predicted aggregate measures of pro-environmental actions [27–29], general willingness to sacrifice (e.g., to pay higher prices to protect the environment), a composite measure of environmental citizenship [29], and general pro-environmental behaviour intention [30]. These studies thus suggest that conceptualising the NAM on a general level with regard to environmental problems can predict aggregate measures of pro-environmental actions. However, the question remains whether general conceptualisations of the NAM variables would also predict a range of specific energy behaviours separately. This is an important question, as it reveals under which conditions general antecedents do or do not predict a wide range of specific actions. For example, perhaps the NAM only predicted the easy behaviours in a composite scale, such as recycling different types of products or encouraging friends to do so, but not the more difficult behaviours with a high environmental impact, such as using other modes of transportation than the car (cf. [29,31]). Studies by Gärling and colleagues [30] and Stern and colleagues [29] also included dependent variables on a general level and relatively easy behaviours such as the intention to act pro-environmental, willingness to pay more to protect the environment and environmental citizenship. An important remaining question is thus to what extent a general conceptualisation of the NAM predicts specific behaviours separately, including energy saving behaviours that may be perceived as rather difficult, costly or inconvenient. One study provided initial evidence that a general conceptualisation of the NAM, in this case focussing on

¹ We focus on outcome efficacy and not on ascription of responsibility as empirical studies have shown that ascription of responsibility and personal norm strongly correlate and are difficult to distinguish empirically [16]. Therefore, it has been suggested that studies could best focus on outcome efficacy when studying collective environmental problems (such as energy consumption; [11]).

perceptions of environmental problems in general, predicted relatively difficult specific actions such as buying organic products and environmentally-friendly travelling [32]. Yet, this study tested an adapted version of the NAM. More specifically, their model included measures of different types of emotions, and they measured ascription of responsibility instead of outcome efficacy as suggested by Steg & De Groot [11]. Therefore, it is yet not clear to what extent general conceptualisations of the NAM, focussing on problems related to energy use, predict a range of specific energy related behaviours, including relatively difficult behaviours.

In addition, only a few studies mentioned above tested the full NAM. That is, many studies did not include all variables of the NAM [27,29] or did not explicitly test the causal pathways of the model [28,29]. This implies that evidence for the predictive power of the NAM is still limited. From a theoretical point of view, it is important to test the full model and to test if the proposed causal relationships of the NAM are supported, or whether the model needs to be adapted.

The aim of this study is to test to what extent the NAM can predict different types of energy use behaviours when the key predictor variables are conceptualised on a general level, that is, focusing on problems related to energy use in general. If our reasoning is correct, conceptualising NAM variables on a general level should predict different types of energy related behaviours in different energy domains. To test this, we selected behaviours related to home energy use (showering), transport (driving style) and food (meat consumption), which represent different domains that substantially contribute to total household energy use [33]. Including behaviour from these different domains allows us to test if a general conceptualisation of the NAM indeed predicts behaviours from several energy domains. In addition, driving style and showering reflect direct energy use, while meat consumption reflects indirect energy use. Indirect energy use is the energy used to produce, distribute, and dispose of products [33]. Few studies on energy use have focused on indirect energy use, while it is a significant source of energy consumption which may not be related to other types of energy consumption, as the energy needed for these actions is less visible and tangible [34], which suggests that indirect energy use may be related to different predictor variables than direct energy use. Therefore, it is important to test if the NAM is also related to behaviours reflecting indirect energy use. Meat consumption is an important example of behaviour associated with substantial levels of indirect energy use, as the production and consumption of meat requires a significant amount of energy [35]. In addition, we included the intention to reduce overall energy use in our study, which is a more general indicator of energy use (and similar to general measures of energy use included in earlier studies). Based on the compatibility principle we would expect that a general conceptualisation of the NAM would more strongly predict a general dependent variable (in this case intention to reduce energy use) than specific dependent variables (i.e., showering time, meat consumption, and driving style). However, we expect that a general conceptualisation would still predict these specific behaviours to some extent, making it important to address these general conceptualisations in policies.

2. Method

2.1. Participants and procedure

Questionnaires were distributed door-to-door in a city in the North of the Netherlands. In addition to the measures described in this paper, the questionnaire comprised questions on values, social representations of climate change, beliefs on consequences of the

reduction of energy use and household energy use.² The questionnaire was completed by 468 respondents (a response rate of 54%). In total 229 females and 233 males participated in the study, 6 participants did not indicate their gender. Age ranged from 18 to 89 ($M = 52.5$, $SD = 14.68$). About 18% of the respondents did not complete any education, or completed primary education or vocational secondary school, while 38% had completed the highest level of secondary school or vocational education and 45% finished university. Around 7% of the sample indicated that their monthly net household income was less than 1000 Euros, 23% between 1000 and 2000 Euros, 30% between 2000 and 3000 Euros, while 39% earned more than 3000 Euros per month. It was thus a varied sample of participants.

2.2. Measures

2.2.1. NAM variables: problem awareness, outcome efficacy and personal norm

We measured the variables of the NAM with regard to energy use. Respondents indicated to what extent they agree with items reflecting these variables on a seven point scale ranging from 1 (totally disagree) to 7 (totally agree). Problem awareness was measured with three items (I worry about CO₂-emissions caused by energy use; Energy use causes important problems for society; Energy use causes serious environmental problems, such as climate change). Mean scores were computed ($\alpha = .82$; $M = 4.70$, $SD = 1.24$). Outcome efficacy was measured with two items (I think it is useful to reduce energy use to reduce environmental problems; I think I can contribute to reducing environmental problems by reducing energy use). The items formed a reliable scale, Cronbach's alpha is .73, therefore mean scores were computed ($M = 5.01$, $SD = 1.17$). Personal norm to reduce energy use was measured with three items (I feel morally obliged to save energy; I would feel guilty if I would not reduce my energy use; I would feel good if I would save energy), which were averaged to compute overall scores. Cronbach's alpha was .81 ($M = 4.61$, $SD = 1.22$).

2.2.2. Energy-related behaviour

We measured energy use behaviours from three domains, namely food (meat consumption), transport (driving style) and home energy use (showering). Two types of energy use behaviour reflect direct energy use (driving style, showering time), while one type of energy use behaviour reflects indirect energy use (meat consumption). Moreover, we included a measure of intention to reduce energy use. To measure meat consumption and showering time, respondents were asked to provide factual data on their behaviours, to prevent socially desirable answers (cf. [36]). Meat consumption was measured by asking respondents how many times per week they consume meat at their main meal of the day, and how many grams of meat they as a person eat on average when they have a meal including meat (see [37]). We focused on meat consumption at the main meal of the day, to prevent underreporting of meat consumption. Both scores were multiplied, resulting in the total grams of meat consumed per person per week ($M = 653.25$, $SD = 446.49$).³ Similarly, showering time was measured by asking respondents how many times per week they take a shower and how many minutes they shower each time on average. Again, both scores were multiplied, resulting in a score reflecting the total

² See <http://gildedeu.hutton.ac.uk/> for full reports on the results of the questionnaire.

³ The average meat consumption in the Netherlands is about 830 g per person per week [45]. The meat consumption reported here is a bit lower because we only include meat consumed at the main meal of the day.

minutes of showering per person per week ($M = 40.87$, $SD = 30.16$). Driving style was measured with one item ‘How often do you consistently drive in a fuel efficient way (look ahead, anticipate traffic, brake carefully and shift to a higher gear as soon as possible)?’. Scores could range from 1 (never) to 7 (always; $M = 4.88$, $SD = 2.06$). The intention to reduce energy use was measured with one item ‘How much energy do you intend to save in the coming year?’. Responses could range from 1 (nothing at all) to 7 (a lot; $M = 4.36$, $SD = 1.16$).

2.3. Analyses

We tested the NAM and the causal pathways between NAM variables with a series of regression analyses (see [38]). We first tested if the variable directly preceding the dependent variable indeed predicted the dependent variable. Next, we tested if including all other variables in the regression analysis significantly increased the amount of variance explained. To test mediation effects we calculated bootstrapping confidence intervals for multiple step models [39]. To compare the predictive power of the NAM for the different dependent variables we calculated 95% confidence intervals around the R^2 values ([40,41]; MS-DOS programme provided by [42]) and examined the extent to which these confidence intervals overlap. We consider R^2 values of the regression model to be significantly different when the overlap of the 95% confidence intervals is less than half the distance of one side of the confidence interval (see [43]).

3. Results

We first tested the causal model with a series of regression analyses (see Table 1). Awareness of Consequences explained 53% of the variance in Outcome Efficacy. The stronger the awareness of problems caused by energy use, the stronger the feelings of outcome efficacy to reduce problems caused by energy use.

Outcome Efficacy explained 47% of the variance in Personal Norm. Personal Norm to save energy was stronger the more one felt that environmental problems can be reduced by saving energy. When Awareness of Consequences was included in the regression analysis as well, the explained variance increased to 58%. Both Outcome Efficacy and Awareness of Consequences predicted Personal Norm. The higher the awareness of problems caused by energy use and perceived efficacy to contribute to solving these problems, the stronger the personal norm to save energy.

Personal Norm explained 9% of the variance in meat consumption, with the 95% confidence interval ranging from .04 to .15. The stronger the personal norm to reduce energy use, the less meat one consumes. When all other variables of the NAM were included in the regression analysis the percentage of explained variance did not increase significantly, and Personal Norm was the only significant predictor of meat consumption. Personal Norm explained 5% of the variance in showering time, with the 95% confidence interval ranging from .02 to .09. The stronger one's general personal norm to save energy, the shorter the showering time. When the other variables were included in the regression analyses as well, the explained variance did not increase. Only Personal Norm was

Table 1
Regression of energy behaviours and intention to save energy on awareness of consequences, outcome efficacy and personal norm.

	β	t	p	Adj. R^2	95% CI R^2	df	F	p
<i>DV: OE</i>								
AC	.73	22.39	<.001	.53	[.46, .59]	451	501.44	<.001
<i>DV: PN</i>								
Model 1								
OE	.68	19.91	<.001	.47	[.40, .53]	452	396.53	<.001
Model 2								
OE	.32	7.25	<.001	.58	[.52, .64]	446	315.76	<.001
AC	.50	11.32	<.001					
<i>DV: Meat consumption</i>								
Model 1								
PN	-.30	-6.48	<.001	.09	[.04, .14]	423	41.92	<.001
Model 2								
PN	-.23	-3.19	.002	.09	[.04, .15]	414	14.25	<.001
OE	-.03	-.36	.72					
AC	-.07	-.95	.34					
<i>DV: Showering</i>								
Model 1								
PN	-.22	-4.72	<.001	.05	[.01, .09]	450	22.32	<.001
Model 2								
PN	-.16	-2.26	.02	.04 ^a	[.01, .09]	440	7.51	<.001
OE	-.08	-1.16	.25					
AC	.01	.11	.92					
<i>DV: Driving style</i>								
Model 1								
PN	.24	5.07	<.001	.06	[.02, .10]	406	25.66	<.001
Model 2								
PN	.22	2.95	.003	.05 ^a	[.02, .11]	397	8.34	<.001
OE	.02	.25	.80					
AC	.02	.24	.81					
<i>DV: Intention to save energy</i>								
Model 1								
PN	.42	9.54	<.001	.18	[.11, .25]	418	91.10	<.001
Model 2								
PN	.16	2.39	.02	.24	[.17, .31]	409	43.42	<.001
OE	.31	4.71	<.001					
AC	.07	.96	.34					

^a The reduction in explained variance is likely to be caused by missing variables.

a significant predictor of showering time. Six percent of the variance in the fuel efficiency of one's driving style was explained by one's Personal Norm to reduce energy use, with the 95% confidence interval ranging from .02 to .11. The stronger the Personal Norm, the more fuel efficient one's driving style. Explained variance did not increase when the other variables were included in the model. The Personal Norm to save energy was the only significant predictor of driving style. Finally, Personal Norm to save energy explained 18% of the variance in the intention to save energy, the 95% confidence interval ranged from .12 to .25. The stronger one's personal norm, the stronger the intention to save energy. When the other variables were included in the regression analysis as well, the explained variance increased to 24%. Both Personal Norm and Outcome Efficacy were significant predictors of intention. The stronger one's personal norm to save energy and the higher one's outcome efficacy to solve environmental problems by saving energy, the stronger the intention to save energy.

As expected, we found that all variables of the NAM explained more variance in the intention to save energy than in the specific energy behaviours. More specifically, the 95% confidence intervals indicate that the NAM explains significantly more variance in the intention to save energy (24%; 95% CI: .17–.31) than in meat consumption (9%; 95% CI: .04–.15), as well as in showering time (4%; 95% CI: .01–.09) and in driving style (5%; 95% CI: .02–.11). We did not find significant differences in the amount of variance explained by the NAM for the three different types of energy use behaviours.

Next, we conducted mediation analysis for the two mediators to further test the causal relationships in the NAM [44]. We found support for the full model when meat consumption was the dependent variable. The mean indirect effect of Awareness of Consequences on meat consumption via Outcome Efficacy and Personal Norm was negative and significant ($a_1 \times d_{21} \times b_2 = -20.92$), with the 95% confidence interval ranging from -43.40 to -8.41. This suggests that the more people are aware of the problems of energy use, the more they feel they can contribute to solving environmental problems caused by energy use, which was in turn related to a moral obligation to reduce energy use (personal norm), that influences their meat consumption.

We also found support for the mediation effects in the causal structure of the NAM model when showering time was the dependent variable. The mean indirect effect of Awareness of Consequences on showering was negative and significant ($a_1 \times d_{21} \times b_2 = -.94$), with the 95% confidence interval ranging from -1.89 to -.29. This suggests that awareness of environmental problems caused by energy use indeed predicted showering time via outcome efficacy to contribute to solving environmental problems by reducing energy use and personal norm to save energy.

The NAM model was also supported when driving style was the dependent variable. The mean indirect effect of Awareness of Consequences on driving style via Outcome Efficacy and Personal Norm was positive and significant ($a_1 \times d_{21} \times b_2 = .06$), the 95% confidence interval ranges from .02 to .12. This again supports the mediation effects in the NAM: awareness of environmental problems caused by energy use increases outcome efficacy to solve environmental problems by reducing energy use, outcome efficacy in turn strengthens personal norm to save energy and a strong personal norm increases an efficient driving style.

Finally, the mediation effects in the NAM model were also supported when the intention to save energy was the dependent variable. The indirect effect of Awareness of Consequences on intention via Outcome Efficacy and Personal Norm was positive and significant ($a_1 \times d_{21} \times b_2 = .04$), with the 95% confidence interval ranging from .01 to .14. This again suggests that the higher one's awareness of environmental problems caused by energy use,

the stronger one's outcome efficacy to contribute to solving environmental problems by reducing energy use. Outcome efficacy in turn influences personal norm to save energy, and personal norm increases the intention to save energy.

4. Discussion

Our aim was to test if a general conceptualisation of the NAM would predict different energy use behaviours. This question is particularly relevant from a practical point of view, because it would imply that policy makers could develop one general campaign aiming to increase awareness of problems caused by energy use in general and outcome efficacy to reduce these problems, which may strengthen one's personal norm to save energy, which could influence many specific energy use behaviours at once. One general campaign may be less likely to lead to information overload among consumers, thereby increasing the likelihood that people attend to and process the information provided, compared to many different campaigns targeting specific energy behaviours separately. Also, campaigns targeting general antecedents may potentially lead to the spreading of pro-environmental actions, as they enable people to relate the information to many different behaviours, rather than only to the behaviour targeted. Therefore, we tested if a conceptualisation of the NAM on a general level predicted different specific energy saving behaviours as well as a general intention to save energy. Following the compatibility principle [20], variables of the NAM should predict dependent variables best when they are measured on the same level of specificity. Based on this, we hypothesised that conceptualising the model on a general level, focussing on energy use, will particularly predict a dependent variable on the same level of specificity (in this case intention to reduce energy use). Yet, we assumed that such a general model still predicts different specific energy behaviours, however, to a lesser extent.

We indeed found that a general conceptualisation of the NAM predicted rather different specific energy behaviours. More specifically, the NAM predicted energy behaviours in different domains, namely transport, food and energy use in the house, reflecting direct as well as indirect energy use. Moreover, as expected, the general conceptualisation of the NAM appeared to be more predictive of a general intention to save energy. This implies that the model indeed predicted the dependent variable that was measured on the same level of specificity (intention to reduce energy use) better than the three specific energy use behaviours (as reflected by the significantly larger percentage of explained variance). Importantly, although the results suggest that a general conceptualisation of the NAM is more strongly related to general indicators of energy use (in this case the intention to reduce energy use), it does predict a whole range of energy behaviours to a some extent, even rather difficult or costly behaviours. Even though behaviours, such as meat consumption, are likely to be influenced by many other factors (e.g., cultural habits, price and taste), they are also related to general normative considerations related to energy problems, as reflected in the NAM variables. Although each behaviour only seems to be influenced by the NAM variables to a small extent, the results suggest that a campaign focussing on energy use in general does potentially influence a wide range of many different energy behaviours, including relatively difficult behaviours, thereby having an overall large environmental impact. This implies that targeting general normative factors related to energy use, as reflected in the NAM, can be a promising strategy to promote the many energy saving behaviours needed to effectively combat climate change. Future research should examine whether a general conceptualisation of the NAM can indeed predict many other (rather difficult) behaviours as well.

Our second aim was to test the expected mediation effects of the NAM. We found full support for the model for all variables included in our study. As expected, the more people were aware of environmental problems caused by energy consumption, the more strongly they felt they could reduce these problems by changing their behaviour. In turn, the more people felt they could reduce these problems, the stronger their feelings of moral obligation to save energy. Finally, the moral obligation to save energy predicted meat consumption, showering time, energy-efficient driving style and intention to save energy. In addition, as expected, mediation analyses supported the relationships of the model. These findings have important theoretical implications, as the structure as proposed by the NAM has rarely been tested in previous research. Our results replicate findings of the few experimental studies that aimed to test the causal relationships in the NAM, but this time including general conceptualisations of the NAM variables and specific behaviour indicators. Importantly, our findings support the causal structure of the NAM not only for dependent variables on the same general level of specificity (such as the intention to save energy), but also for different specific energy behaviours, including relatively difficult energy behaviours.

As expected, we found that the NAM predicted a dependent variable on the same general level of specificity (intention to save energy) better than dependent variables on a more specific level (specific energy behaviours). However, intention was not only measured at the same level of specificity as the NAM model, but it was also likely to be less difficult than the more specific dependent variables. For example, it may be rather easy to indicate that you intend to save energy, while it will be more difficult to actually reduce your meat consumption. The difficulty of energy behaviours may greatly influence which factors influence the relevant behaviours [48]. Circumstantial evidence indeed suggests that the NAM may predict easy behaviours better than relatively difficult behaviours (cf. [29,31]). Future research could systematically examine whether (general) conceptualisations of the NAM indeed predict easier behaviours better than difficult behaviours. This would reveal whether the perceived difficulty of the behaviour moderates the relationship between the NAM variables and energy use behaviours. We expect that a general conceptualisation of the NAM predicts easy behaviour better than difficult energy behaviours. In our research we included energy use behaviours from three domains (food, transport and home energy use), which reflected direct as well as indirect energy use. This suggests that the model is related to a broad range of energy use behaviours from different domains. However, future research is needed to test if a general conceptualisation of the NAM also predicts other types of energy use based on other distinctions in energy use. For example, how well does the NAM predict curtailment behaviours, energy efficiency behaviours and the use of renewables?

In our study we tested the relationships between the variables of the NAM and energy use. Future research is needed to test if strategies targeting the NAM variables focusing on energy use in general indeed result in changes in a range of energy use behaviours. Would an increase in awareness of the problems caused by energy use or an increase in the extent to which people believe they can help solve these problems by changing their behaviour lead to stronger personal norms and changes in many different energy behaviours? For example, would it promote shorter showering times, an energy-efficient driving style, and reduce meat consumption? Furthermore, future research could test if campaigns targeting general awareness of energy problems and general outcome efficacy are indeed more effective in realising wide-scale changes in energy use than campaigns that target awareness of consequences and outcome efficacy on a specific level, for example focusing on showering.

5. Conclusions and policy implications

Our results have important practical implications for policies aiming to reduce energy use. In order to reduce energy consumption to effectively mitigate climate change, people need to change a wide range of energy use behaviours. However, designing a new policy for every single energy-related behaviour one aims to change may lead to information overload and people losing interest in the information, so that they no longer pay attention to these policies or campaigns. Furthermore, campaigns targeting specific energy behaviours may be less likely to spread to other pro-environmental actions compared to a general campaign addressing general motivations (cf. [25,26]).

Interestingly, we found that the general NAM even predicted meat consumption, reflecting indirect energy use; people often have little knowledge regarding indirect energy use [34]. This again suggests that targeting general antecedents following our general conceptualisation of the NAM is a promising strategy to reduce overall energy use, as people may relate such policies and campaigns to many energy saving behaviours from different domains reflecting direct as well as indirect energy use. Our findings suggest that practitioners could also design policies aimed at strengthening general awareness of environmental problems caused by energy use and strengthening the extent to which people feel they can contribute to solving these problems. This will in turn strengthen their feelings of moral obligation to save energy and thereby promote a range of energy saving actions. Indeed, experimental studies have shown that the extent to which people are aware of (environmental) problems and the extent to which they perceive they can contribute to solving these problems can be strengthened via information provision, and that this indeed strengthens one's feelings of moral obligation to solve these problems in turn promoting behaviour change [11]. Although such interventions are likely to change specific energy behaviours to a lesser extent than behaviour-specific campaigns would do, the overall environmental impact of such a general campaign may be substantial as it is likely to influence many different energy use behaviours simultaneously. As such, this can be an effective strategy for practitioners that aim to manage the serious environmental problems the world is facing today, such as global climate change.

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