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Title:

Energy curtailment behaviors in Greek households: different behaviors, different predictors

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1. Introduction

The academic literature on what drives households' energy-saving behavior has increased significantly over the past years. Latest research, alongside the usual demographic/house variables (e.g. Sardianou, 2007), have tested the role of information & feedback (e.g. Abrahamse et al. 2007; Ek and Soederholm, 2010), environmental attitudes and concern (e.g. Martinsson et al. 2011), values and psychological factors (Abrahamse and Steg, 2009; Webb et al. 2013). All this research has one thing in common: it treats the dependent variable, i.e. 'energy conservation', as a holistic behavior which is thus measured as a single scale and/or factor. Such an approach is rooted on an important theoretical tradition in environmental psychology which argues that pro-environmental behavior is, and should be treated as, an aggregate, uni-dimensional construct (cf. Kaiser, 1998). The opposite view maintains that pro-environmental behavior consists of distinct types (cf. Stern, 2000), a claim which implies that the various energy-saving behaviors should be studied individually.

The theoretical debate concerning the *uni*- vs. *multi*-dimensional character of energy-saving behavior is by no means settled. While previous research did show that the performances of various environmental behaviors correlate to quite some extent (e.g. Kaiser and Wilson, 2004), this does not preclude the possibility that they are nevertheless dependent on different causes. As a matter of fact, the handful of available studies which studied household energy-saving behaviors in a semi-aggregate fashion did reveal such differences. Thus, Karlin et al. (2012) found distinct profiles for energy (electricity, in particular) '*curtailment*' (i.e. the 'frequent and/or low cost (or free) energy saving behaviors', e.g. turn-off lights when leaving room) and energy '*efficiency*' (i.e. the 'infrequent structural changes and/or those requiring investments or purchases'– e.g. add insulation in home) clusters of behaviors (see also Barr et al. (2005) for similar findings). Furthermore, Urban and Scazny (2012) report that even *within* the energy(/electricity)-curtailment cluster the various behaviors depend on different predictors. These results reaffirm Black et al.'s (1985) findings of almost thirty years ago: the clusters of energy-saving behaviors have different predictors while the internal consistency of these clusters, as measured by the Cronbach's α, is rather low (op.cit. 9).

Taking our cue from the aforementioned research, in this paper we study in detail a number of households' different energy- (more particularly, electricity-) curtailment behaviors. Our research aims to address two questions: first, are the various electricity-curtailment behaviors dependent on different predictors? And second, which predictors are relevant for each specific behavior? Answering these questions is of theoretical interest since it relates to the uni- vs. multi-dimensional debate concerning the nature of energy-related behavior. Also, it will offer further clues to a largely under-researched topic, since, to our knowledge, Urban and Scazny's (2012) study is the only one examining energy/electricity-curtailment behaviors in a discrete fashion. That said, we should note that our explanatory schema differs from Urban and Scazny's (2012) since we include in our analysis psychological and value-based predictors: although 'the majority of energy behavior studies in this last decade has been dominated by the psychology research' (Lopes, Antunes, and Martins, 2012:4096), there are no studies which employed such an approach for *discrete* energy behaviors. Thus, in this paper we attempt to address this theoretical lacuna by including predictors originating from the VBN (values-belief-norms) theory and the Theory of Planned Behavior (TPB) (see Literature Review). Finally, our research is also of relevance and importance to policy making. According to recent reports, households are ultimately responsible for almost a quarter of the European Union's total greenhouse gases emissions (EEA 2012) while, and despite the introduction of more efficient appliances (JRC 2012), their electricity consumption continues to rise. Thus, understanding what drives households' particular electricity-curtailment behaviors would allow us to develop tailor-made interventions for reducing electricity consumption.

Our paper develops as follows. In the next, Literature review, section we discuss the findings of previous research concerning the influence of demographic and structural as well as psychological and moral factors on electricity-curtailment behaviors and present the hypotheses which we are going to test with our data. The data originates from telephone interviews with Greek multi-person households in the capital city of Athens (N=285), conducted in early 2012. We find that the performances of the various electricity-curtailment behaviors do not cluster together, a result which underscores that they should be studied and analyzed separately. We also find that each electricity-curtailment behavior depends on different predictors yet, overall, the psychological and the demographical/structural clusters of variables substantially contribute to the explained variance of electricity curtailment behaviors. On the other hand, the moral cluster's contribution was found to be not statistically significant, a fact which is due to the moral variables' substantial correlation with the psychological ones. In the concluding section of the paper we discuss our findings and their policy implications regarding the promotion of electricity-curtailment behaviors.

2. **Previous research and guiding hypotheses**

2.1 *Demographic & Structural factors influencing energy curtailment behaviors*

Available research concerning the effect of demographic and structural predictors on energy curtailment behavior (as an aggregate concept) has returned contradictory results. Reported effects of 'Age', 'Gender' and 'Income' vary between negative, insignificant and positive ones while the 'level of education' and the 'number of persons in the household' were found to have either a positive or a negative effect (cf. Karlin et al. (2012) as well as Urban and Scazny (2012) for two recent literature reviews). This polyphony is likely due to the fact that the various studies have used multi-item scales, each one of them including different variables, for measuring the *aggregate* energy curtailment behavior: as research on environmental concern has demonstrated, the influence of predictors is contingent on how the dependent variable is measured and/or operationalized (cf. Marquart-Pyatt, 2007; Van Liere and Dunlap, 1981). The varied influence of the demographic predictors resurfaces when we study energy behaviors in a *discrete* fashion. Thus Urban & Scazny's (2012) study of five electricity-curtailment behaviors[1] across 9 OECD countries showed that the various demographic/structural predictors are not

[1] These behaviors were: 'Switching off lights when leaving a room'; 'turning down AC or heating when leaving a room'; 'economic use of the washing machine and dishwasher'; 'turning off unused appliances'; and, 'turning off standby mode in household appliances'.

equally relevant for all behaviors: while 'gender' and 'age' impacted on some behaviors[2], 'education' and 'number of persons in household' proved statistically non significant for all, and 'income' for the vast majority of all, behaviors.

As far as structural predictors are concerned, the house's actual size seems of relevance when studying electricity-curtailment. One may plausible argue that certain behaviors would be more difficult to perform in bigger houses: for example, ensuring that lights are turned off in an empty room or not letting electric devices on stand-by may be conditioned by size of the house (thus the number of rooms) and, consequentially, by the number of electric devices which exist in these rooms. Nevertheless, the house's physical size had been rarely used as an explanatory factor in energy conservation studies (cf. Guerin et al. 2000:59). While Black et al. (1985), in their study of clusters of energy-curtailment behaviors, found no direct effect for house's size (pp. 15-17), there exist no studies examining its possible influence on discrete curtailment behaviors.

Thus, and due to scarcity of relevant research findings, our examination of the impact of demographic-structural predictors on discrete curtailment behaviors will be exploratory, and the only hypothesis which we could put forward is that,

Hypothesis 1 (H1): Each discrete electricity curtailment behavior will depend on different demographic and structural predictors.

2.2 Psychological and moral factors influencing energy curtailment behaviors

Similarly to other pro-environmental behaviors, 'the majority of energy behavior studies in this last decade has been dominated by the psychology research' (Lopes, Antunes, and Martins, 2012:4096), and the bulk of these studies is guided by two of the most influential psychological theories: the Values-Beliefs-Norms (VBN)

[2] In particular, elderly people were more likely to turn off unused appliances as well as not leaving them to standby mode while males were less likely to turn off the standby mode as well as to use economically the washing machine/dishwasher.

one (Stern, 2000) and the Theory of Planned Behavior (TPB) (Ajzen, 1991). The VBN theory argues that pro-environmental behavior stems from an individual's "moral values" which shape his/hers "beliefs" about the condition of the natural environment. While assessing an existing situation, an individual may come to believe that the current conditions (will) have detrimental effects on the environment ("awareness of consequences") and that s/he should and/or could undertake certain actions in order to avert those consequences ("ascription of responsibility to self"). This in effect creates a "personal norm" for undertaking action or, in other words, for engaging into some kind of pro-environmental behavior. On the other hand, the Theory of Planned Behavior (TPB) seems to downplay the role of moral considerations, focusing instead on individualistic and rational calculations. According to the TPB framework, a person behaves pro-environmentally because s/he has the "intention" to do so. This "intention" is influenced by that person's "attitude" toward the behavior in question (i.e. the personal evaluation of the particular behavior's likely outcomes), his/hers "subjective norms" (i.e. the extent to which the individual's social surroundings condone or otherwise the performance of the particular behavior as well as the extent to which the individual is willing to conform with those societal influences concerning the behavior in question) as well as his/hers "perceived behavioral control, PBC" (i.e. the individual's confidence in his/hers ability to perform the behavior).

Despite the prominence of the psychological beat in the research concerning energy-related behaviors, only a handful of psychology-oriented studies focused on energy-curtailment and all of them examined behavioral *clusters*. Thus, and on the one hand, Black et al. (1985) employed the VBN framework in order to account for minor energy curtailments (relating to heating) in US households and they found that the 'personal norm for energy curtailment' has the strongest direct effect on actual behavior. On the other hand, Karlin et al.'s (2012) study of a three electricity-curtailment behaviors' cluster comes closer to the TPB tradition since they use "social norms" ('perceptions of how others behave' and 'perceptions of what others approve' (p.13)) as a predictor, a concept which captures the essence of the "subjective norms" component in TPB: yet, Karlin et al. (2012) found that social norms are not statistically significant in explaining the cluster of electricity-curtailment behaviors.

Accordingly, our paper aims to address a research lacuna, namely to assess the influence of psychological factors on *discrete* electricity-curtailment behaviors. In so doing, we opt for an integrative use of the VBN and the TPB theories. The vast majority of past research has considered and employed those two theories as mutually exclusive explanatory schemata of pro-environmental behaviors. Nevertheless, recently we are moving towards an integration of the moral considerations of VBN with the rational framework of TPB (for a review, see Turaga et al. (2010:217)). While the exact role moral norms play within the TPB framework is still unclear (op.cit.), available research suggests that moral considerations have a significant, and distinct from the TPB predictors, explanatory contribution on pro-environmental behaviors (e.g. Harland et al. 1999; Kaiser, 2006; *contra* Kaiser and Scheuthle, 2003) while they appear to be more relevant in explaining energy *curtailment* behaviors in particular (see Oikonomou et al. 2009). Thus, alongside the TPB predictors, in this paper we will test for the influence of two predictors stemming from the VBN/norm-activation theory: "moral norms" and "feelings of moral regret" relating to electricity-use curtailment.

Similarly to the demographic/structural predictors, we have no a priori hypotheses concerning the impact of individual psychological predictors on particular behaviors save that

Hypothesis 2 (H2): Each discrete electricity curtailment behavior will depend on different psychological and moral predictors.

2.3 The relative influence of demographic & structural and psychological & moral predictors

To our knowledge, Abrahamse and Steg's (2009) is the only study which tries to evaluate the influence of both demographic, structural, psychological and moral predictors as well as the relative importance of TPB vs. VBN predictors on households' energy saving. Their results indicate that the various predictors affect differently on 'direct energy use' (i.e. 'gas, electricity and fuel use') and on 'indirect energy use' one (i.e. 'changing purchase decisions (e.g., meat consumption; avoid throwing away food)'). Of those two, it is 'direct energy use' which comes closer to our own dependent variable of 'electricity curtailment'. Abrahamse and Steg (2009) found that the TPB predictors ('attitude' and 'perceived behavioral control') contributed (marginally) significantly to the explained variance of 'direct energy use' while the norm-activation cluster[3] had no contribution. On the other hand, the socio-demographic cluster of variables had a significant contribution (p.717). These findings guide the final hypotheses we are going to test with our data, although one should note that Abrahamse and Steg's (2009) findings apply to the calculated, actual energy use of households (p.714) and not to self-reported electricity curtailment behaviors. Notwithstanding the previous reservation, we anticipate that

Hypothesis 3 (H3): The Theory of Planned Behavior (TPB) cluster of predictors will significantly explain the variance of electricity curtailment behaviors.

Hypothesis 4 (H4): The norm-activation cluster of predictors will **not** significantly contribute to the explained variance of electricity curtailment behaviors.

Hypothesis 5 (H5): The socio-demographic cluster of predictors will significantly contribute to the explained variance of electricity curtailment behaviors.

3. Data and Methods

3.1 Data

Our data originates from a telephone survey of Greek households in the capital city of Athens, conducted in early 2012. We opted for a simple random sampling technique. A total of 1,700 Athenian landline phone numbers were initially selected through a random numbers' online facility and these phone numbers were contacted at various times during the day, in order to ensure that working couples were not excluded from our survey, while in cases of non-response we called the particular number again at different hours/days, up to three extra times. One should note that landline phone ownership in Greece for multi-person households ranged between 80-89% for 2013 (Eurobarometer 2013:132). According to Mohorko et al. (2013), surveying *only* landline phones, as we do in this study, ran the risk of (slightly) over-covering male, elderly and/or higher educated Greeks for the year 2009. Although we cannot know if this would also be the case for 2013 (the year of our research) and despite the fact that Mohorko et al.'s (2013) conclusions are based on one-person households as well (contrary to our research-design), we cannot rule out the existence of some coverage errors in our sampling approach. We acknowledge this as a shortcoming and suggest

[3] In Abrahamse and Steg (2009) study the norm-activation cluster consisted of the 'awareness of consequences' and the 'ascription of responsibility' constructs but *not* of the 'subjective norms' one which they excluded from their analysis.

that future telephone surveys should include both landline and mobile phone-lines in their sampling scheme (cf. Mohorko et al. 2013).

Our final sample includes 285 multi-person households[4]. Respondents were asked to participate, under conditions of anonymity, in the telephone survey concerning the electricity saving behaviors they engage in within their household. All phone interviews lasted less than 15 minutes.

3.2 Measurement

3.2.1 Dependent variables: the discrete character of energy-curtailment behaviors

The dependent variables for our analysis originate from the answers given to the following, broad question: '*I would like to ask you what you personally do for saving electricity in your household*'. Respondents were asked to indicate 'how often' they engage in each of the following actions (see Table 1), following Thogersen and Gronhoj's (2010) research. Each behavior was originally measured on a 5-point Likert scale with the labels "never", "rarely", "half the time", "often" and "always/everytime", while a "non relevant" response option was also available. Nevertheless, for the following analyses the dependent variables (i.e. behavioral performance) were dichotomized between '2: always/everytime' performing the particular behavior and '1: all other valid replies'. The main reason for this dichotomization is that we are not interested in studying the frequency changes in performing a particular behavior but rather in understanding why people exhibit a consistent (i.e. 'always/everytime') electricity curtailment pattern in their daily, household routines. Furthermore, previous research had showed that a more diversified response format makes participants' answers more arbitrary and less reliable (cf. Kaiser and Wilson, 2000) and, accordingly, researchers have similarly dichotomize their original polytomous response format (e.g. Kaiser and Wilson 2004; Karlin et al. 2012).

************** Table 1 about here********************

[4] Of the initial 1,700 phone numbers, 1,011 (or 59.4%) of them were not operational at the time of research; 15.4% belonged to companies/state agencies/etc.; 7.1% refused to participate in the research or were fax-machine numbers while 1.2% were single-person households which are not relevant for our purposes.

In the previous section we have argued that energy (curtailment) behaviors do not necessarily form one cluster and thus should be studied individually. This claim is supported by our data: a principal components analysis of the aforementioned seven electricity-curtailment behaviors (Oblimin rotation with Kaiser normalization[5]) returned three factors (explaining over 56% of total variance, see Table 2) of curtailment behaviors (*contra* Karlin et al. 2012 who found a single curtailment factor, yet for a different set of behaviors).

************** Table 2 about here*********************

3.2.2 Predictor variables

A. <u>Demographic and structural variables</u>

We test for the effects of four demographic variables: the 'Age' of the respondent (calculated by subtracting the respondent's year of birth from the year of research), his/her 'Gender' and 'Level of educational attainment' as well as the 'Number of persons living in the household' (minimum two persons). The original response format for the 'Level of Education' had six categories ('0': *Has not attended school*; '1': *Attended some classes of/graduated from elementary school*; '2': *Attended some classes of/graduated from high school*; '3': *Attended some classes of/graduated from Lyceum*; '4': *Higher education degree (i.e. college, university)*; '5': *Post-graduate degree (i.e. M.Sc., Ph.D.)*) yet for this research we trichotomized the responses into 3 educational categories - 'Low', 'Medium' and 'High'. We also employ another structural predictor, the respondent's 'Home size' (measured in square meters).

For our analysis we do not employ an 'Income' predictor. While a question on the respondent's 'income' was part of the original questionnaire, during the initial telephone-interviews we experienced a strong refusal by respondents, who were unwilling to give such a personal piece of information "over the phone". In the face of

[5] An oblique (Oblimin) rotation was selected in order to allow for a correlation between the ensuing factors. This decision was taken since there are several publications opting towards the use of oblique rotation instead of varimax (orthogonal) rotation (e.g. McCroskey and Young, 1970) and also for comparative reasons since Karlin et al. (2012) study, which found a "clustering" of energy-curtailment behaviors, used the oblimin rotation approach as well (p.14). Nevertheless, the fact that the correlation coefficients of the factors (not presented herein) are close to zero suggests that the factors are independent to one another (in other words, a varimax rotation would return a highly similar solution to the one we have obtained by using the oblimin rotation).

this reaction, we subsequently decided to exclude the particular question all together. While we acknowledge this omission as a short-coming of our research, it is quite unlikely that the inclusion of an ‘income’ predictor would substantially change our results. The reason for this anticipation is that both Karlin et al. (2012) and Urban and Scazny (2012) found that ‘income’ is not statistically significant concerning electricity-*curtailment* behaviors[6]. This is hardly surprising if one considers that the curtailment behaviors we are studying have very low financial costs, thus it is quite unlikely that their performance would be substantially influenced by income differences. Albeit plausible, this is a tentative argument and future research should explore the impact of ‘income’ alongside the other demographic/structural, psychological and moral predictors we employ in the present study.

B. Psychological latent structures

All variables used in the construction of the following structures were measured on a 7-point Likert scale. Unless otherwise stated, most statements originate from Thogersen and Gronhoj (2010) and possible answers range from ‘1: totally disagree’ to ‘7: totally agree’ (with ‘4: neither agree nor disagree’ as the middle point).

“Attitude”: 2-item scale (Cronbach’s $\alpha = 0.667$); (by saving electricity I contribute to avoiding global warming; by avoiding unnecessary electricity consumption I save money on the electricity bill).

“Subjective norms”: 2-item scale ($\alpha = 0.234$)[7]; (most of my acquaintances expect from me that I save electricity in my home; most people who are important to me think that I [‘1: should not’ *to* ‘7: should’] make an effort to save electricity).

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[6] On the contrary, both studies found that personal ‘income’ has a significant, positive effect on electricity-*efficiency* behaviors, such as ‘switching to energy-efficient light bulbs’ or ‘purchasing energy-efficient appliances’.

[7] The subjective norms’ low Cronbach’s α raises some statistical concerns. Facing a similar finding, Abrahamse and Steg (2011) argued that it might be due to the diversity of the various reference groups and thus they opted for using ‘a single-item measure of subjective norm, namely the extent to which household/family members accepted a social norm in favor of energy conservation, as it was thought to be the reference group most relevant for domestic energy conservation’ (p.33). Suboptimal results were also returned in Thogersen and Gronhoj’s study (2010:7735) which employs the same two variables we use in this study.

Once we identified this low Cronbach α, we conducted an exploratory factor analysis of the construct’s two items (as indicated by the Eigenvalue criterion). The factor analysis explained a moderate percentage (≈57%) of their variance thus, although the specific construct explains a rather small proportion of the shared variance among the two variables, the two items still form a single factor

“Perceived Behavioral Control”: 4-item scale (Cronbach’s α = 0.726); (I believe that I’m able to avoid all unnecessary electricity consumption in my home [ranging from ‘1: most certainly not’ to ‘7: most certainly’]; to which extent do you believe that you are able to limit electricity consumption in your household to the absolute necessary? [ranging from ‘1: not at all able to do it’ to ‘7: able to do it to a high extent’]; how certain are you that you are able to avoid all unnecessary electricity consumption in your home [ranging from ‘1: very uncertain’ to ‘7: very certain’]; how much control do you feel that you personally have over how much electricity is consumed in your household? [ranging from ‘1: very little control’ to ‘7: complete control’].

C. Moral latent structures

All variables used in the construction of the following scales were measured on a 7-point Likert scale ranging from ‘1: totally disagree’ to ‘7: totally agree’ (with ‘4: neither agree nor disagree’ as the middle point).

“Feelings of moral regret”: 3-items scale (Cronbach’s α = 0.837), following Kaiser (2006); (it makes me feel like a better person to save electricity in my home; I feel bad about using more electricity than necessary in my home; I get a bad conscience if I waste electricity in my home).

“Moral norms”: 3-items scale (Cronbach’s α = 0.731), following Kaiser and Scheuthle (2003); (saving electricity in my household is a responsible behavior towards other people and/or the environment; it is my obligation towards other people and/or the environment to save electricity in my household; not saving electricity in my household is at odds with my principles).

3.3 Method

We test the predictors’ influence on the various electricity curtailment behaviors though hierarchical binary logistic regression modeling (Agresti, 2002)

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suitable for replacing them as their underlying construct. In addition to these statistical grounds, and more importantly, we have opted for retaining the construct for this analysis since it is theoretically sound. We will return to the possible implications of this decision in the Discussion section of the paper.

which has been the standard in most similar studies (e.g. Karlin et al. 2012; Abrahamse and Steg, 2011), yet future research on this specific topic may offer us further insights by fitting more complex regression models, for instance generalized additive models that replace the linear terms of logistic regression with non-parametric functions of the predictors[8].

In particular, for modeling the seven electricity curtailment behaviors we hypothesize that the latter binary dependents Y_i (i=1,2,…,7) follow a binomial distribution with probability $P(y_i = 2) = \pi_i$ and $P(y_i = 1) = 1 - \pi_i$. Then, if $\mathbf{x} = (x_1, x_2, ..., x_m)^T$ is the set of predictor variables, each logistic regression model is expressed as:

$$\log it(\pi_i) = \log\left(\frac{\pi_i}{1-\pi_i}\right) = \mathbf{x}^T \cdot \boldsymbol{\beta},$$

where $\boldsymbol{\beta} = (\beta_1, \beta_2, ..., \beta_m)^T$ is the corresponding vector of coefficients for the m explanatory variables. For connecting the dependent and the covariates we have used the logit link function: $f(x) = \log\left(\frac{x}{1-x}\right)$.

We fit the logistic models in three consecutive steps. In the first step (Model A) we examine solely the explanatory power of the psychological predictors' cluster, of those constructs pertaining to the Theory of Planned Behavior (TPB). In the next Model B we add the moral variables' cluster, basing our choice of order on the (limited) empirical evidence suggesting that moral concerns' impact may be indirect and mediated through the TPB variables (cf. Turaga et al. 2010). The socio-structural variables are added to the aforementioned predictors in the final Model C, since they are also assumed to influence behavior indirectly (Ajzen and Fishbein, 1980; see also Abrahamse and Steg (2009:716) for a similar approach).

The backward selection technique was used for the fitting of all three models regarding each electricity-curtailment behavior. Thus we are able to identify the optimal set of independent and statistically-significant predictors for each behavior, avoiding over-fitting.

4. Results

[8] We thank the anonymous reviewer for pointing this out to us.

In Table 3 we report the bivariate correlations between the predictor variables/constructs. We notice that the two moral constructs are, rather unsurprisingly, substantially correlated while they are also substantially correlated with the ‘attitude’ construct.

************** Table 3 about here*********************

The results of all three models for each electricity curtailment behavior are presented in Table 4. For clarity reasons, in the cell entries we report only the statistically significant b coefficients. Also, for ease of reference, the discrete behaviors which load on a single factor (see Table 2) are presented in adjacent columns in Table 4.

Concerning out first Hypothesis, examining the ‘Model C’ columns in Table 4 reveals that each discrete electricity curtailment behavior is influenced by different, both quantitatively and qualitatively, demographic and structural predictors (thus Hypothesis 1 is confirmed). In particular, five out of seven behaviors (turning off the lights; switch off TV; switch off PC; not leaving appliances on standby; and, placing the lid while cooking) are statistically significantly influenced by a single predictor - yet not the same one. The remaining two behaviors (washing at a lower temperature; and, starting the washing machine when it is full) are influenced by more than one predictor – yet again, not by the same ones. Of all the socio-structural predictors, ‘Age’ and ‘Gender’ are the ones impacting on more electricity-curtailment behaviors. Elder respondents are more likely than younger ones to wash their clothes at a lower temperature, to switch off the PC and to put a lid on the pot while cooking, yet this age effect is rather weak: for a one-unit increase in ‘Age’ (i.e. for one extra year in the respondent’s age) the odds of ‘always/everytime’ performing any of the aforementioned behaviors increase by a mere 2-3%[9]. The odds of a male ‘to switch off the TV when no one is watching’ or ‘not to leave appliances on standby’ are respectively around 2.4 and 2 times higher than for a female. On the other hand, females are around 3 times more likely than males to do the washing at a lower

[9] The odds ratio for increasing/decreasing the performance of each energy curtailment behavior by one-unit increase in the predictor variable is calculated by exponentiating the cell entries (b scores) in Table 3 (i.e. odds ratio = e^b).

temperature. Occupants of bigger houses are more likely to do their washing in a full machine but less likely to switch off the lights when leaving an empty room –yet in either case the effect of ‘house size’ is very small. The more persons living in the household the less likely it is to start the washing machine when it is full while higher educated individuals are almost five times more likely to do their laundry at a lower temperature than the least educated ones.

The second Hypothesis we wished to test with our data was that the various electricity-curtailment behaviors will depend on different psychological predictors as well. Again, examining the ‘Model C’ columns reveals that this Hypothesis 2 is also confirmed. Only two behaviors (switching off the lights; and, turning off the TV) are influenced by the same group of psychological variables – in particular, by the PBC (Perceived Behavioral Control) and the Moral Norms. The remaining behaviors are influenced by different combinations of the PBC and/or the moral predictors (moral norms & feelings of moral regret) with the notable exception of ‘turning off the PC’ which is not influenced by any psychological or moral variable. Overall, PBC seems to be the more relevant explanatory psychological variable, influencing four out of the seven behaviors with the odds ratios ranging from 1.29 (for starting the washing machine when it is full) to 1.83 (for not leaving the appliances on standby). Moral norms make more likely the performance of 3 out of 7 behaviors (odds ratios ranging from 1.4 for ‘turning off the TV’ to 2.01 for ‘turning off the lights’), the same number of behaviors influenced by feelings of moral regret (odds ratios ranging from 1.29 for ‘putting the lid on while cooking’ to 1.55 for ‘not leaving the appliances on standby’). An important finding is that neither ‘Attitude’ nor ‘Subjective norms’ seem to influence any of the electricity curtailment behaviors in the final Model Cs. We discuss the reasons for this in the Conclusions’ section.

Finally, we turn our attention to the remaining Hypotheses 3 to 5. Checking the Likehood Ratio Test (LRT) statistic (see the last row of Table 4, the entries for Model As) shows that the TPB (psychological) cluster explains more variance of the dependent variable than the null model (i.e. the fit improvement is statistically significant between Model A and the null model) for five out of seven behaviors, thus Hypothesis 3 is overall confirmed. Also, Hypothesis 4 is confirmed: as it follows from the Likehood Ratio Test (LRT) statistic (see the last row of Table 4, the entries for Model Bs), for all energy curtailment behaviors –save ‘not leaving appliances on standby’- the inclusion of the norm-activation cluster of predictors does not contribute to the fit of the model (i.e. the fit improvement is statistically not significant between Models A & B). Finally, Hypothesis 5 is also confirmed: the socio-demographic cluster of predictors significantly improves the explained variance of performing all energy curtailment behaviors (refer to LRT statistic for Model Cs, which compares the fits of Models B and C).

************** Table 4 about here*********************

5. Conclusions and Policy implications

This paper set out to examine what drives the households' electricity curtailment behaviors. We hypothesized that these behaviors would depend on different predictors and thus should be studied independently. This guiding proposal was supported by our data. As it was showed in Table 2, and contrary to other research, electricity curtailment behaviors do not form one single cluster. Furthermore, as shown in Table 4, even those behaviors which load on the same 'behavioral factor' (please refer to Table 2) do not depend on the same predictors, thus confirming Urban & Scazny's (2012) findings[10].

Despite the differences between the various electricity curtailment behaviors, some overall patterns are clearly discernible. To start with, the inclusion of the moral predictors (Model B) barely improves the predictive power of the TPB cluster (Model A): the LRT scores for Model B are statistically non-significant (with the exception of the 'not leaving appliances on standby' behavior). This result, which confirms Kaiser and Scheuthle (2003) over Harland et al. (1999), suggests that moral considerations are interwoven in the TPB constructs. In particular, the drastic reduction on Attitude's unique contribution following the introduction of the two moral predictors confirms

[10] These results are very similar if we use the original polytomous response format for the dependent variables (i.e. the electricity-curtailment behaviors) instead of the dichotomous (i.e. "always/everytime" performing the behavior vs. all other answers) ones used in this study. Due to space restrictions, the results for the 'polytomous' models are not presented herein yet they are available upon request. The only difference revealed by our re-runs was that while the moral predictors were statistically significant for some of the 'dichotomous' electricity-conservation behaviors, once we use a 'polytomous' format they cease to be so -for the majority of these behaviors. These findings, which follow from the 'full' (i.e. all predictors included) models, suggest that, even more so than it was the case for the 'dichotomous' models, the moral predictors do not contribute significantly to the explained variance of electricity curtailment behaviors. Apparently, while moral concerns play a role in determining the performance *consistency* of some electricity-curtailment behaviors (as shown by the 'dichotomous' models), they do not account for *frequency changes* in performing these behaviors (as it follows from the 'polytomous' models).

earlier findings that the ‘attitudes’ construct of TPB largely incorporates ‘moral norms’ (cf. Kaiser, 2006; Kaiser and Scheuthle, 2003), a fact which is underlined by the substantial correlation between those variables (see Table 3). A similar, yet more moderate, reduction effect occurs also for the PBC’s unique contribution as soon as the moral predictors are included. These findings seem to suggest a specific policy option for promoting electricity curtailment, similar to what Oikonomou et al. (2009) argue for energy efficiency policies: to focus on ‘moralization, which implies convincing people that they should protect collective environmental qualities [..] and that their contribution will be socially helpful.’ (p.4795). That said, one should keep in mind that communication campaigns telling people how ‘they should feel and act’ are unlikely to have a straightforward effect on an individual’s behavior or to “hot-wire” an individual into action by appealing to his/her moral concerns: we should not forget that ‘personal [i.e. moral] norms are internalized social norms, and communicating the social norm *might, in the long run, stimulate this internalization*’ (Harland et al. 1999:2524, our emphasis).

Talking about social norms brings us to the second general pattern revealed by our data: the fact that ‘subjective norms’ are not a statistically significant predictor in any of the Models -the only variable to be so. Previous research has identified ‘subjective norms’ as the weakest predictor of the TPB framework and this weakness has been primarily attributed to the fact that ‘subjective norms’ are measured by single items (cf. Armitage and Conner, 2001). Nevertheless, multiple-items measurements, as the one we use in this study, may face problems of their own. Midden and Ritsema (1983) showed that people attribute different levels of commitment to energy conservation norms to the different referent groups (such as the authorities, their family and/or the social acquaintances), a fact which is underlined by the low reliability of the ‘subjective norms’ scale in this study (see also Abrahamse and Steg (2011:33) for a similar finding). Furthermore, Midden and Ritsema (1983) found that people are more likely to comply with the norms of higher authorities and of family members- and not of their societal milieu (friends, neighbors, colleagues, acquaintances) (p.50). Accordingly, the non statistically significant impact of our ‘subjective norms’ construct may be due to the fact that it consists of two referent groups which have *different* norm-compliance relevance for an individual’s electricity-curtailment behaviors (see also Knight Lapinski and Rimal, 2005:137-138). Of course, trying to avoid this hurdle leads us back to the problem of single-item measurement we have referred to earlier. Furthermore, it seems that even using high-relevance reference groups as a single proxy for 'subjective norms' does not improve the situation. Thus, Abrahamse and Steg (2009) used the extent to which 'family/household members' are in favor of energy conservation as a single-item measurement for 'subjective norms' yet they got not statistically significant results. Similarly, when we re-tested our models using a single-item measurement for subjective norms (i.e. 'most people who are important to me think that I [should not-should] make an effort to save electricity')[11] we also got not statistically significant results (save the 'not leaving appliances on standby' behavior). Thus, these disappointing findings may point to a different explanation concerning the non-significant influence of subjective norms on electricity-curtailment behaviors: namely, that it is due neither to the number of scale-items used nor to the relevance of the various reference groups but rather to the specific context within which these behaviors are performed. Arguably, since all these electricity-curtailment behaviors are performed in the privacy of one's home and not necessarily in the presence of others (even of family members) 'then not only is there no opportunity to observe others' behavior (and thus no information about behavioral prevalence), but one's own behaviors would also not be observable for others' scrutiny' – a fact which would 'moderate [any possible] normative influences' (Knight Lapinski and Rimal, 2005:141). This is a plausible explanation, yet further research is needed in order to establish whether this is indeed the case.

Another finding is that while the demographic-structural cluster is statistically significant for all electricity-curtailment behaviors, its composing variables impact differently on specific behaviors. This observed differentiation suggests that broad-brush awareness/informational campaigns would not suffice, but policy interventions should rather focus on specific segments of the population regarding a given behavior. For example, the fact that individuals with a lower educational attainment are almost five times less likely than highly-educated ones to do their laundry at a lower temperature (at 60^{o}C instead of 90^{o}C) clearly highlights that any campaign concerning the particular behavior should target the former educational stratum.

Despite these similarities, we should not lose sight of the fact that each electricity-curtailment behavior is a different story, and the fact that the suggested

[11] Due to space restrictions, the results of these re-runs are not presented herein yet they are available upon request.

models predict each behavior's performance with varied accuracy is a case to the point. Examining the Nagelkerke R^2 for the full Model Cs, one notices the difference, for example, between the miniscule 0.036 for 'turning off the PC' and the substantial 0.233 for 'turning off the lights'. Why is this the case? Standard statistical reasoning would posit that the inclusion of further predictor variables would improve the models' fit. Nevertheless, it is hard to imagine which extra predictors would be relevant here, especially since we are dealing with energy-related behaviors which arguably accrue no economic costs, require little -if any- extra personal effort and whose practice hardly reduces the performer's welfare/comfort. Rather, we expect that the observed differences in the explained variances of these behaviors relate to a combination of structural practicalities, habitual conveniences and/or personal (mis)conceptions. For example, it is plausible to argue that people might feel that turning off completely the electric appliances is not a readily option when most modern electronic appliance do *not* have a inbuilt turn-off button; that putting a lid on the boiling pot prevents you not only from stirring your stew but also from keeping an eye on it while you are otherwise engaged in the kitchen; that if you switch on and off the electric devices on demand (instead of leaving them on standby mode) "they will not last so long"; or, that washing at a higher temperature is necessary for keeping your clothes "really" clean. We suggest that future research assesses the validity of such rationalizations, since they have clear policy implications for electricity-saving campaigns. If it turns out that these contextual, habitual and/or cognitive factors significantly influence the performance of energy-curtailment behaviors then our earlier recommendations in favor of 'moralizing' and demographically tailor-made interventions should be coupled with informative campaigns and, more importantly, with policy measures giving consumers a *real* option to press the "off" button on their households' electricity consumption –if they so wish.

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Table 1: Energy curtailment behaviors' descriptive statistics ('1': never - '5':always/everytime)

Behavior	N	Mean	Std. deviation	Valid % of 'always' answer
Switch off all light when leaving a room as last person? *(lights)*	284	4.27	0.874	49.3
Set the washing machine's temperature at 60^{o}C instead of 90^{o}C? *(wash_60C)*	277	4.29	1.111	62.1
Start the washing machine when it is not completely full? (**reverse**) *(wash_full)*	279	2.34	1.264	30.5
Switch off the TV when nobody watches it? *(TV)*	284	4.04	1.173	48.9
Switch off the computer when it is not used? *(PC)*	259	3.94	1.255	47.9
Switch off standby when electric devices are not used? *(no standby)*	284	3.12	1.457	25.0
Put a lid on the pot when boiling food? *(put lid)*	280	4.35	0.911	57.9

Table 2: Oblique rotated loading matrix for energy curtailment behaviors – "always" vs "all other valid answers"

	Rotated factor loadings		
Behavior	**Factor1**	**Factor2**	**Factor3**
Switch off all light when leaving a room as last person? *(lights)*	**.605**	.093	-.005
Set the washing machine's temperature at 60°C instead of 90°C? *(wash_60C)*	.088	**.809**	-.125
Start the washing machine when it is not completely full? (**reverse**) *(wash_full)*	.000	.086	**.878**
Switch off the TV when nobody watches it? *(TV)*	**.637**	-.001	.212
Switch off the computer when it is not used? *(PC)*	**.675**	.186	-.133
Switch off standby when electric devices are not used? *(no standby)*	.579	.019	.544
Put a lid on the pot when boiling food? *(put lid)*	.122	**.737**	.242
Explained variance	*24.81%*	*16.19%*	*15.33%*

Note: Values in bold indicate the behavior's loading on a specific factor (threshold level: 0.6)

Table 3: Correlations between predictor variables/constructs

Variables/Constructs	1	2	3	4	5	6	7	8
1. Attitude	---							
2. Subjective norms	0.215*	---						
3. PBC	0.358**	0.331**	---					
4. Moral regret	0.541**	0.293**	0.315**	---				
5. Moral Norm	0.615**	0.363**	0.400**	0.652**	---			
6. Age	0.286**	0.193**	0.189**	0.379**	0.378**	---		
7. Education	0.134*	n.s.	n.s.	n.s.	n.s.	-0.160*	---	
8. Gender	0.176*	0.122*	n.s.	n.s.	0.147*	n.s.	n.s.	---
9. Persons in house	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.122*	n.s.
10. Home size	n.s.	n.s.	n.s.	n.s.	0.123*	n.s.	0.214**	n.s.

n.s.: non-significant; *: significant at the 0.01 level (two-tailed); **: significant at the 0.05 level (two-tailed)

Table 4: Electricity-saving behaviors' predictors (binary logistic regression results, backward selection. The cell entries report the b coefficients. Reference category for the dependent variable: '1- all other answers' ('2' - always performing the behavior).

			Cluster 1 of energy-curtailment behaviors								
			Lights			**TV**			**PC**		
			Model A	**Model B**	**Model C**	**Model A**	**Model B**	**Model C**	**Model A**	**Model B**	**Model C**
constant			-0.098	-0.097	0.725	-0.062	-0.05	-0.367	-0.07	-0.051	-1.014
Model A predictors	**Psychological factors**	*Attitude*	0.457***			0.233*					
		Subjective norms									
		PBC	0.695***	0.572***	0.498***	0.425***	0.395***	0.35**			
+ Model B predictors	**Moral factors**	*Moral regret*								0.281**	
		Moral norms		0.615***	0.701***		0.259*	0.347**			
+ Model C predictors	**Age**										0.022**
	Gender (ref. female)	*Male*						0.866***			
	Level of education (ref. 'High')	*Low*									
		Medium									
	Structural conditions	*Persons in household*									
		Home size			-0.007**						
	Nagelkerke R^2		0.188	0.215	0.233	0.086	0.086	0.126	0.0	0.025	0.036
	% of correct classification		65.5	66.3	66.7	58.4	60.6	63.3	51.8	53.9	54.8
	-2log-likelihood		346.7	337.5	315.3	370.6	368.1	339.6	355.9	349.8	327.2
	Likehood Ratio Test (LRT)		46.9***	9.2 (n.s.)	22**	22.9***	2.5 (n.s.)	29**	2.68 (n.s.)	6.1 (n.s.)	23**

***: p< 0.01; **: p<0.05; *: p<0.1

Table 4 (continued, I)

			Cluster 2 of energy curtailment behaviors						*Cluster 3*		
			Wash 60C			**Put lid**			**Wash full**		
			Model A	**Model B**	**Model C**	**Model A**	**Model B**	**Model C**	**Model A**	**Model B**	**Model C**
	constant		0.517	0.504	-0.291	0.32	0.33	-0.833	-0.844	-0.833	-0.686
Model A predictors	**Psychological factors**	*Attitude*	0.582***	0.473***							
		Subjective norms									
		PBC				0.315**					0.254*
+ Model B predictors	**Moral factors**	*Moral regret*		0.294*	0.416***		0.413***	0.261*			
		Moral norms			0.416***						
+ Model C predictors	**Age**				0.032***			0.027***			
	Gender (ref. Female)	*Male*			-1.1***						
	Level of education (ref. 'High')	*Low*			-1.585**						
		Medium									
	Structural conditions	*Persons in household*									-0.296**
		Home size									0.007**
	Nagelkerke R^2		0.123	0.127	0.215	0.032	0.052	0.1	0.0	0.0	0.059
	% of correct classification		65.7	64.3	71.6	58.5	60.9	60.3	69.9	69.7	69.5
	-2log-likelihood		337.8	335.1	298.2	370.7	364.7	333.9	337.5	336.1	307.4
	Likehood Ratio Test (LRT)		29.83***	2.7 (n.s.)	37**	10.52**	6 (n.s.)	31**	5.53 (n.s.)	1.4 (n.s.)	29**

***: p< 0.01; **: p<0.05; *: p<0.1

Table 4 (continued, II)

			Not loading to a single cluster		
			No standby		
			Model A	**Model B**	**Model C**
constant			-1.237	-1.312	-1.601
Model A predictors	**Psychological factors**	*Attitude*			
		Subjective norms			
		PBC	0.741***	0.655**	0.606**
+ Model B predictors	**Moral factors**	*Moral regret*		0.446**	0.441**
		Moral norms			
+ Model C predictors	**Age**				
	Gender (ref. female)	*Male*			0.69*
	Level of education (ref. 'High')	*Low*			
		Medium			
	Structural conditions	*Persons in household*			
		Home size			
	Nagelkerke R^2		0.111	0.152	0.17
	% of correct classification		75.1	78.5	76.2
	-2log-likelihood		293.6	281.9	265.2
	Likehood Ratio Test (LRT)		25.8***	12**	17**

***: p< 0.01; **: p<0.05; *: p<0.1