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Environmental Attitudes and Household Electricity Use among Budapest Residents

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Abstract: This paper addresses the question of whether the evidence on positive relationship between environmental attitudes and household energy consumption in advanced post-industrial societies can be extended to emerging economies. In this study, we focused on electricity use and utilized multivariate regression to test the above hypothesis on a sample of residents of Óbuda (Budapest) in February 2011. The analysis suggests that the findings on the positive environmental attitude-behaviour relationship in advanced post-industrial societies can be extended to some (relatively affluent) communities in post-socialist societies. Our data also showed that the effects of housing type and demography are much larger compared to the effects of the attitudes. We emphasize that our findings do not provide evidence against the hypothesis on the interaction between the effects of societal culture and individual attitudes on pro-environmental behaviour.

Keywords: *environmental attitudes, pro-environmental behaviour, energy consumption, electricity use, post-socialist societies*

Introduction

Overconsumption of natural resources is one of the major eproblems (e.g., Katzev and Johnson, 1987). This consumerism is typically encouraged by 'officially sanctioned and culturally accepted beliefs that perpetual economic growth is necessary for 'progress' and for social and political stability. […] the affluent, industrialized nations are often exhausting the natural

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resources of the poorer developing nations by our overuse of energy, minerals, timber, and so on' (Oskamp, 2000: 503). Energy consumption was an essential topic of public interest in the 1970s, when oil price increased dramatically. This interest gradually calmed down, but recently, as a part of resurgence of general environmental inquiry, a renewed interest in energy conservation emerged.

Certainly, the energy prices are not the only motivation for energy conservation. Economic factors that are closely related to infrastructural (Bihari, Gróf and Gács, 2010), social, and psychological factors (Kollmuss and Agyeman, 2002) are of great importance. In many cases, savings may be achieved partly by technological investments; however, they can be largely achieved by changing the behavioural patterns of residents. Therefore, the best solution is to integrate all viewpoints, economic, technical, sociological, and psychological (Krebs, 1975; Brandon and Lewis, 1999). Many studies conducted in the last decades supported this view.

This study aimed to assess the relationship between environmental attitudes and household energy use. We addressed electricity use and utilized multivariate regression technique to investigate the above link on a sample of residents of Óbuda (Budapest, Hungary) in February 2011. We incorporated different types of explanatory (control) variables into the model systematically in order to better understand the structure of electricity use and its relationship with individuals' attitudes.

Some earlier research indicated that environmental attitudes have a significant effect on pro-environmental behaviour (e.g., Thompson and Barton, 1994; Stern, Dietz and Guagnano, 1995; Poortinga, Steg and Vlek, 2004). Those findings relied on evidence gathered in advanced post-industrial societies.

One should note, however, that the social context may also influence the congruence among pro-environmental values, attitudes, and behavior (Olli, Grendstad and Wollebaek, 2001). Social context might refer not only to friends or family, but also to the entire social milieu; therefore, one should not ignore the social value system of a given society (Ewert and Baker, 2001; Nordlund and Garvill, 2002).

Our analysis is motivated by the conjecture that cultural traits of a given society might influence the relationship between environmental attitudes and pro-environmental behaviour. That is, conclusions drawn from the evidence gathered in advanced post-industrial societies may not be extended to emerging economies.

Our scope is well outlined. We aimed at testing the attitude-behaviour relationship concerning energy consumption in the context of a middle-income post-socialist society. In Central-Europe, electric power is not the most relevant energy resource for households, but from our standpoint, it has several attractive characteristics. First, it reflects the consumption levels and individual preferences on energy consumption directly. Second, the survey measurements of household electricity consumption are rather valid, which is an important component of sociological and environmental psychological research.

We do not put forward a new theoretical argument to justify our test. Moreover, we do not intend to develop a comprehensive model of household energy use. Nonetheless, we address both issues in the concluding section. Though the topic and the approach are relatively thoroughly investigated and discussed in the literature, our data are remarkable given the geographical area in which only few similar studies have been conducted.

We conclude that the results on the positive environmental attitude-behaviour relationship in Western Europe can be extended to some (relatively affluent) communities in post-socialist societies. However, our findings do not provide evidence against the hypothesis on the interaction between the effects of societal culture and individual attitudes on pro-environmental behaviour.

Protecting the Environment: Individual Attitudes and Household Behaviour

Household energy use is by no means a question of individual behaviour alone. Networks of energy delivery and public transport are just as important as the technologies for building and renovating housing estates. Nonetheless, individual decisions do have significant effect on aggregate demand for energy resources as well as on the optimal designs of energy delivery and transport networks.

For a few decades, social scientists have investigated the motivations to engage in pro-environmental behaviour. A detailed knowledge of why individuals behave pro-environmentally (or why they do not) is important not only for researchers, but also for policy makers. It can help find solutions to environmental problems that require behavioural change. Unfortunately, some research efforts tend to polarize the data. Economists, for example, tend to exaggerate the importance of the influence of external conditions, such as price and socio-economic characteristics, on the behaviour. Psychologists, in contrast, typically concentrate on linking psychological variables, for instance, the risk perception (Steg and Sievers, 2000) or the political attitudes (Olli, Grendstad and Wollebaek, 2001) to behaviour. Social psychological and environmental psychological theories and models argue that pro-environmental behaviour is derived from internal values, beliefs, environmental knowledge, and pro-environmental attitudes (c.f. Kollmuss and Agyeman, 2002). Therefore, consumers' attitudes are considered as important determinants of household energy use. From the 1980s, a handful of integrative approaches have been published. Van Liere and Dunlap (1980: 194) emphasized that 'the most powerful analyses of the social bases of environmental concern will likely be those which consider both its demographic and cognitive determinants'. Psychological processes, such as environmental values and attitudes, play key roles in determining how global conditions impinge on individuals' everyday behaviour (Stokols, Misra, Gould, Runnerstrom and Hipp, 2009)[1].

Most psychological studies focus on the relationship between internal variables and behaviour (c.f. Fransson

and Gärling, 1999). Regarding the concordant opinion of researchers and theorists, attitudes and underlying value orientations predict behaviour and behavioural intentions (Poortinga, Steg and Vlek, 2004). For example, Thompson and Barton (1994) found that ecocentric and anthropocentric value orientations independently explain general conservation behaviours. Stern, Dietz and Guagnano (1995) published a broad social-psychological model to systematize a series of sequential relationships among environmental concern factors and behaviour, suggesting that social and institutional contexts have an early and very strong effect on the emergence and development of individual psychological variables, specifically on values. Values then have strong formative influence on general beliefs and broad worldviews, such as altruistic norms, and are tightly connected to environmental concerns. Later, from these general ideologies emerge more specific attitudes that lead to formation of behavioural intentions and ultimately to actual behaviour. This theory gives a comprehensive explanation of pro-environmental behaviour.

Unfortunately, a coherent model concerning specifically energy conservation behaviour is not available yet, but psychologists and sociologists provided many relevant data. Research shows that residential energy conservation is influenced not only by simple everyday decisions such as whether to turn down the gas stove or turn off the lights, but also by major demographic factors, such as where to live (Dewine-Wright and Howes, 2010). The results of a comprehensive study on energy consumption conducted in Canada found that energy use was well predicted by housing characteristics (e.g., fuel type, single vs. multiple family), resident characteristics (bigger, wealthier families with more members use the most energy), and attitudes (beliefs that energy conservation is or is not important) (Ritchie, McDougall and Claxton, 1981). Others found that four beliefs are strongly related to energy use and conservation, particularly the beliefs that energy use is important for comfort and health, that person's energy savings are worth the effort, that these efforts can make difference for the person, and the beliefs about the reality of the energy crisis (Samuelson and Biek, 1991). These four attitudes predict over half of the variance in actual electricity use by households (Becker, Seligman, Fazio and Darley, 1981). Nevertheless, attitudes cannot explain the entire energy conservation behaviour, as people who have pro-conservation attitudes frequently do not engage in pro-conservation behaviours (Neuman, 1986). Income and status, for example, have strong relationship with the home energy conservation, as relatively high and very low income earners conserve more (Blocker and Koski, 2007). Residential ownership and building type also seem important, as homeowners take more pro-environmental actions compared to renters to make their dwellings energy efficient, but, interestingly, they do not reduce energy-consuming activities more than renters do. Residents living in multiple-unit dwellings conserve less. The explanation is simple. Typically, such buildings had only one gas or electric meter installed for

the whole building. At the time these buildings were built, although energy was cheap, installing separate meters in every unit would have been expensive (c.f. Delprato, 1977).

As we have seen, environmental attitudes may motivate pro-environmental behaviour. Those attitudes, in turn, might reflect specific value systems and social norms[2] of the relevant reference groups. According to Olli, Grendstad and Wollebaek (2001) the social context (e.g., social network of which the individual is part of) also determines the congruence among pro-environmental values, attitudes, and behavior. Ewert and Baker (2001) argued that social context refers not only to friends or family, but to the entire social milieu and social learning processes (via media or formal education)[3]. In this respect, we have to consider the social value system of a given society (Nordlund and Garvill, 2002).

If cultural traits of a given society can significantly influence the effect of environmental attitudes on pro-environmental behaviour, then new data from an emerging economy may shed new light on the attitude-behaviour relationship tested only in advanced post-industrial societies so far. In this paper, we present the findings of a survey conducted in Budapest, Hungary. In line with earlier research, we tested the effect of the attitudes, respondents' socio-economic status, and housing context on household energy use. Nonetheless, the indicators we use are somewhat different from those used in previous analyses. Moreover, we put special emphasis on the possible mediating role of purchasing certain consumer goods.

Data and Method

We analysed a sample of residents living in Óbuda, a North-West area of Budapest[4] with cca. 125,000 inhabitants. Dominant housing type and average socio-economic status of households vary significantly across the housing belts of Óbuda. Almost 80% of its inhabitants live in large panel housing estates established in the seventies and eighties, but a traditional inner city area, suburban and 'rurban' neighbourhoods, and areas dominated by small condominiums can also be found in this district. Moreover, there are significant differences in the property market positions among various large panel housing estates in our sampling area (Csizmady, 2002).

Fieldworkers conducted 503 face-to-face interviews in February 2011. We adopted spatially stratified sampling method to control for the variance in housing characteristics. Areas dominated by large housing estates were under-represented in the sample in order to increase the variance. Within each stratum, random-walk sampling design was implemented[5].

Our questionnaire addressed the major aspects of household energy use and included some attitude items and questions on the basic household characteristics and the respondent's socio-economic status.

We selected electricity use to analyse the attitude-behaviour relationship. In Central-Europe, electric power is not the most important energy resource for households concerning direct costs, natural resource use, pollution, or saving opportunities. However, it has several characteristics, which make it the perfect subject for such an analysis.

First, due to a unified distribution technology, household expenditures directly reflect consumption levels. Thus, researchers did not have to investigate the consumption data for every single household. It sufficed to ask respondents about their monthly bills. This is surely not true for heating, for instance, which is responsible for a fair share of energy use in European households, except those from the southern part of the continent Technological differences and complex pricing policies make it hard to collect the data on expenditures on heating even within a relatively small urban area.

Moreover, electricity use may reflect individual preferences for energy consumption. Again, the case with heating is strikingly different. Central heating, for example, can put strict constraints on individual decisions in many households, just as some characteristics of building technologies do.

Third, across different parts of the year, the time-consumption profile is relatively smoother in the case of electricity use than it is in the case of heating and transport, since it does not suffer from such seasonal 'shocks' like the other two major types of resources. This makes questionnaire-survey measurement of household consumption of electricity fairly valid.

Our point of departure is that the supposed positive relationship between awareness of and concern about environmental issues on the one side, and actions taken to reduce energy use also exist within an urban context of a middle income society that has just passed the long transition period from state-socialist regime to a market economy.

We tested the above hypothesis with the help of multivariate regression technique. We systematically entered different types of explanatory (control) variables to better understand the structure of electricity use and its relationship with individuals' attitudes.

Variables Included in the Analysis

The dependent variable is the average monthly payment for the electricity bill of the household. This might be regarded as a continuous variable; therefore, we chose linear regression technique to analyse our data. Only a handful of participants refused to provide this information or did not know the answer to this question.

The average self-reported monthly electricity bill was HUF 9,700 (EUR 36) in our sample. The median value was HUF 8,000 (EUR 30), with about two-thirds of the respondents reporting paying less than HUF 11,000 (EUR 41). According to our findings, about a tenth of households pay more than HUF 15,000 (EUR 56) for electricity on a monthly basis.

Independent variables have been grouped into six (somewhat overlapping) categories, namely: 1) environmental attitudes, 2) structural constrains on demand, 3) income, 4) socio-demographic characteristics, 5) consumer decisions on purchasing energy-demanding electric devices, and, finally, 6) concern for effective resource use in smaller-scale decisions (see Appendix for the descriptive statistics of those variables).

To address environmental attitudes, we adopted the New Ecological

Paradigm (NEP) scale (Dunlap, van Lierre, Kent, Mertig and Jones, 2000), which consists of 15 items, and it has been proved to be a valid measure of environmental concerns (see Table 1). NEP has already been used in some other household oriented studies (e.g., do Valle, Reis, Menezes and Rebelo, 2004; Poortinga, Steg and Vlek, 2004). Attitudes are measured on a five–point Likert scale.

Table 1. *The New Ecological Paradigm Scale under its revised version*

1. We are approaching the limit of the number of people the earth can support.
2. Humans have the right to modify the natural environment.
3. When humans interfere with nature it often produces disastrous consequences.
4. Human ingenuity will insure that we do NOT make the earth unliveable.
5. Humans are severely abusing the environment.
6. The earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. Despite our special abilities humans are still subject to the laws of nature.
10. The so-called 'ecological crisis' facing humankind has been greatly exaggerated.
11. The earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

Source: *Dunlap et al.,* 2000.

We carried out factor analysis to extract a proxy for general environmental awareness. Factor score of the un-rotated first factor created by principal component method was then adopted as an independent variable in our regression models. The communality of this first factor is 30 per cent (see Appendix for more details). One should note that this finding is very similar to the result Dunlap et al. (2000) presented based on a survey of Washington residents in 1990.

Size matters in shaping demand for energy. Apartment size as well as family size may put constraints on controlling energy use. Both of those two variables were included in the analysis. We also controlled for housing type to test additional structural constraints beyond size itself.

Wealth is a major determinant of demand for most consumer goods. We suppose that energy use is no exemption to the rule. Appropriate and accurate measurement of income, however, is a serious challenge for any questionnaire survey.

We used a direct indicator and few proxies to delineate household purchasing power. First, we calculated monthly income per consumption

unit[6] from responses to a question on household income. The item offered a response card with income-categories to increase response-rate. Missing values were substituted with the median value. Second, we asked respondents about financial problems in general, and difficulties with paying energy bills in particular. We also included information on labour market status of household members, which might be a proxy for income as well. One should note that the variable of housing type (labelled as a structural constraint above) is also a proxy for wealth and current income.

We controlled for the socio-economic background of the respondent, namely, gender, age, and cultural capital (education).

The last two categories of regressors include variables that might depend on environmental attitudes. Therefore, their theoretical status is different from the one of the indicators described above. We inquired about the possession of freezer, dishwasher, tumble-drier, electric stove, electric oven, home theatre system and computer. Finally, two dummy variables were created to assess the use of energy-saving light bulbs in the household and selective waste collection.

Results

In our sample, the average monthly expenditures on electric power amounted to HUF 9700 (EUR 36). Our data show that those who are particularly sensitive to environmental issues spend less on electricity compared to the others. The top 10 per cent of respondents along the environmental attitude factor spend only HUF 7,500 (EUR 28) per month. This amount is 12500 (EUR 46) for the households at the lowest 10 per cent of this dimension.

We extended our linear regression model stepwise, as described above. Results are shown in Table 2. The results of the regression estimates show that family demography and fundamental housing characteristics play a crucial role in determining the expenditures on electricity. The effect of income, on the other hand, is not significant.

One can also see that attitudes largely affect power consumption through the refusal to buy certain high consuming electric appliances. Note that in the model, we controlled for income and some other factors influencing purchasing decisions.

Our first model involved a bivariate analysis of the relationship between attitudes and behaviour. The independent variable explained about 4 per cent of the variance in the dependent variable. In model 2, we added some basic characteristics of family and housing. As a result, explanatory power of the model (R2) jumped from 4 per cent to 43 per cent According to the regression estimates, one consumption unit increase in family size increases electricity bill by HUF 3,500 (EUR 13 at the average level of expenditure). Those living in a non-panel condominium pay HUF 1,800 (EUR 7) more on an average compared to similar families living in a panel housing estate in an apartment of similar size. This kind of expenditure premium is HUF 2,800 (EUR 10) for detached housing. One should also note that every $10m^2$ increase in

Table 2. *OLS linear regression estimates on electricity consumption*

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constants	9.726***	-1.026	-0.722	-0.161	-0.799	-0.911
Apartment size (m^2)		0.064***	0.062***	0.061***	0.051***	0.050***
Condominium (NOT panel)		1.085*	1.128*	1.105*	0.792	0.701
Detached house		2.849***	2.977***	2.986***	3.240***	3.232***
Family size		3.503***	3.552***	3.562***	3.180***	3.218***
Household income / cons. unit.			-0.001	-0.003	-0.007	-0.006
Utility expenditures are too high			-1.001	-1.058	-1.370	-1.495
There are financial problems			-0.297	-0.241	-0.701	-0.718
Unpaid bills or heating restricted			-0.716	-0.774	-0.487	-0.522
Has a job				-0.005	0.104	0.133
Female				-0.260	-0.050	-0.031
Age				-0.002	0.005	0.007
College degree				1.158*	1.143*	1.173*
Freezer					1.445**	1.473**
Dishwasher					-0.780	-0.769
Electric stove					0.570	0.649
Electric oven					-0.413	-0.420
Tumble-drier					3.188*	3.338*
Home theatre system					-0.584	-0.598
Computer					1.674**	1.718**
Only energy saving light bulbs						-0.544
Do not use selective container						0.133
Factor score of environmental attitudes	-1.029***	-0.507**	-0.464*	-0.464*	-0.279	-0.294
R^2	4%	43%	43%	44%	47%	47%

Unstandardized coefficients. Dependent variable: average sum (in thousands of HUF) of the monthly electricity bill (EUR 1 = cca. HUF 270). N=503.

* p<0.05; ** p<0.01; *** p<0.001

apartment size adds HUF 600 (EUR 2) to the electricity bill.

One can see in Table 2 that when controlling for some family and housing characteristics, the size of the attitude-effect decreased by half. Namely, a respondent belonging to an average household but showing more sensitivity to environmental issues compared to the 85 per cent of the sample spends at least HUF 1,000 (EUR 4) less for electricity compared to a person of an otherwise similar household who belongs to the lowest 15 percentile of the environmental attitude scale[7].

Model 3 extended model 2 by incorporating some household's income indicators. Contrary to our expectations, these indicators hardly improve the explanatory power of the model. One should be careful

not to jump to the conclusion that income does not play a role in demand for electricity. Note that some other variables, which can also be considered proxies for income, do have significant effects on expenditures.

Model 4 included additional socio-demographic characteristics. According to the parameter estimates, respondent's age, gender, and labour market status do not seem to play a role in determining household demand for electricity.

One of the most striking results of our regression analyses is that those with college degree spend significantly more on electricity compared to the others, even if we controlled for the effects of several other status indicators.

Models 5 and 6 incorporated regressors that are different from the previous ones in their supposed positions in the causal chain. Decisions on purchasing certain power intensive electric appliances or energy saving light bulbs might depend on environmental values themselves.

As one can see, inclusion of those variables significantly reduced the direct effect of environmental attitude score. The use of tumble-drier, not surprisingly, increases electricity bill by a large amount. Independent freezer also has a significant contribution on power consumption. One should note that households with a computer consume significantly more energy compared to those without it. It is striking that energy saving bulbs, which are the focus of EU-wide policy campaigns, play a minor role in reducing resource use.

In sum, attitudes do have an effect on power consumption. Nonetheless, they play a minor role compared to the effects of basic housing and family characteristics. Moreover, values, in a large part, influence power consumption through the decisions on purchasing certain electric appliances.

Discussion and Conclusions

We investigated whether earlier findings on positive effect of sensitivity to environmental issues regarding household energy saving can be extended to households of an emerging post-socialist economy. We found a positive attitude-behaviour relationship in our sample of Budapest residents. Our data also showed that the effects of housing type and demography are much larger than the effects of the attitudes.

The results on the positive environmental attitude-behaviour relationship are in line with some earlier findings in advanced post-industrial societies. One should note, however, that our findings do not provide evidence against the hypothesis on the interaction between the effects of societal culture and individual attitudes on pro-environmental behaviour. Only international surveys could shed light on the above interaction.

Further research is warranted to clarify contradictory results of the regression analysis. We did not expect, for instance, that cultural capital would have a negative effect on pro-environmental behaviour. Due to possible causal inter-relationships between independent variables, only more complex modelling techniques (like structural equation modelling) could single out direct and indirect effects of cultural capital, attitudes,

income, or potentially other variables.

Theoretical reasons for further inquiry come from our understanding of the complexity of cross-cultural differences in social value systems. One of the key theories in relation to environmental values, the theory of post-materialism (Inglehart, 1981), argues that an emerging set of new values has become a general background factor of the value systems of middle-classes in post-industrial knowledge societies across the developed world. In the seventies, negative externalities of mass consumption came into the spotlight. In addition to environmental problems, health and safety issues were also important, as were equity in international trade, alienation, and other social problems.

While the theory of post-materialism lays down a straightforward relationship between those general values and environmental attitudes, the evidence on the issues are controversial. For instance, a survey conducted in Istanbul with 1,565 subjects by Göksen, Adaman and Zenginobuz (2002) showed that education and urbanity positively affect local environmental concern while affecting the relationship with post-materialistic values negatively. In this study, local environmental concern was more likely to be influenced by the materialistic values rather than post-materialistic ones. However, in case of the global environmental issues, post-materialistic values overturned the effect of education and urbanity. Inglehart's theory, which is based on the assumption that individuals have a distinct but homogeneous set of values, presupposes that one cannot simultaneously have both post-materialistic and materialistic values. According to the results of this study, this presupposition is still open to challenge. Some other research results challenged Inglehart's ideas in other ways (Brechin and Kempton, 1994; Dunlap and Mertig, 1997; Brechin 1999), showing that higher levels of post-materialism related positively to pro-environmental attitudes while in some cases, pro-environmental attitudes related negatively to wealth. One possible explanation is that environmentalism is a global process rather than a consequence of post-materialism. Others (Kidd and Lee, 1997; Kemmelmeier, Król and Kim, 2002; Franzen, 2003) found supportive evidence for Inglehart's theory. More recently, Gelissen (2007) confirmed the contextual effect of the post-materialist culture. In a multilevel analysis of 50 nations, the author found a direct association between post-materialism and public pro-environmental attitudes, even after controlling for national wealth.

Our conjecture, at least partly in line with findings of Göksen, Adaman and Zenginobuz (2002), is that in middle income societies, saving on energy seems to be an economic rather than a moral issue for the poor and the lower middle class. Moreover, educated middle- and upper-middle class consumers might be still too enthusiastic in exploiting the opportunities of an emerging consumer society while, at the same time, sympathising with some of the post-materialistic values which have emerged in the Western culture they may look at as a point of reference. Those phenomena may imply a more complex relationship between general values, environmental attitudes, and

pro-environmental behaviour.

As we have seen, several open questions remain. However, our study has some straightforward policy conclusions. Our evidence suggests, for example, that energy-consumption patterns are relatively resistant to change. One could see that housing characteristics determine a large part of energy consumption even in the case of electric power. High usage rates are a part of the high-level lifestyle of many residents who are not ready to sacrifice important elements of their consumer basket. On the other hand, small and more popular steps to save energy have, not surprisingly, minor influence on resource use.

Earlier research on energy consumption have already shown that one-time investments, such as buying more efficient cars or installing home insulation, frequently initiated by the policy-makers, can save significantly more energy than repeated minor actions, such as turning down heating devices or turning off lights (Gardner and Stern, 1996). In the same time, economic and technological considerations of the energy problem seem to receive more attention than psychological and sociological approaches. We do think that psychologists, sociologists, and other social scientists have a fundamental role in discovering the underlining motivations of energy saving behaviours and thus to help achieve relevant modifications in the human behaviour (Oskamp, 2000).

Notes

[1] Interestingly, people's attitudes are often based on overconfidence about what they know. A survey of home owners showed that when the residents were asked to rank the energy requirements of various household appliances, people grouped them by function and size, and strongly argued that larger machines use more energy than do smaller ones (Baird and Brier, 1981) even though this is not always true.'Unfortunately, it seems people often confuse what they *believe* with what they *think* they know and what they think they have done with what they have *actually* done' (Gifford, 1997:370 – original emphasis).

[2] In a special and important way, energy conservation can be considered a social dilemma (Gifford, 1988), as each member of a limited commons (in this case: the energy) has the choice of acting in self-interest (for instance: using household energy without paying; turning on air conditioner all the time to adjust the temperature) or in the public interest. The essence of the social dilemmas is the choice between the self-interest and the public interest. Typically, the self-interest option seems more rewarding for the participants than does a public interest choice, although the group comprising of similar participants may benefit more from acting in the public interest. Frequently, the public-spirited acts are more expensive, time consuming, and less recoverable, at least in the short period. Psychological research on social dilemmas has shown that individuals frequently behave in selfish way but sometimes they act in the public interest. Environmental psychologists consider the individuals' decision in the social dilemmas to be an empirical problem, and the main

question is that under which conditions persons conserve in self-interest. Social dilemmas have been studied from many approaches (c.f. Dawes 1980; Schmuck and Vlek, 2003). One of the most researched topics involves the energy-related values, attitudes, and behaviours.

[3] One should also note that social context tends to provoke, within the person, a set of attitudinal responses that may not reflect actual values or behaviors but fit a more socially desirable set of responses (Ewert and Galloway, 2009). These socially-desirable responses are not strongly attached to the individual's actions. This is one more reason why a hiatus develops between the people's environmental beliefs or values and their actual environmental actions.

[4] Our survey actually targeted the households in district 3 of Budapest. 'Óbuda' is commonly used to name district 3, though the community of Óbuda had covered a smaller area within this district before having integrated into the city of Budapest in 1873.

[5] The sampling was designed and supervised by the research team at the Budapest University of Technology and Economics while the fieldwork was carried out by a professional research institution.

[6] Based on OECD's adjusted consumption unit scale (see Appendix).

[7] The parameter values in Table 2 show the change in the effect along the scale by one unit change in variance. In our case, about 15 per cent have value lower than -1, and 85 per cent have one lower than 1.

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Appendix

A) Results of the factor analysis of the environmental attitudes

Table A1. *One factor solution of principal component analysis on the variables of the New Ecological Paradigm Scale*

Variables	Factor loadings
1. We are approaching the limit of the number of people the earth can support.	0.456
2. Humans have the right to modify the natural environment.	-0.486
3. When humans interfere with nature it often produces disastrous consequences.	0.618
4. Human ingenuity will insure that we do NOT make the earth unliveable.	-0.454
5. Humans are severely abusing the environment.	0.710
6. The earth has plenty of natural resources if we just learn how to develop them.	-0.450
7. Plants and animals have as much right as humans to exist	0.697
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations	-0.580
9. Despite our special abilities humans are still subject to the laws of nature.	0.432
10. The so-called 'ecological crisis' facing humankind has been greatly exaggerated.	-0.523
11. The earth is like a spaceship with very limited room and resources.	0.357
12. Humans were meant to rule over the rest of nature.	-0.569
13. The balance of nature is very delicate and easily upset.	0.563
14. Humans will eventually learn enough about how nature works to be able to control it.	-0.417
15. If things continue on their present course, we will soon experience a major ecological catastrophe.	0.755

N=503 (mean values were imputed for missing observations).

Table A2. *Summary statistics of the principal component analysis on the variables of the New Ecological Paradigm Scale*

Components	Eigenvalues	Variance explained (%)
1	4.535	30.2
2	1.733	11.6
3	1.340	8.9
4	1.138	7.6
5	0.957	6.4
6	0.839	5.6
7	0.742	4.9
8	0.693	4.6
9	0.649	4.3
10	0.555	3.7
11	0.442	2.9
12	0.433	2.9
13	0.368	2.5
14	0.305	2.0
15	0.272	1.8

B) Other variables used in the regression analyses

Table A3. *Distribution of dummy variables (%)*

Variables	Yes (%)	No/DK/ NA (%)
Housing: condominium (NOT panel)	20	80
Housing: detached house	15	85
Shortcomings of the apartment: utility expenditures are too high (respondent's opinion)	2	98
The household has financial problems	16	84
The household has unpaid utility bills and/or heating is restricted for financial reasons	15	85
The respondent has a job	53	47
The respondent is female	55	45
The respondent has college degree	21	79
The household has a freezer	30	70
The household has a dishwasher	13	87
The household has an electric stove	24	76
The household has an electric oven	29	71
The household has a tumble-drier	2	98
The household has a home theatre system	16	84
The household has a computer/computers	79	21
The household has only energy saving light bulbs	25	75
They do not use selective containers	25	75

N=503 for all variables (missing values are coded as 0). The sample is weighted. The weighting proccess is based on census data on the composition of the local population by gender, age, education and labour market status. We are indebted to Péter Brózik for creating the weighting variable.

Table A4. *Descriptive statistics for the continuous variables*

Variables		Mean	Median	Standard deviation
Average sum of the monthly electricity bill	(000 HUF)	9.7	8.0	5.3
	(cca. EUR*)	36	30	20
Apartment size (m2)		62.5	55	25.5
Household size (consumption unit§)		1.75	1.8	0.56
Household income# / consumption unit	(000 HUF)	120.2	106.67	63.1
	(cca. EUR*)	445	395	234
Age (year)		48.3	49.0	16.8

N=503 for all variables (median values were imputed for missing observations). The sample is weighted.
* EUR 1 = cca. HUF 270 (at the time of the final revision).
§ Based on OECD's adjusted consumption unit scale. Consumption unit = 1 + (Nadults - 1)*0,5 + Nchildren*0,3.
# A response card with 9 income categories was used.