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## Research Review Of Energy Savings Changing People's Behavior: A Case Of Foreign Country

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### Abstract

Behavioral change is becoming an important research object in order to reduce energy consumption. More and more programs and projects for environmental behavior research are made, that provides innovative tools and methods. This paper provides an overview of energy-saving potential of changing the behavior of the population, made in Switzerland, Germany, United Kingdom, Netherlands and USA. Purpose of the study is to analyze foreign research related to energy saving, changing people's behavior. The empirical study showed that the measures, aimed at the habits and routine procedure changes, such as the information disclosure, setting targets and feedback of energy consumption, and social impact let's a substantial saving of energy consumption in households, but mostly examined studies faced with a variety of methodological shortcomings as an example, in the study was used only one type of instrument, or has been used a few, but was not distinguished each of their impact on energy savings. Studies have shown that receiving a regular and effective feedback on energy consumption behavior, allow individuals to change their behavior. Based on assessments on the energy-saving potential in changing people's behavior, carried out in Switzerland, Germany, United Kingdom, Netherlands and USA can be said that people's behavior in relation to energy consumption affects the number of macro-level and personal factors. Macro-level factors include technological progress, economic development level, demographic, institutional and cultural country factors, while personal factors include personal human qualities, attitudes, beliefs, norms, motivation, skills, knowledge, habits and routines.

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## 1. Introduction

Climate change mitigation policy is the priority environmental policy in global world. The individual behavior has significant impact on environment. The choices of individuals related to products and life style have tremendous direct and indirect impact on environment and personal and collective wellbeing. Though sustainable consumption is the core element of sustainable development and there are many global agreements on sustainable development emission reduction including public awareness however the changes in this field are going very slow. At the same time energy consumption is the main sources of pollution and climate change and shifts in population behavior can provide tremendous benefits in successful implementation of climate change mitigation and sustainable development policies at no costs or in the cheapest way. In the past three decades energy saving in households was an important issue in scientific investigations. Since oil crises in 1970 there was a good reason to enhance investigations in this field. Currently behavioral economics plays an important role in the field of economics. Behavioral change is becoming an important research object in order to reduce energy consumption. More and more programs and projects for environmental behavior research are made, that provides innovative tools and methods. This paper provides an overview of energy-saving potential of changing the behavior of the population, made in Switzerland, Germany, United Kingdom, Netherlands and USA. **Purpose of Study** – To analyze foreign research related to energy saving, changing people's behavior. **Methods** - The main research methods used: analysis of scientific literature, the scenario formation, statistical analysis and modeling.

## 2. Behavior change process and measures

Behavioral change is an important object of study in order to reduce energy consumption. An increasing number of programs and projects are carried out for the environmental behavior research that provides innovative tools and methods. We will review the energy saving potential by changing people's behavior the energy saving potential by changing people's behavior assessments made in Switzerland (Poortinga, Steg, Velek & Wiersma, 2003), Germany (Noeren, 2007), United Kingdom (DEFRA, 2006), Netherlands (Abrahamse, 2007, Nonhebel & Moll, 2001), USA (Wang, 2011, Gardner & Stern, 1996). In order to improve the policy, with which we want to make the influence to household and consumer environmental behavior, to offer the best tools, guidance on how to develop and implement successful policies, the Project BEHAVE was carried out (Behave, 2007). Studies, which were made in Germany (Noeren, 2007) showed that user behavior depends on the information, motivation and responsibility. These factors determine the instruments:

- Energy-saving incentives (financial);
- Energy consumption Consulting (mandatory during construction and devices installation);
- Information emitted by environmental companies, publications, workshops, feedback projects (assessing the potential savings) and educational projects that increase public awareness.

In the study of BEHAVE project "Evaluation of Energy Behavior Change Programmes" (Behave, 2007) provides an overview of the conducted studies in households results (100 cases in eleven countries). The measures, which can influence consumer behavior and the observations, are set. Breukers and others (Breukers, et al., 2009) expands the distribution of tools and provide instruments, the contextual factors affecting the implementation of policy instruments, and the main target group of factors which would lead instrument, a summary. Apart from identified as a significant and innovative tool, provided the carbon dioxide emissions calculation (Padgett, 2008). The study "A Comparison of carbon calculators" (2008) states that the carbon calculations are an important tool to reduce CO<sub>2</sub> emissions, by support of calculations in finding information that can influence the behavior and policy changes (Padgett, 2008). Energy consumption metering devices encourage people to save, to buy energy-efficient appliances and turn them off when not in use. Study conducted in the Netherlands "Energy conservation through behavioral change: Examining the effectiveness of a tailor-made approach" (Abrahamse, 2007) are provided behavioral change measures/ intervention. Author the behavioral change measures fall into two types: primary intervention and the consequences intervention, applicable after certain activities. According to Abrahamse (Abrahamse, 2007), feedback is becoming an important tool for behavior change. Feedback types are provided by Ken, and others (Ken, et al., 2008). Thanks to new technologies, special devices can continuously monitor the energy consumption of household appliances or car. Using a variety of programs and connected to a number of initiatives, in the Internet can track and monitor their own and other household energy consumption trends (Ken, et al., 2008). According to Abrahamse,

(Abrahamse, 2007) the most effective in changing behavior is a set of intervention - focused information, goal setting, and feedback. Household's intention to save more dependent on psychological factors than on socio - demographic. Government's energy policy should not be directed only to households (demand), but also to supply. Industry should be encouraged to provide CO<sub>2</sub> dedicated to production of products and transportation. In this way, users can decide which product to use. Also the government policy has to promote technological innovation development and implementation (subsidy).

### 3. W. Poortinga and others study “Household preferences for energy - saving measures: A conjoint analysis”

In the W. Poortinga and others (Poortinga, Steg, Velek & Wiersma, 2003) study “*Household preferences for energy - saving measures: A conjoint analysis*” draws attention to the direct and indirect energy consumption. Traditionally, the direct energy consumption reduction measures have gained more attention than the indirect measures of energy consumption. However, more than half of the energy used by households consumed indirectly. Reducing indirect energy consumption can achieve a significant energy savings. Indirect energy is the energy devoted to the manufacture, transportation, sale of services and goods, which are consumed by households. Indirect energy consumption can be reduced by the use of less energy intensive goods. W Abrahamse (Abrahamse, 2007), W. Poortinga and others (Poortinga, Steg, Velek & Wiersma, 2003) distinguish household energy consumption reduction strategies: technical and behavioural change strategies. Technical measures are generally expensive way to reduce energy consumption; it requires an initial investment (e.g., economical car). Energy saving strategies can be divided into three types: increasing energy consumption efficiency (technical measures), saving use of energy (behaviour change); consumption, switching to other products / services consumption. Household savings potential studies assessing the ability to save by increasing efficiency and saving use are presented by G. T. Gardner and P. Stern (Gardner & Stern, 1996). Households in the U.S. (including transport), use 21.7% of the final consumption of energy, and generates 21.1% of U.S. CO<sub>2</sub> emissions. G. T. Gardner and P. Stern examined the U.S. household savings potential in 2005. In sixth table the household energy savings percentage by type of activity is provided. W. Poortinga and others (Poortinga, Steg, Velek & Wiersma, 2003) found which energy saving measures in households is more acceptable. The results of research - the technical tools are more acceptable than behavioral change, in addition the measures to reduce direct energy consumption is more acceptable than the measures to reduce indirect energy consumption. Transition to other goods / services use strategy is least acceptable, because it is not very economical. Energy-saving in household is more preferable than in transport sector. Older people Transport sector measures are more acceptable for older people than young. Technical measures are more acceptable to people with higher incomes, this may explain the bigger initial investment. Acceptability of indirect energy saving measures can be increased through policy, raising awareness.

### 4. Netherlands greenhouse project

In the Netherlands conducted *GreenHouse* project report (Nonhebel&Moll, 2001), the analysis of the energy demand is provided and GHG reduction opportunities in areas such as nutrition, clothing, household activities, mobility. From conducted studies, the various measures of the results were determined, to reduce CO<sub>2</sub> emissions by activity. It was found that by implementing various measures, to U.S. households at the national level, GHG emissions may be reduced by 27%. However, the desire for change is small and it leads to real reductions in the exchange of 5%. By implementing GHG emissions reduction targets, the important role goes to knowledge. Knowledge is necessary for consumers to make rational decisions. The project has shown that there is a lack of knowledge, particularly in the field of indirect energy consumption. An important role performs governmental institutions and the government. The national government may set certain standards for local government, with the aim of developing a supportive infrastructure for GHG emission reduction (bike paths and so on.). Government policy should be directed to the goal-oriented strategy, with the target emission reduction, and secondly, to inform, to encourage participation of key people in the formulation of the social and cultural norms, to promote education, community formation (Nonhebel&Moll, 2001). Nonhebel and Moll, (2001) present such proposals to promote environmental behavior policy:

- In a short period it is important to reduce the indirect emissions associated with consumer products, increasing production efficiency.

- In the medium term, it is important to increase energy efficiency by changing the use of long term goods by other goods (refrigerators, cars, dryers, and others).
- The development of knowledge and understanding, including behavioral changes feedback, it is important to disseminate information about emissions and implications and household consumption on the GHG.
- Also important: the eco-labeling, and the spread of the software, which can help households to monitor energy consumption
- Focus on the education sector: Teacher knowledge development, increase students' self-awareness.
- Creation of public organizations: organic food growing, cooking and so on.

##### **5. J.h. Wang study behavioral policy modeling: consumer behavior impacts on residential energy consumption**

In Wang, (2011) study *Behavioral policy modeling: Consumer Behavior Impacts on Residential Energy Consumption* measurement programs impact on household appliance energy consumption is analyzed. Studies with smart metering showed, that users saved the energy from 3.5% to 22%, when the use of information tools can reduce 5-10%. J. H. Wang results reveal that implementing the only measurement program, energy savings will not be achieved. Feedback is important. Feedback information on their energy consumption is effective to reduce energy consumption and has a high efficiency when energy prices are high. This area is becoming very important when we start to use intelligent devices and real-time feedback. The projects BEHAVE report states that the policy measures have now directed mainly in the following areas:

- *Increased dissemination of information*: it is assumed that the information will change attitudes, which, in turn, will lead to the desired change in behavior.
- *Making the influence to the economic costs and benefits*: it is assumed that this is the main obstacle to consumers (Egmond, & Bruel, 2007).

It was found that there is a need to improve the know-how of environmental program developers to improve the program above (market segmentation, target marketing) and oriented policies and objectives in the long run (Intelligent energy – Europe, 2006). Through policies aimed at changing consumer energy use efficiency and saving, it should be borne in mind that the mere information and educational campaigns are not enough. In addition, despite the fact that the information and training to strengthen the environmental thinking and help people understand the consequences of their behavior on the environment, it does not cause a sudden change in behavior (Pellegrini Masini, 2007). Household's attitude to save energy is strongly associated with psychological factors (Streimikiene, Volochovic, & Simanaviciene, 2012). The intention to reduce the energy consumption mostly associated with the household's perceived opportunities to reduce energy consumption and their approach to energy consumption. The more households felt able to reduce energy consumption, the more positively they evaluate the energy savings, there were bigger intentions to save energy. Saving energy is usually explained by perceived behavioral control and responsibility for any problems related to energy consumption (Abrahamse, 2007). DEFRA study "Promoting Pro-Environmental Behavior: Existing Evidence to Inform Better Policy Making" (DEFRA, 2006) major findings to improve environmental policy:

- *Behavioral multidimensional*. Behavior is a multifaceted, complicated and influenced by many factors that need to be influenced combined to change behavior. Different audiences behave differently. Policies designed to influence behavior, has to assess these factors. It should be created different kinds of "package" (eg., infrastructure, fiscal measures, information). It is suggested that the measure would primarily focus on external factors (infrastructure and cost), then the internal factors (psychological or approach).
- *The importance of local environment and accountability*. To be effective, policies must be very specific. Transferring policy development responsibilities, accountable institutions (local government, business and industry, voluntary and community groups) can help to ensure the suitability of the local region and strengthen their legitimacy. Attention should be paid to ensure that the relevant properties, resources and skills are available to organizations.
- *To create an interactive and analytical policy making environment*. We cannot watch passively to audiences whose behavior you want to change. Feedback is necessary for changing behavior. Policy makers should try to bridge the gap between policy formulation and implementation results. The effect of better coordination would

be mutual: policy would be created at the basis of previous experience, and the desired outcomes and objectives would be properly identified.

- *Relevant reports and a demonstration of different approach and offering.* Government policy should provide a clear message and to act purposefully towards that goal. Research organizations have to ensure more effective and consistent data collection and comparison. In the future, it is appropriate in the development phase of policy to introduce a formal evaluation structures.
- *To promote behavioral change leaders.* Public figures should be included in behavior change process. They should be an example and from them it should be learnt.
- *Avoid false and unjustified results.* Policy makers need to ensure that policies tools would prevent disproportionately large negative financial and environmental consequences for the most vulnerable sections of society, and where possible, to reduce inequality.

In German studies results, the tips for policy-making are provided. It is argued that it is important to conduct educative training for development of professionals. Meetings, training, best practices and examples of leaflets have a great potential for energy savings. Training sessions should be mandatory. Local training networks intended for Switzerland's consultant's education have been very successful and has resulted in 10% CO<sub>2</sub> savings over 4 years. Development of new technologies is important in order to increase energy efficiency. Environmental technology transfer should include the following points:

- Energy-saving and environmentally friendly home construction financing from the government;
- Preparation of building codex and guidelines;
- Product energy and environmental efficiency labeling;
- Demand side management programs are designed to promote energy efficient lighting and equipment;
- Research and development (R&D) institutions to develop products that meet community priorities (Noeren, 2007).

## 6. Conclusion

Behavioral models are designed to create a conceptual framework for identification of the specific personage behavior and for creation of empirical tests, in order to figure out how the various interventions act to prescribed behavior. The main behavior models and the theories embrace a rational choice, causal action, planned behavior, ecological value, symbolic interaction, Triandi interpersonal behavior, persuasion and social learning concepts. All of these theories and models have some limitations, so in order to create energy saving potential, by changing people's behavior, evaluation model it is necessary to use all strengths of these theories and draw attention to their limitations. Based on the carried out behavior model analysis and their insights systematization, it can be said that people's behavior in relation to energy consumption affects a number of macro and personal factors. Macro level factors include technological progress, economic development level, demographic, institutional and cultural factors in the country, while personal factors include individual human characteristics, attitudes, beliefs, norms, motivation, skills, knowledge and habits and routines. Energy consumption behavior of population is mostly influenced by habits and routine practice. This kind of behavior is difficult to change, because it is partly determined by the individuals used devices characteristics, but it is more important that it is influenced by internal and external factors, such as beliefs, values, attitudes and behavior of other individuals, cultural constraints, as well as economic initiatives and restrictions. The empirical study showed that the measures, aimed at behavior and routine procedures change, such as information disclosure, setting targets and energy feedback, and social impact, allows significantly to save energy consumption in households, but most examined studies faced with a variety of methodological limitations such as, in the study only one type of instrument was used, or has been used a few, but was not distinguished impact from each of them to energy savings. Studies have shown that receiving a regular and effective feedback on energy consumption behavior, provides an opportunity for individuals to change their behavior, especially if the current behavior is not consistent with their values or beliefs. The feedback also provides a lot of benefits, changing the attitudes of individuals, identifying bad habits and let's to avoid them.

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