Behavioural Changes and GHG Emission Reductions in Lithuanian Households

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Abstract. The article deals with the effectiveness of interventions aiming to encourage households to conserve energy in Lithuania. The aim of the paper is to assess the possibilities of energy saving and GHG emission reduction in Lithuanian households while changing their behaviour and to compare findings with the results of studies conducted in other countries. The pilot study conducted in Lithuania aimed at evaluation of energy saving and GHG emission reduction potential in households by applying intervention measures targeting household behavioural changes. The scenarios approach, carbon footprint, experiment and surveys were applied for GHG emission reduction potential assessment. The study revealed that energy saving potential makes 0.132 tne per year and GHG emission reduction potential in Lithuanian households makes 1.95MtCO_2/year.

Keywords: Energy Conservation, Climate Change Mitigation, Interventions, Behavioural Changes, Households.

1. Introduction

GHG mitigation policies requires an understanding not just economics but also behavioral and psychological factors. Behavioral experiments show that the monetary initiatives are not enough to implement climate change mitigation policies. All environmental policies involve some notion of the economic good. Scientists proved [1, 2] that giving people a shared responsibility and appealing directly to a sense of the common good is much more effective way of gaining acceptance for climate change mitigation and other environmental policies.

Economists using evidence from behavioral economics suggested a redirection of public policy from supply side to demand side measures. Very practical examples of using behavioral understandings to inform policy include the design of energy savings plans and improving the reliability of identification in policy lineups. Intergovernmental Panel on Climate Change (IPCC) has established the task to address lifestyles and environmental behavior in the Fifth Assessment Report of IPCC upcoming in 2014.

Lithuania after the closure of Ignalina Nuclear Power Plant (Ignalina NPP) faces the increase in GHG emissions however Lithuanian climate change mitigation policy is targeting mainly supply sector and the priorities for GHG emission reduction are set on production side – building new nuclear power plant at Visaginas. However there are also available cheap energy saving and GHG emission reduction measures at demand side. Such measures as antecedent and consequence interventions are not popular in Lithuanian climate change mitigation policy.

The aim of the paper is to estimate the possibilities of energy saving and GHG emission reduction in Lithuanian households while changing their behaviour and to compare findings with the results of studies conducted in other countries. The main tasks of the paper to achieve established aim are: to review intervention measures targeting behaviour changes; to conduct case study in Lithuania and to compare results of Lithuanian case study with other intervention studies conducted.

2. Intervention measures

Energy saving and GHG emission reduction in household can be achieved by two different ways: by the behavioral changes or process innovations and by implementing product's innovations. The behavioral

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changes are first of all related with implementation of principles of sustainable consumption. Product innovations are related with the replacement of not energy efficient appliances or cars by new one, consequently more advanced in terms of energy saving, renovation of buildings etc. The product innovations are related with some costs however the behavioral changes can be achieved at no or negative costs and no harm for well-being.

Behaviours related to household energy conservation can be divided into two categories: efficiency and curtailment behaviours [1]. Efficiency behaviours are one-shot behaviours and entail the purchase of energy-efficient equipment, such as insulation. Efficiency behaviours are related with product innovations. Curtailment behaviours involve repetitive efforts to reduce energy use, such as lowering thermostat settings. Most policies are aiming at both efficiency and/or curtailment behaviours, with the later seeming somewhat underrepresented. In general, energy-saving potential of efficiency behaviours is considered greater than that of curtailment behaviour [1] however curtailment behaviour can achieve GHG emission reductions at no costs.

A goal setting is effective measures to change behaviour. A goal can be set by the experimenters, or by the households themselves. This type of intervention is usually used in combination with other interventions, such as feedback or as commitment to conserve a specific amount of energy.

The provision of information is a very often used strategy to promote energy conservation behaviours. This may be general information about energy or environment related problems, or specific information about various energy-saving measures households can adopt seeking to achieve significant energy savings or GHG emission reductions [2; 3].

Tailored information is highly personalized and specific information. An advantage of this approach is that participants receive relevant information only, rather than getting an overload of general information, which may not always apply to their household situation [4].

Feedback is often applied to promote energy conservation. Feedback consists of giving households information about their energy consumption, or energy savings. It can influence behaviour, because households can associate certain outcomes (e.g. energy savings) with their behaviour. Ideally, feedback is given immediately after the behaviour occurs [2]. There is a differential effect of feedback frequency [5]. The more frequent feedback allows receiving more significant changes in energy savings [6].

Monetary rewards may serve as an extrinsic motivator to conserve energy. Rewards can either be contingent on the amount of energy saved, or a fixed amount (e.g. when a certain percentage is attained). Overall, rewards seem to have a positive effect on energy savings: all studies reviewed report significant differences between households who had received a reward and those who had not.

The user behavior is dependent on information, motivation and responsibility. All these factors have to be addressed by several instruments like incentives for energy savings (e.g. financially), energy consultancy (as mandatory during construction and installation of appliances) and information given by campaigns, publications, workshops, feedback projects (energy demand per hour/saving potential by behavior) and lighthouse projects to increase information and interest since the general public opinion is important to trigger the consumer's behavior which plays a major role for individual energy savings.

As information about energy-efficiency options is often incomplete, unavailable, it is particularly difficult to learn about the performance and costs of energy-efficient technologies and practices, because their benefits are often not directly observable. For example, households typically receive an energy bill that provides no breakdown of individual end-uses and no information on GHG emissions. It is necessary to provide sufficient feedback to consumers on their energy use and on the potential impact of their efficiency investments.

There are several studies conducted in European Union member States and US aiming at assessment of energy saving and/or GHG emission reduction potential in households. The biggest energy saving achievements was obtained by research conducted in UK. G. T. Gardner and P. C Stern [1] showed that households can achieve the energy savings of 27% of all energy consumed by households due to energy saving measures and behavioral changes. Newertheless conducted studies indicated that consequence interventions (feedback and rewards) can increase energy saving considerable. Therefore it is necessary to

apply holistic approach and introduce several packages of inteventions seeking to obtained considerable increase in energy savings by households behavioral changes.

3. Lithuanian case study

The energy saving study in households conducted in Lithuania in 2010 was aiming to evaluate the impact of several intervention measures on energy savings and GHG emission reductions in Lithuania achieved due to behavioural changes (curtailmnet behaviour). The experiment was conducted by applying 2 scenarios: baseline scenario: the energy consumption in households was registered in special journals according doing nothing or basic scenario without any behavioural changes and energy saving measures.

The time spent for specific activity has been recorded and consumed energy (electricity, gas, gasoline) was assessed for baseline and GHG emission reduction scenario for households participating in survey. Based on this data the energy consumed has been multiplied by specific coefficient (carbon foot print) and GHG emissions for each activity were evaluated. Specific coefficients were obtained from Carbon Calculator available on website developed by EU campaign "You control climate change".

The registration was performed during 2 months (June and January).

Energy saving scenario: after evaluation of results of basic scenario the goal was set for energy savings and tailored information was provided for households based on analysis of their energy consumption patterns registered during doing nothing scenario. The households were required to fill in energy journals during two months (July and February). The GHG emissions were evaluated based on energy consumption records for baseline and energy saving scenarios. The carbon footprint developed by UK was applied for conversion of energy to GHG emissions [7]. The survey conducted before the experiment allowed selectingthe households willing to participate in the experiment and to evaluate their environmental cautions and alertness in environmental pollution and climate change. After evaluation of survey results the following interventions targeting curtailment behaviour in households were selected:

- The workshop was conducted for 6 households (control group) selected as willing to participate in experiment. During this workshop the climate change problem and climate change mitigation policies and measures were introduced to workshop participants. The impact of energy savings on GHG emission reduction was emphasized and the measures to save energy and reduce GHG emission at households were presented;
- Energy saving target was set for households – reduction of monthly energy consumption by 20% by announcing that 6 households will compete seeking to implement the same target;
- The several measures were proposed for energy savings in households related with curtailment behaviour:
  - Reduction of energy consumption by switching of electricity then leaving the room, the shortening time for watching TV set and/or using PC, the washing at lower temperatures and using eco regimes or replacing automatic washing by hand washing; the limiting time of use of shower; switching of appliances from stand by regime; the use of refrigerator, ovens and other apliances according instructions;
  - Reduction of fuel consumption by car: the use of public transport, use of bicycle instead of car, walking instead of using car or public transport, ecological driving and keeping relevant speed during the drive, use of car for few families;
  - The behavioural changes in consumption patterns: use of local products, the reduction of meat consumption, the sorting of waste and use of such measures as
- The feedback was ensured by evaluating the results in achieving the set goal by the selected households.

It is necessary to remind that heat savings were not included in evaluations as households in multi-flat buildings do not have ability to regulate heat consumption in the apartments.

Energy saving potential was evaluated by analysing registration journals filled in by 6 housholds during 4 months.

The average energy savings during the month obtained by 6 households make about 16.75 kWh of electricity, 0.17 m^3 of natural gas and about 13.47 l of fuels. These energy savings can be converted into the tne by applying calorific values for energy carriers. Therefore one household in Lithuania can save on average about 0.011 tne of energy per month or about 0.132 tne per year. Based on data of Department of Statistics (2010) [8] there are 1.39 Million households in Lithuania and the total energy saving potential in households makes about 0.18 Mtne in Lithuania. The saved energy was evaluated in GHG emisison reductions by aplying the carbon footprint. The achieved energy saving during experiments conducted in Lithuanian indicated significant GHG emision reduction potential in households due to curtailmnet behavior.

The average monthly GHG emission reduction achieved by household during summer makes 14.8% and 18.4% during winter. Therefore the average GHG emission reduction potential at households due to behavioural change makes about 16.6%.

The average monthly GHG emission reduction potential by household makes 0.115 t CO_2 or 1.38t CO_2 per year. As according Department of Statistics (2010) [8] there are 1.39 Million households in Lithuania, and the total GHG emission reduction potential in households due to behavioural changes makes 1.96 Mt CO_2 per year.

According Lithuanian policy documents [9] GHG emission reduction potential in Lithuania in 2010 was evaluated as 20.2 Mt CO_2/year. Therefore GHG emission reduction potential in Lithuanian households would make about 9% of total GHG emisison reduction potential. In addition it is necessary to emphasize that this potential can be achieved at no costs. Just costs of information dissemination and other interventions aiming at behavioral changes need to be taken into account however these measures are very cheap comparing with expensive GHG emisison reduction measures at supply side such as building new nuclear power plant or new capacities based on renewables etc.

Comparing the results of this pilot study conducted in Lithuania one can notice that evaluated GHG emission reduction potential in Lithuania (16.6%) is similar to results obtained in Netherlands, UK and other countries. In Netherlands according study conducted [10] GHG emsiosn reduction potential due to behavioural changes of households makes about 27%; in UK according [11] GHG emisison reduction potential due to behavioural changes at households makes 17%.

4. Conclusions

The potential impact of lifestyle and tradition on energy use and GHG emission reduction potential has been evaluated in various studies. IPCC states that changes in life style and behavior patterns can significantly contribute to climate change mitigation. At the same time Lithuanian climate change mitigation policy is targeting mainly energy supply sector and promotes mainly price initiatives for GHG emission reduction.

The pilot study conducted in Lithuania indicated that the average GHG emission reduction potential at Lithuanian households due to behavioural change makes about 16.6% or 1.96 Mt CO_2 per year. This makes about 9% of total GHG emission reduction potential in Lithuania.

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