Primary submission: 04.11.2022 | Final acceptance: 21.01.2023

Use of Nudges for Promotion of Sustainable Energy Consumption in Households

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ABSTRACT Sustainable energy consumption in household is linked to energy saving and the use of renewable energy sources. These are also the main measures of GHG emission reduction linked to energy consumption. There is a huge GHG emission reduction potential linked to energy consumption in households as climate change mitigation policies and measures aiming at sustainable energy consumption are mainly targeting energy supply sector. Climate change mitigation policies in households linked to promote of energy savings and use of renewable energy sources were not able to overcome behavioural barriers of sustainable energy consumption in households, as they were targeting economic barriers mainly. Therefore, new policies and measures targeting behavioural barriers of sustainable energy consumption inn households are necessary. The paper analyses behavioural barriers of sustainable energy consumption in households and provides analysis of policies and measures set to overcome behavioural barriers of sustainable energy consumption. The analysis of advantages and disadvantages of nudges is provided policy recommendations were developed based on analysis conducted.

KEY WORDS: sustainable energy consumption; households; barriers; renewable energy sources; energy savings, nudges.

JEL Classification: H30, P18, Q20, Q30.

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1. Introduction

Climate change mitigation takes policy priority in EU and other countries due to major risks caused by climate change. The leading world countries have signed the Paris agreement and agreed to ensure to limit global warming to below 1.5 degrees Celsius, compared to pre-industrial levels. The Paris Agreement is a legally binding international treaty on climate change. 196 Parties signed this treaty in Paris in 2015 and the agreement entered into force in 2016.

The Paris Agreement requires Parties of treaty to develop long-term low greenhouse gas emission (GHG) development strategies showing the climate change mitigation policies and measures and their impacts. Fuel combustion sector is major sources of GHG emissions in developed countries. The main policies and measures to reduce greenhouse gas (GHG) emissions are mainly linked to energy supply sector though there is huge potential of GHG emission reduction in demand sectors, especially in households' sector. The household's sector in EU is responsible for about 30 % of final energy consumption (EUROSTAT, 2022) and is important source of GHG emissions. Energy saving in households can be achieved by energy renovation of residential buildings and use renewable energy micro generation technologies for electricity, heating, and cooling. The use of electric vehicles is also important

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measure to reduce GHG emissions in household's sector.

There are many papers analysing the various barriers (Painuly, 2001; Lu et al., 2020; Huang et al., 2013; Sorrell, 2015), and drivers (Cadoret & Padovano, 2016; Karatayev et al., 2016; Malik et al., 2019; Papież et al., 2018; of climate change mitigation in energy sector including households (Raza et al., 2015; Seetharaman et al., 2019) however there is a lack of studies providing a comprehensive review and assessment of climate change mitigation policies and measures targeting behavioural barriers of sustainable energy consumption in households, as most of the studies are dealing with policies and measures targeting economic, social, technological, or infrastructure barriers of sustainable energy consumption in households (Streimikiene et al., 2020).

This paper aims to overcome this gap and provides comprehensive analysis of behavioural barriers of sustainable energy consumption in households and qualitative assessment of policies and measures targeting behavioural barriers of sustainable energy consumption in households. The paper is structured in the following way: in the first section, literature review on sustainable energy consumption in households is provided; in the second section, methods and data are described; in the third section, the behavioural barriers of sustainable energy consumption are classified; in the fourth section, policies and measures targeting behavioural barriers of sustainable energy consumption are assessed by evaluating their main strengths and weaknesses; in the fifth section, conclusions and policy implications are developed.

2. Literature Review

Sustainable energy consumption in households covers two main areas: energy use efficiency improvements providing for energy savings and use of renewable energy sources in residential buildings (Streimikiene et al., 2022). Abrahamse et al. (2005), in analysis of energy-related behaviour, stressed the importance of participation, social context, and peer-to-peer networks all having impact on energy use in terms of technology, institutions, and culture.

Based on Martiskainen (2007) two ways of sustainable energy consumption behaviour can be distinguished:

– Curtailment (saving) behaviour including energy conservation efforts such as reducing heating temperature, turning appliances off and other measures linked to energy sufficiency approach.

Energy efficiency behaviour including buying decisions and linked to investments in energy efficiency improvement and new efficient energy technologies.

Studies analysing adoption of energy-efficient behaviour in households are based on

behavioural economics, psychology, and sociology concepts (Carlsson-Kanyama & Linden, 2007).

Cooke and Fielding (2010) proved in their study that consumption autonomy or internal self-determination motivation can be a key variable in contributing to low-carbon transition and development of low-carbon lifestyle that are the key for sustainable energy consumption.

Veenhoven (2008) distinguished the following possibilities of energy sustainable consumption:

- Less consumption. This term means significantly reduced energy consumption by following also sufficiency approach. (Sorrell et al., 2020)
- Eco-consumption. This term also refers to a pattern of consumption that does not cause harm to biosphere. Such consumption refers to behaviour such as abstaining from harmful household items chemicals, waste sorting and recycle, give preference to environmentally friendly goods and services. Reducing pollution and CO2 emissions is also included ecological consumption. Such consumption also means respecting nature and living "natural" life.
- Traditional-friendly consumption. This is a new concept of sustainable consumption, which describes the consumption of old-fashioned goods and traditionally produced products. For example: consumption of "grandma food", refrainment from modern electronic devices like the microwave by giving preference to traditionally produced goods.

Thus, the following three possibilities of sustainable energy consumption mentioned by R. Veenhoven can be used to manage energy consumption in households.

As a counterweight to R. Veenhoven's sustainable consumption definitions, Park and Ha (2012) believe, that sustainable consumption does not mean the reduction of consumption, but manifests the reduction of negative impact of consumption on

 DOI: 10.5709/ce.1897-9254.495

the environment, therefore the main aim of sustainable energy consumption is reduction of resource usage and pollution. This means that sustainable energy consumption requires limiting the impact of energy consumption on the environment instead of limiting energy consumption.

However, the energy sufficiency concept (Seidl et al., 2017; Sorrell et al, 2020) is based on a goal or an outcome defined by a level of energy service consumption that is consistent with equity, well-being and environmental limits, or intentional reductions in energy service consumption.

Therefore, energy sufficiency requires reducing consumption of energy services and energy efficiency requires using less energy to provide energy services both of them leading to energy savings and sustainable energy consumption patterns in households.

Many energy sufficiency actions will reduce energy costs, however such cost savings or an increase in real income will be spent then on other goods and services that require energy to provide (Sorrell et al., 2020). This phenomenon is called rebound effect and the size of it depends on the pattern of re-spending (Sorrell et al., 2007).

In conclusion, it can be said that sustainable energy consumption which includes actions on energy efficiency and energy sufficiency enhancement must be cultivated from childhood, and benefit not only the environment, society, future generations, but also to provide satisfaction to the person who uses it harmoniously.

Based on the assumption that consumption decisions mostly depend on of individual values and habits, measures promoting more sustainable consumption earlier were mainly focused on the user as an individual and the development of his values and promoting an environmentally friendly lifestyle. On the other hand, external factors (technical qualification, globalization, marketing actions, etc.) only correct individual choice motives, therefore the development of the value attitudes of the user as an individual remains one of the most effective measures promoting more sustainable consumption (Karpuškienė 2021; Szostek et al., 2022).

However, recently, in order to offset the manufacturers efforts to promote pseudo-needs and increase consumption are increasingly focused on the legal and normative regulation of consumption, which inevitably includes not only consumption, but also production area.

Traditionally policies and measures promoting sustainable consumption can be divided into five main groups (Tanner & Kast, 2003):

- Mandatory provision of more detailed information about goods and services;
- Development of environmentally friendly consumer attitudes;
- Promotion of environmentally friendly (green) public procurement;
- Adjustment of the tax system (green taxes);
- Promoting ecological efficiency of production and services.

Providing more detailed information about the offered goods and services is focused on the fact that it is the buyer, as an individual, making the final decisions related to consumption (what to buy, how much to buy, etc.). Therefore, it is important to provide not only general information about the quantity and quality of the product, country of origin, and so on., but also information about the raw materials and materials used and the potential of the product impact on the environment throughout the life cycle. A special ecological marking can play an important role. The (green) labelling is developed to provide information that this product is either made from recycled materials or is generally environmentally friendly, namely, it consumes little energy for its production and operation, it does not contain harmful substances, etc. (Zhang et al., 2020).

The development of environmentally friendly consumer attitudes is particularly important. Education and training institutions should play an important role in developing these attitudes. As global experience shows, the best results are achieved when such education begins at the kindergarten age of children (Iwasaki, 2022).

3. Approach and Methods

The main approach followed in this paper is the review of behavioural barriers of sustainable energy consumption and their classification in order to provide assessment of policies and measures targeting these behavioural barriers by evaluating their main strengths and weaknesses in addressing these barriers.

The main methods applied are: analysis and synthesis and qualitative assessment of policies based on the

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results of recent scientific research conducted in this field. Therefore, the qualitative research method was applied to elicit the main strengths and weaknesses of nudges and boosts. A secondary literature review was applied as a core methodology, where evaluation of nudges and boosts was provided.

4. Behavioural Barriers of Sustainable Energy Consumption in Households

The main behavioural barriers of sustainable energy consumption can be defined and summarized in 3 main areas: limited cognition; comparison with others; knowledge-biased barrier, and limited or unconscious behaviour.

Detailed explanation of behavioural barriers is provided in Table 1.

Limited cognition is the main behavioural barrier of sustainable energy consumption. This barrier is associated with decision making heuristics as the individual is thinking is not fully rational and thus acts as a barrier to adopting sustainable energy consumption behaviour. No interest in sustainable energy consumption or assigning sustainable energy consumption or energy saving, use of renewable energy sources duties to others are important aspects of limited cognition of individuals. Poor regulation of behaviour and decision making provides for the gap between intentions and actions of individuals.

Comparison with others is an important behavioural barrier of sustainable energy consumption as individuals tend to make social comparison with neighbours. Social norms and networks have a strong impact on specific behavioural norms in terms of sustainable energy consumption. Perceived inequality is also playing an important role as individuals tend to raise the question why should he/she change their behaviour if others will not change?

Knowledge and information barriers are linked to lack of information about energy saving options and their benefits; limited knowledge about individual's own's energy consumption. The justification of current system or energy consumption architecture is also important as individuals thinking has the tendency to defend and justify the societal status quo.

Table 1

Behavioural Barriers of Sustainable Energy Consumption

Barriers	Explanations
Limited cognition	Decision making heuristics; No interest in sustainable energy consumption; Assigning sustainable energy consumption or energy saving, use of renewable energy sources duties to others; Poor regulation of behaviour.
Comparison with others	Social comparison with neighbours Social norms and networks having impact on specific behavioural norms Perceived inequality by raising the question why should I change my behaviour if others will not change?
Knowledge or information-based barriers	A lack of information about energy saving options and benefits Lack of information and knowledge about own's energy consumption Justification of current system or energy consumption architecture.
Unconscious behaviour	Strong habits and routines (e.g., no habit to save energy); Resistance to change; Rebound effect.

 DOI: 10.5709/ce.1897-9254.495

Unconscious behaviour barrier is linked to strong habits and routines the individuals are accustomed and resistance to change behaviour towards sustainable energy consumption. In addition, some mitigating effort is made, the gains made are diminished or erased by subsequent increased energy consumption actions causing the rebound effect described in literature review section.

One can notice that all behavioural barriers are interlinked and provides for not rational decision making in context of sustainable energy consumption.

In order to overcome these interlinked behavioural barriers of sustainable energy consumption the nudging theory and policy tools were developed (Mongin & Cozic 2018; Reijula et al., 2018).

5. Evaluation of Strengths and Weakness of Nudges

Nudge concept was developed by Thaler and Sunstein (2008). It is a decision-making framework designed to help individuals to take right decision leading to desirable outcomes.

Individuals need to make decisions about energy consumption which include a choice between several options, like installing solar collectors or heat pumps or doing nothing etc. The making decision to renovate house or doing nothing. Based on insights of Nudge concept, individuals are usually selecting the easiest option more similar to status quo, rather than option leading to better outcomes based on heuristics. The role of nudge policies is a push individual to make the right decisions providing the highest long-term benefits for them (Yanoff & Hertwirk, 2016; Wang et al. 2022).

Therefore, nudges can help individuals to select renewable energy micro generation technologies, to make decision to renovate their houses or to buy energy efficient installations etc. The default option is example of nudge for being involved in energy efficiency improvement or housing renovation programmes for households as this default

Table 2
Strengths and Weaknesses of Nudges in Overcoming Behavioural Barriers of Sustainable Energy Consumption

Behavioural barriers	Strengths	Weaknesses
Limited cognition	Nudges can help individuals to make better long-term decisions and to select sustainable energy consumption option providing for energy and costs savings of households.	It is not always possible to make the right choice as use of nudging can be tricky in promotion of sustainable energy consumption. Sometimes nudging makes individuals think that they are "doing their part," distracting them from other more sustainable energy consumption options.
Comparison with others	Opt out schemes can provide for better outcomes for all society by increasing of the number of people that select sustainable energy consumption option to enable energy savings, GHG emission reduction and increased security of energy supply with reduction of energy import dependency. Social norms can be created by providing information about sustainable energy consumption practices in neighbourhoods or from individuals' own community or from similar people.	Nudging is paternalistic and paternalism is problematic when it is difficult to detect. The manipulation by nudging is different from rational persuasion or appealing to reason as they attempt to undermine individual's control over his/her own deliberation and are threatening to liberty and free choice of individual.

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Table 2

Strengths and Weaknesses of Nudges in Overcoming Behavioural Barriers of Sustainable Energy Consumption (Continued)

Behavioural barriers	Strengths	Weaknesses
Knowledge or information barriers	Nudges can help inform people about the risks or benefits associated with some behaviours, helping them select the right decision. The use of social advertising or sending the letters (reminders) or informing people about the benefits of the sustainable energy consumption (like energy renovation or installation of renewable energy technologies) by experts.	Sometimes, nudging provides for unexpected and unpredictable outcomes. In promotion of sustainable energy consumption behaviour, nudging can backfire and even lead to completely opposite outcomes. Sometimes, sending out letters informing people of how much they were using compared to others in their neighbourhood can provide to unexpected outcomes as individuals who have learned that they are consuming less energy than they neighbours can start to increase their energy consumption instead of saving energy.
Unconscious behaviour	The use of nudges can provide for change in habits and reduces uncertainty, as uncertainty usually reduces the frequency of sustainable energy consumption behaviour. Some behaviours that have a great deal of behavioural momentum and therefore are very difficult to change. The nudges can direct individuals to change their habits by providing default settings for lighting (Daylight choice option).	Inappropriate use of nudges can provide for backfire as well. Sometimes interventions aiming to increase individuals' motivation to save energy, particularly placing too much emphasis on competition such as bonus schemes or incentives for individual household's provides for negative outcome and backfire of nudges. Nudges reduce human autonomy as repeated directed interventions by external parties can reduce a person's ability to live their lives in the way they want. So, this is rising ethical problems. Nudges are insulting as they treat people as incompetent decision-makers. Nudging makes people feel that other people are deciding what is best for them.

option directs them towards a sustainable energy consumption decision by creating situation that this decision is the easiest to make (Hertwirk & Yanoff, 2017).

The scholars (Kasperbauer, 2017; Momsen & Stoerk, 2014; Mongin & Cozic, 2018) argue about strengths or advantages of nudges and their weaknesses in addressing behavioural barriers of sustainable energy consumption. Though nudges can provide for significant transformations in energy consumption due to overcoming behavioural barriers, however these policy tool also have several important strengths and weaknesses. In Table 2 the main strengths and weaknesses of nudges in overcoming behavioural barriers are provided.

Though nudges have many strengths in overcoming behavioural barriers, it is important to consider the analysed weaknesses of nudging while devising new interventions.

 DOI: 10.5709/ce.1897-9254.495

6. Conclusions and Policy Implications

Though there are plenty of policies and measures targeting sustainable energy consumption in households there is clear gap between intention of sustainable energy consumption and actions due to behavioural barriers.

The traditional economic and financial measures dealing with financial barriers of sustainable energy consumption were not able to provide for expected outcome in promoting sustainable energy consumption and climate change mitigation in households.

The new policy tools targeting behavioural barriers and helping households to make the best decision and to choose sustainable energy consumption option were developed to close this gap.

There are several important arguments against using nudges as these policy interventions to promote sustainable energy consumption are of paternalistic nature, manipulating and reducing the freedom of choice of individuals by this way insulting them as treating them as incompetent decision-makers.

However, taking into account the massive architecture of energy sector which does not allow autonomy in energy consumption, use of nudges can be justified from ethical point of view.

In addition, the use of nudges requires to take into account of possible unexpected outcomes, so before introducing a nudge, one should consider many different factors, including the extent to which it would have a desirable impact.

Finally, the use of nudges alone for promoting sustainable energy consumption is not enough, as other policy frameworks must be combined with nudges in order to deliver sufficient support for sustainable energy consumption as economic, social, infrastructure and technological barriers of sustainable energy consumption exists.

Therefore, nudging is permissible and advisable policy to promote sustainable energy consumption and to close the gap between intentions and actions, however it must be used together with other policies and measures and by taking into account the context of situation and possible negative outcomes, and backfires.

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