

# Energy Use Research in the Social Sciences—Introduction to a Research Topic

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## 1. Introduction

In our paper we analyse the scientific perception of energy use in the social sciences. To understand the issue in a detailed manner, we conducted a systematic literature review [1]. As we will show in what follows, the literature on energy use is booming; despite this, the scientific literature focusing on energy use is less developed.

Although there has been a proliferation in the prevalence of scientific articles in recent decades, the literature on energy use is less rich. If we focus on the articles discussing the social aspects of energy use, we can also see that the number of papers is continuously growing; however, this growth is focusing on attitudes toward energy use and on energy poverty. In the following, we systematically review the literature as well as the papers of the present Special Issue.

We conducted a systematic literature review of Web of Science by using the five most important key words of our call for papers to sketch the context of the Special Issue on factors influencing households' energy consumption.

The paper presents the results of the systematic literature review, then the main findings of the research papers on factors influencing households' energy consumption, and finally shows some promising research directions.

## 2. Materials and Methods

Systematic literature reviews originate from the health and medical sciences, but they are now also used in almost all other disciplines. In our analysis we conducted a scoping review [1] to understand how the defined terms appear in the scientific literature. The basis of the methods is to pre-define the selection criteria of the analysed papers [2].

In our analysis we defined the timeframe of the search as well as the keywords based on the main topics of our paper. We involve the five most interesting key words of the Special Issue—energy use, households, energy poverty, attitudes, and climate change—in order to maintain the focus of the paper. Through the use of a systematic literature review, our results are transparent and reproducible [3].

In our review we used the Web of Science database between 4 November and 15 November 2022. We analysed a thirty-year-long period, between 1991 and 2022, using the keywords “energy use”. Then, to focus on the subthemes of the Special Issue, we added the following keywords: “energy use” AND “household”, “energy use” AND “climate change”, “energy consumption” AND “attitudes”, “energy use” AND “energy poverty”, and “energy use” AND “social”. We searched for these terms among titles, abstracts, author keywords, and KeyWords Plus.

## 3. Results

After the first analysis we changed energy use to energy consumption in the search on “energy use” AND “attitudes”. In the following, we will argue that the literature prefers the earlier expression. We decided to simplify the expressions “social stratification”, “social



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differences”, and “social inequality”, because these expressions resulted in only very few results. We decided to split the terms into simple “social” and “energy poverty” expressions to assess the role of social factors in earlier research on energy use. The results of the first search are presented in Table 1.

**Table 1.** The prevalence of the terms differs greatly (%).

Search Term	Number of Publications Containing the Expressions	Three Main Web of Science Categories			
		Environmental Sciences	Energy Fuels	Environmental Studies	Social Sciences
“energy use” AND “climate change”	2267	37.19%	29.69%	19.98%	1.32%
“energy use” AND social	1288	31.75%	30.05%	28.49%	3.18%
“energy consumption” AND “attitudes”	342	18.71%	17.25%	15.50%	1.17%
“energy use” AND “household”	1475	33.29%	41.36%	30.44%	1.63%
“energy use” AND “energy poverty”	76	32.89%	55.26%	35.53%	1.32%

Source: Own compilation based on data from Web of Science.

According to our table, we found the most articles on energy use and climate change and the fewest on energy use and energy poverty. Looking at the disciplinary backgrounds of the articles, it is clear that most of the papers were published in the field of environmental sciences, being the most common category except for the “energy use” AND “household” search, and in almost each case, except for “energy use” AND “attitudes”, it contains one-third of the articles. We can also see from the table above that the social aspects of energy use are an under-examined topic; although we used search expressions with social relevance, such as poverty, household, and attitudes, the search results never went above 4%. Our original aim was to explore the existing knowledge on social inequalities and energy use, but based on the systematic literature review we broadened our focus and decided to analyse the articles discussing the social aspects of the above themes.

Our aim was to review the literature on social aspects of energy use in a broad sense; thus, we had to reduce the scope of our analysis to articles that contain the search topic “social”. In the following, we present the main results of the systematic literature review. The articles for the “energy use” AND “social” search discuss the topic in very broad terms (for example: Taylor et al. 2018, Abrahamse 2011, Darby 2006 [4–6]), covering many different topics, from social psychology and social learning to factors influencing energy use and behavioural changes that induce reduced energy use.

### 3.1. Energy Use and Energy Poverty (Originally Social Stratification)

As we mentioned earlier, the search for “energy use” AND “social stratification” resulted in two papers [7,8]. Yang et al. performed a general analysis of the interconnections of social and environmental inequalities. Lutzenhisser–Hackett [7] analyse the effects of carbon taxes on energy prices and the energy use of different social strata. The search for “energy use” AND “social inequalities” resulted in one paper [9]. The policy analysis states that social inequalities also influence inequalities in energy use, and without clear policies they will not change in Brazil. To have deeper knowledge of the existing scientific knowledge on social inequalities and energy use, we decided to expand our research and also present the results of the search for “energy use” AND “energy poverty”. As Table 1 shows, there are 76 articles on Web of Science with a title, abstract, or keywords containing both expressions. We overviewed the abstracts of these articles and found that there are

three main types: articles seeking a definition of energy poverty, articles analysing the factors influencing energy poverty, and articles revealing the connection between policies, energy use, and energy poverty.

Many of these articles are still struggling with the definition of energy poverty (for example: Thomson et al., 2017 [10]); conceptualizing energy use and energy poverty using a capabilities framework (“The energy austerity pitfall: Linking hidden energy poverty with self-restriction in household use in Austria”); and at the same time usually providing a critique of the existing definitions or highlighting the controversies of certain definitions. Thomson et al. review the different definitions and state that the consensual approach instead of the expenditure approach became widespread. The consensual approach asks whether someone is able “to afford items that the majority of the general public considered to be basic necessities of life” [11]. Despite this, authors [10] argue over the use of the so-called direct approach, which “attempts to measure if sufficient levels of energy services are being achieved in the home, such as heating and lighting” [10]. They state that this method has never been used in Europe at this point.

Analysing the factors that influence energy poverty and energy use in relation to energy poverty mainly involves focusing on an exact country (for example: [12]). The articles analysing the effects of energy policy [13] argue that energy poverty can be reduced by better policies, which means a better energy mix and energy production that considers regional differences.

### 3.2. Household Energy Use

As Table 1 shows, there were 1475 results for “household” AND “energy use”. We refined these down to 20 results by selecting the “soci\*” category and reviewed the abstracts of these 20 articles. These articles overview the factors influencing household energy use; not only the sociodemographic, but also the psychological variables (for example: Abrahamse and Steg [5,14]). Based on a survey analysis, they found that household energy use is in strong connection with sociodemographic variables alongside attitudinal variables and self-transcendence values. They also analysed the attitudes toward energy use and found that these are in positive interconnection with perceived behavioural control and attitudes toward energy conservation [5,14,15].

Verachtert [16] analysed ESS data from 2018 to reveal the factors influencing household energy use and found that gender, income, and education have the highest effect on energy-related behaviour, in addition to the fact that some attitudes can be important, such as climate change concern, responsibility and awareness. At the country level, GDP and the unemployment rate have a small but existing effect.

### 3.3. Energy Use and Attitudes

From the literature presented above, it is already clear that the research on attitudes toward energy use are in the focus of the social scientists interested in energy research. We analysed the 342 articles found for the search topics “energy use” AND “attitudes” in the domain of the social sciences. As we presented earlier, Verachtert [16], in her analysis of ESS data, found that climate change attitudes play a crucial role in energy use behaviour. Steg and her co-author [17] also found that sociodemographic variables, such as income, household size, and age, influence households’ energy use, but argue that attitudinal variables and self-transcendence values also have an effect. They found that these latter aspects are generally influence intentions to reduce household energy use. According to the theory of planned behaviour, the best proxy for a behavioural change is the intention to perform it; this is the reason why so many authors have decided to analyse attitudes toward energy use and the environment in addition to the value sets of respondents. Although value sets are influential, the final results of the multivariate analysis show that, ultimately, sociodemographic variables influence energy use at the household level the most.

### 3.4. Energy Use and Climate Change

“Energy use” AND “climate change” resulted in more than 2200 results, but by focusing our search on solely the social sciences the number of articles reduces to 30. In reviewing these articles, we see that most of them focus on tourism-related travel, more precisely on attitudes toward travelling and factors influencing long-distance travel preferences as well as realized travels. A study from New Zealand proves that international and domestic travel contributes to two-thirds of the energy use of an average trip [18]; thus, by altering their travel styles consumers can substantially reduce their energy footprint.

Another group of studies analyse the perspective of energy use at a micro- or macro-level: Adua et al. [19] argue, using U.S. national data, that household characteristics (called political economy) and biophysical peculiarities (human ecology) influence household energy use, while technologies (ecological modernization) have a lower impact.

York’s study [20] is more straightforward, arguing that there is no “free lunch”; despite all efforts, CO<sub>2</sub> emissions are increasing, and all energy resources have an effect on CO<sub>2</sub> emissions. Without radical change, there is no possibility to reduce emissions. He also points out that population growth makes it difficult to expect radical changes.

Some papers [21] compared the energy use behaviours and attitudes of German and American students. They found that, in general, German students act more environmentally friendly. According to the authors, this is linked to the biospheric environmental concerns of German students and the more typical egoistic environmental concerns of American students. German students are also more likely to think that ethical considerations to reduce energy use are important as well as accept that the personal costs of energy reduction behaviours are important. As the authors argue, “An assessment of cost–benefit considerations played less of a role in indirect than direct energy reduction behaviours”.

Another set of papers analyse how policies can contribute to CO<sub>2</sub> emissions; the results are contradictory. While some studies argue that these can have effects, such as Reksten’s paper on companies’ voluntary climate reductions [22,23], others argue that policies are less effective.

After reviewing the literature on the social determinants of energy use, we found that while the amount of scientific evidence is growing, it is still not huge. Although the eighth round of the ESS collected [24] Europe-wide data on climate change perceptions and linked these to energy use, there are still only a few studies on the social determinants of energy use. After presenting the main points of the literature on the topic of this Special Issue, we review the most important papers dealing with similar topics to those of the authors of this Special Issue.

## 4. Discussion

This Special Issue reflects the versatility of household energy consumption research. The research published here focuses on internal and external barriers to energy efficiency [25], the context between social differences in energy use, access, and consumer behaviour, and the acceptance of management services as well as technical innovations.

A constant theme of works with a sociological approach is the correlation between social inequalities and the manner as well as amount of energy consumption. A general finding of the international literature is that the behaviour patterns of energy consumers are related to the sociodemographic characteristics of households [26]; however, much less research has been performed on whether consumer behaviour is more strongly influenced by the characteristics of an apartment or house or the differences in the sociodemographic compositions of consumer households. Györi et al. (in this Special Issue) [27] analyse Hungarian household energy consumption between 2006 and 2017 on a representative probability sample from 2006, 2012, and 2017. They used the “latent profile analysis” (LPA) method to find groups of households, according to energy use, and the changes in their compositions between the given time periods. They found six household groups according to the combinations and intensities of the use of energy sources. The characteristics of houses and apartments have the strongest influence on different energy consumption

behaviours; however, the social differences measured by the social and demographic characteristics of the owners and users of residential buildings are also reflected in the types of energy use. The size, equipment, and physical properties of residential buildings and apartments determine the possibilities of energy use, but properties and the availability of housing are socially distributed. As the Hungarian example shows, consumers with the lowest status (less than a high school diploma, lower income, and backwards regions), who live in older, technically poorly equipped buildings, primarily in villages, use conventional fuel (coal and wood) and propane gas, while the gas and electricity users with a higher income and education typically live in apartments with a larger floor area in privileged districts of cities. The degree of energy vulnerability follows the hierarchy of society accordingly, but the authors also warn that the connection of energy consumer behaviour patterns with the sociodemographic characteristics of households does not necessarily follow a linear relationship.

To understand the very complex motivation of residential energy use, studies have identified many components. According to Mills–Sleich [28], knowing the accessibility of knowledge forms is definitely an essential element of understanding, which is closely related to the ability to recognize the chance of the return and rationalization of the necessary investments of the population [29]. Values, patterns that can be followed [30–32], and the behaviours of reference groups and friends [14] can all affect consumer habits [33]. Mapping the impact of social inequalities in the dimensions of energy use and access requires further complex and international research, which can deepen our knowledge of external and internal barriers to households' energy efficiency.

Park and Jeong's paper (in this Special Issue) [34] contributes to the research on social inequalities affecting energy consumption by analysing a special dimension. Their theoretical innovation is that, compared to previous research concerning the investigation of what factors influence the use of the Internet of things (IoT) in the services of home energy management (HEM) systems, they separate the concepts of passive and active acceptance. Passive acceptance refers to the simple personal use of technology, while active acceptance means that a consumer who personally uses technology also encourages others to use said technology. According to the results of a series of empirical studies conducted on Korean data, three important conclusions were reached. This study identifies consumer perceptions, propensities, and demographic characteristics as influencing the active and passive acceptance of HEM systems with the IoT. The majority of consumers assessed that the use of HEMS systems and the IoT could improve home energy efficiency, and this belief was essential in increasing active adoption. Older people proved to be more open to accept and use new technologies. The correlation between gender and passive acceptance is not relevant, but higher active acceptance was statistically significant among women.

Csizmady et al. (in this Special Issue) [35] present questions and indicators for measuring energy poverty, the most serious social factor related to residential energy use. Guided by theoretical considerations, they argue that, going beyond the conventional classification of households as energy-poor and non-energy-poor, it is also worthwhile to introduce the transitory category in terms of household energy vulnerability. Their empirical analysis found statistically relevant differences between the three household categories when using a Hungarian database. Their well-founded recommendation is that it is necessary to extend sustainability policies to encourage and support transitory households, which are not in a much better financial position than energy-poor households but are much more sensitive to the environment, climate change, and pollution.

A paper presents research on the energy choices for the cooking and lighting of rural households in Pakistan (Ahmar et al., in this Special Issue [36]). The significance of the multivariate empirical analysis is highlighted by the fact that there are many households in developing countries that do not have access to electricity and therefore use traditional energy sources for cooking and lighting. Since clean energy is unaffordable or inaccessible for technical reasons (lack of mains electricity or gas) for hundreds of millions, they are forced to use energy sources that burden the environment and air. The high proportion

of the rural population and the intensively growing investments of the governments of developing countries in the development of electricity networks provide a special emphasis to the understanding of household decisions related to the use of energy sources. The research uses the recognition of relevant literature that it is advisable to include a multitude of possible variables in analyses, not only the various socioeconomic, demographic, and infrastructural characteristics but also, for example, the role of women, or the geographical distance of available clean energy utility lines.

The results show that the energy used for cooking is obtained from traditional fuels, primarily firewood, followed by agricultural residues and biomass pellets. The energy choices for lighting are equally divided between clean (i.e., grid-connected electricity and solar systems) and traditional (kerosene oil) sources. Female heads of households, access to credit facilities, higher education, and a higher number of school-aged children make it more likely to choose clean energy sources. In contrast, the distance from a market/road, a larger household size, and an older age of a household head have a negative effect on the use of clean energy sources. Henzel et al. (in this Special Issue) [37] present the advantages of forecasting the energy consumption and elimination of possible measurement errors.

## 5. Conclusions and Further Research

Our systematic literature review shows that, although there is a huge amount of literature on energy use, social factors, especially social inequality, social integration, and social stratification, are an under-researched field. The papers of this Special Issue partially fill this gap.

In summary, we can quote the results of the study by Kim and Park [34], who provide an overview and statistical analysis of the studies on household energy use published between 2011 and 2020, in this Special Issue. In the given time interval, microgrid systems, smart homes, energy digitization, solar energy production systems, household batteries, energy measurement and forecasting, energy breakdown, and renewable energy supplies are the intensively researched topics. Analyses related to household energy consumption focused on the advantages of new technologies, smart homes, clean renewable energy technologies in the household sector, carbon-neutral policies, improving energy well-being and quality of life, energy efficiency and carbon neutrality, and related energy policies. The studies of the Special Issue emphasize the social, demographic, and value factors of residential energy use through their new results and reinforce the need for a multidimensional study on the factors affecting the adoption and acceptance of new techniques. Authors should discuss the results and how they can be interpreted from the perspective of previous studies as well as that of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions could highlight the social differences linked to the differences in energy use.

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