

FROM AWARENESS TO ACTION: ENERGY LITERACY AND HOUSEHOLD ENERGY USE

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Overview

Energy is a vital resource that powers the modern world and enables economic growth. With the increasing demand for energy, it becomes clear that the current approach to energy production, distribution, and consumption must change. Energy literacy has emerged as one key concept in the effort to transition to a more sustainable energy system. In fact, it has the potential to change energy consumption in households; through either reducing it or by shifting it to when energy is cheaper. In this literature review, we strive to examine the current state-of-the-art literature on energy literacy's impact on energy related behaviours in households.

Energy literacy is a complex multidimensional concept that still lacks a common assessment scale. In fact, each author proceeded to evaluate the levels of literacy according to the data they collected and the domains they focused on. The results of several studies conducted in Europe, North America, and Southeast Asia, have found that the levels of energy literacy are considerably low, and while the knowledge levels are variable, it is evident that people do not demonstrate sufficient energy saving, efficient, or flexible behaviours (Martins et al., 2020). In addition, studies have found that individuals who are more aware about energy are more likely to make more rational decisions regarding their energy use, which can result in more sustainable and cost-effective practices (Brounen et al. 2013).

Despite the growing body of literature on energy literacy, several gaps remain in the state-of-the-art publications. The effect of energy literacy on the energy consumption behaviour of households is still unclear; other reviews on the topic either focus on distinguishing different types of energy literacy (van den Broek, 2019), or focus on its determinants (Martins et al., 2020). For these reasons, we choose to focus on the different behaviours which are potentially influenced by energy literacy. Energy literacy can enable individuals to adopt more flexible and efficient energy usage behaviours, resulting in improved demand side management, greater demand side flexibility, lower energy bills and reduced greenhouse gas footprint. Multiple disciplines, including economics, psychology, and sociology, have driven the energy literacy literature, giving an independent examination of the outcomes. We aim to give a holistic view on the discussions and conclusions in the respective fields and suggest avenues for future research.

In this paper, we identify and cluster the different behaviours and decisions related to energy that are influenced by energy literacy, focusing on the potential for demand-side flexibility, which is acquiring growing importance in energy research. Addressing these gaps in the literature will be crucial to advance and clear our understanding of energy literacy and its potential to contribute to a more sustainable future through upskilled households.

Methods

We conducted a literature review of peer-reviewed scientific articles from various disciplines, including economics, psychology, education, and engineering. Given the multidisciplinary nature of the topic, we do not claim to conduct a comprehensive review, besides, we aim at understanding and critically analysing the studies on energy literacy, focusing on the different types of energy consumption behaviour that are associated with it. For this reason, the most appropriate way to run our study is to conduct an integrative literature review. The purpose of an integrative literature review is to provide an overview of the knowledge base, to critique it, and potentially to create new theoretical knowledge in regard (Snyder, 2019). We based our approach on the methodology proposed by Torraco (2005), using it as a set of guiding principles.

We used several academic databases (e.g., Google Scholar, Scopus, Web of Science), proceedings of energy related conferences (IAEE, IEEE), in addition to other search engines and online resources. The search strings always included the term “energy literacy”, alternatively paired with “flexibility “demand response”, “demand side management”, “energy efficiency”, “energy consumption”, “electricity bill”, “dynamic tariff”, “emissions”, and “household”. We also examined publications from non-academic and governmental agencies (e.g., the International Energy Agency, US Department of Energy).

We collected the literature in a table and used it to identify various characteristics of the articles, including methodology (quantitative or qualitative), sample characteristics, how the authors define energy literacy, if it is

paired with financial literacy, if they assess the effect on consumption behaviour and if yes, what are the results obtained. As in van den Broek (2019), we followed an inductive approach to identify the different clusters of behaviours linked to energy literacy, since this method allows a better understanding of how energy literacy has been studied in academia.

Results

We identified three main clusters of behaviours that are connected to energy literacy: energy savings, investment in efficiency improvements, adoption of dynamic electricity tariffs. The last two clusters are related to each other since both are also linked to financial literacy. We found different studies which prove a positive relationship between energy literacy and higher energy savings in households, however, this is not confirmed by all the papers on the topic. Energy literacy, and in particular, energy-related financial literacy has a positive impact on more rational decision making and on making energy efficiency investments. Finally, we found that energy literacy may play a role in the understanding and consequently the adoption of more dynamic tariffs, which are an important tool for households to participate in the energy transition through demand-side flexibility.

The first cluster consists of energy saving in households. Empirical and qualitative investigations into this topic produced divergent outcomes regarding the impact of energy literacy on energy saving. However, there is consensus that action energy literacy increases energy savings. Action energy literacy is a sub-set of energy literacy defined as the ability to identify the behaviours that yield the highest energy saving outcomes (Van den Broek 2019).

The second cluster includes a relatively new branch of research that focuses on how energy efficiency investments are influenced by energy-related financial literacy, which is defined as “the combination of energy cost-specific knowledge, financial literacy and cognitive abilities that are needed in order to take decisions with respect to the investment for the production of energy services and their consumption” (Blasch et al. 2021). This study, together with Filippini et al. (2020) and Blasch et al. (2019) shows that individuals with higher energy-related financial literacy are more rational when choosing appliances for their households, meaning that they adopt more energy efficient solutions.

The third cluster comprehends the literature on understanding and adopting different electricity tariffs. Being aware of the price per kWh is a common component of energy literacy measurements (O’Sullivan & Viggers, 2021, El Gohary et al., 2022), and will acquire growing importance since domestic electricity tariffs are increasingly shifting from static to dynamic. A survey carried out by Reis et al. (2021) suggests that energy literacy may play a role in the understanding and adoption of dynamic tariffs. Results showed that most respondents were not able to correctly read graphs and to calculate the energy costs associated with a time-differentiated tariff (TDT). They also found that higher energy and graphical literacy were associated with a higher willingness to adopt a TDT.

Conclusions

Energy literacy is a relevant and complex area of research that has generated a significant body of knowledge across a variety of disciplines. The studies we reviewed demonstrate a range of perspectives and approaches: at the same time, there are many opportunities for further investigation in this field. Throughout this review, we emphasize that with an increase in energy literacy comes a potential change in behaviour. However, without a unified measurement standard for energy literacy, it is difficult to quantify this change.

Our contribution consists of the identification of the three main household energy behaviours influenced by energy literacy: energy conservation, efficiency investment, understanding and adoption of electricity tariffs. This clustering brings more clarity in the multidisciplinary domain of energy literacy, and allows us to better identify research gaps. In fact, it emerges that despite the growing importance of flexibility of electricity demand in households, this behavioural change has not been sufficiently explored in energy literacy research. This literature review synthesizes existing research to provide an overview of the current state of knowledge on energy literacy and household behaviour. Based on that, we identified two main gaps that need to be addressed in future research:

1. Work towards a standard measurement of energy literacy in households, as it will allow for a better comparison of the results obtained in research.
2. Strengthen the understanding of the relation between energy literacy and demand-side flexibility in households.

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