A Review on the use of Household Energy

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ABSTRACT

This article provides a thorough review of the theory and research on household energy use predictors at individual levels. In the light of social sciences literature, we examine two broad categories of variables that were identified as potential explanations for variability in consumption and conservation of energy, namely socio-demographical factors (e.g. income, occupational condition, type/size of dwelling, property ownership, household size, family life cycle) and psychologic factors (e.g., beliefs and attitudes, motives and intentions, perceived behavioural control, cost-benefit appraisals, personal and social norms). We find empirical proofs of the effect of these variables, despite an expanding literature, far from consistent and conclusive. Such incoherence presents challenges in drawing widespread conclusions and highlights the complexity of consumer behaviour in this area. In this article, we propose a variety of factors — directly, indirectly or interactively — affect how households consume and conserve energy. By understanding what these factors are and how, when, where, why and for whom they work, research and practise can be greatly advanced. Finally, we outline certain important practical implications for policymakers and guidelines for future research.

Keywords: Household Energy, Uses, Review

INTRODUCTION

In recent years, a growing research group has sought to identify the key factors behind residential energy use and conservation patterns. In order to precisely identify which factors are associated with energy saving and energy wasting behaviour, many studies have been carried out in particular to investigate various types of energy consumer "profiles" (e.g.[1–5]). Several important determinants have been identified, ranging from situational external factors (e.g., contextual, structural, and institutional factors) to consumer attributes (e.g. socio-demographic, psychological, motivational) [6–12]. However, efforts to summarise, integrate and synthesise key results throughout the studies have been unsuccessful. A comprehensive review of published research on the socio-demographic and psychological determinants of household energy consumption and conservation addresses this gap in the present report. In the literature, the behaviour related to energy conservation is sometimes classified as 'curtailment' (that is, on-going day-to-day measures to reduce consumption such as the setting of thermostats, the switching off of lights, restrictions of heating/cooling and air-tight systems etc) and 'efficiency' behaviour. In this article we concentrate on both energy consumption categories. In that way, we aim to offer researchers, practitioners and policy makers a more detailed understanding of what individual factors may explain different patterns of household energy consumption and thus provide valuable insights into when, where, why and who energy-efficient interventions can promote and sustain new energy conservation practises.

For many reasons, it is important that we understand the key factors that shape consumer energy behaviour. In the context of global concerns over climate change and increasing greenhouse gas emissions, the use of renewable and sustainable energy has become one of the major challenges and opportunities to improve the social and ecological resilience of communities around the world. Globally, researchers and policymakers invest substantial resources to design cost-effective solutions and new technologies to boost energy efficiency and conservation in the household. However, there is a huge scope for improvement, as reflected by recent calls for more integration in energy research into social and behavioural sciences[15]. Solving many energy-related problems in the world requires not only technological progress but also human behaviour—and successful shift in consumer behaviour to the required direction (that is to say, more efficient and sustainable practises) by identifying potential causal and explanatory variables (predictors and "mediators"), and various contingencies (introduction)

So why is it important to identify the energy consumption and conservation correlations? The answer is simple: know how, with whom, where, and when to intervene. It is necessary to understand what drives the energy and conservation consumption of households in order to determine how such behaviours, technological solutions, public policy initiatives and other such strategies can be used fully altered. Following a major study from social sciences and behaviour, we review research and empirical evidence on household energy use predictors at the individual level in order to identify key characteristics and variables which explain the behaviour of the consumer. This includes a review of important socio-demographic factors that have been mentioned, which explain individual differences in household energy consumption and energy conservation and the psychological and motivational characteristics of consumers who are also assumed to play a role. We examine both primary and secondary research publications and studies using a range of designs and methodologies. We provide a brief summary of the research in the article itself with a more detailed review of Empirical evidence and citations in the accompanying table to describe our key findings and conclusions. Finally, we draw on the implications for theory, research and practise of our key findings with the focus on identifying cost-efficient behavioural solutions that influence energy consumption and conservation in households.

In recent decades the factors underlying different attitudes and behaviour in the environment have been studied from a range of different theoretical viewpoints (see [16–20] for reviews). Due to its complex and dynamic nature, a wide range of conceptual models has been hypothesised and numerous studies have been carried out to investigate the variables that influence environmental decision-making and action. The most influential and commonly mentioned perspectives, theories and models of pro-environmental behaviour include: [21] Hines et al's model of environmental responsibility; [22, 23] Ajzen's theory of planned behaviour; [24] Guagnano and others [25] model attitude-behavior-External Conditions (ABC).

These theoretical studies in the broad area of environmentally-friendly behaviour have extended into the more specific area of residential energy conservation with an increased focus in recent years on identifying the specific factors affecting household energy consumption (i.e. consumption) and changes in overtime energy use (i.e. cuts and efficiency behaviours) [6,13,14,27]. An exhaustive summary of all relevant household energy usage theories, frameworks and design models is beyond the scope of this paper. However, some of the most significant and frequently cited approaches include: Van Raaij and Verhallen's [8] residential energy behaviour model; Costanzo et al. [10] socio-psychologic energy conservation model; and Stern and Oskamp [28] causal resource use model. Hägerstrand's time-geographic approach to study domestic energy-related activities has also been applied by some researchers [31,32] and the Schatzky [34,35] practise theory to study unconscious habits and technological structures that influence the consumption of residential energy [34,35]. The diffusion of the theory of innovation by Rogers[36,37] was also used to explain consumer decision-making and behaviour, particularly in the context of the implementation of energy-saving methods and products[38–42], in the context of residential energy consumption.

CONCLUSION

While there have been a variety of theoretical perspectives in the literature, there is no single conceptual framework or model accepted universally by scholars to provide an all-inclusive explanation of energy consumption and conservation or a single approach predicting precisely different behaviours. The existing literature instead appears to show that the question of what distinguishes above and below average energy users — or energy-saving and "energy-saving" consumers — is so complex that a single frame is difficult to capture[43-48]. Further, while empirical evidence shows that some variables may be better than others to be predictors of energy consumption, over time, contexts, participant samples and studies have still not been consistent. This inconsistency can be partly an artefact: due to the conceptual and operational definition of an energy-related "compliance," for example it can be measured as an overall energy consumption (e.g. kilowatts per hour use), changes in certain day-to-day practises (e.g., curtailment actions), or adoption of certain energy-efficient technologies (e.g., effectiveness action). And the role of various explanatory variables may vary, depending exactly on how a 'compliance' is defined and measured, and the relationships specified (or 'allowed') in the model. The contradiction can be due to the fact that a very small number of studies have thoroughly tested causal relations using the appropriate scientific methodology (i.e. randomised controlled trials), many of which rely on non-experimental designs to explore correlations only between variables. In the absence of well-designed, consistently specified and rigorously conducted empirical research, we cannot draw firm conclusions on the precise causal impact on the energy consumption and conservation of certain factors.

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