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Spatial variation in energy attitudes and perceptions: Evidence from Europe

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ABSTRACT

Driven by socio-economic processes, the influence of spatial factors on household energy related attitudes and perceptions is largely neglected in the literature. This paper analyses the extent to which energy perceptions and attitudes vary across different geographical contexts in Europe. We use representative Eurobarometer survey data to analyse how social conceptions of important energy issues, Europe's future energy priorities, and future energy system characteristics are shaped by rural, small urban, and large urban contexts. Using binary and ordered probit models, we find that householders in large and small areas are less likely to think of energy as a nationally important issue compared to their rural counterparts. Large city residents are less likely to think that renewables will play a significant role in the future energy system. Residents of large urban areas are more likely than those in rural areas to think that national energy policy should be centred on protecting the environment, guaranteeing a continuous supply of energy, and less around guaranteeing low prices for consumers.

1. Introduction

In the context of rising household energy demands [1], concerns for energy security, threat of climate change, and uncertainties in the price of energy (the so-called '*energy trilemma*', [2]) require transformation of the ways in which energy is produced, delivered and consumed. Householders can play significant roles towards this transformation by undertaking energy efficiency actions, adopting low carbon technologies or moving from consumers to 'prosumers'.[1] However, built environment (such as sparse settlements or different land uses) and infrastructure characteristics as well as institutional structures can facilitate or hinder the formation and carrying out of sustainable energy practices and behaviours on a daily basis. While academic literature is contentious on whether sustainable living can be achieved via changes in social practices and/ or individual behaviours [3–5], it is across space that both social practices are ordered [6] and economic motives come to life. Despite a vast literature highlighting the influence of social, cultural and institutional contexts [7], the role of spatial factors on household energy behaviours and attitudes is overlooked.

Some recent studies, using aggregate data sets, document differences in energy consumption across urban and non-urban areas [8,9]. Hori et al. [10] are among few exceptions noting how different lifestyles between rural and urban areas can affect technological choices and uptake of energy efficiency measures. However, in addition to shaping behaviours and lifestyles, built environment also influences densities of social and information networks, which are shown to play significant roles on the adoption of low carbon technologies [11–13].

Yet, not only does the existing literature ignore the role of spatial factors on energy attitudes and perceptions, but also most of the literature on energy behaviours is based on small sample sizes within a single country context [14–16]. Moreover, the differences in the types of technologies and behaviours assessed, explanatory variables, and methods used, along with their temporal and geographical scales make cross-study comparison of the findings difficult [17]. As a result, the robustness of these findings across different countries, using large surveys, is yet to be achieved, necessary for generating stronger evidence [18].

Another factor that is important for influencing public behaviour towards energy efficient behaviours is information provision [19,20]. In a recent study, Craig [21] reveals how consumers' awareness of energy efficiency programmes influence their decision to participate. It is highlighted that awareness of a topic would enable forming related attitudes and perceptions, followed by planning to behave accordingly [the so-called theory of planned behaviour, [22]]. Beyond utility companies, the literature is very scarce on the level of trust in the source of information [23]. More specifically, the analysis of which institutions the public trusts for energy related information in the European context and how this might vary across different geographi-

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[1] Prosumers also includes consumers who produce their own power from a range of different onsite generators (e.g. diesel generators, combined heat-and-power systems, wind turbines, and PV systems) [63].

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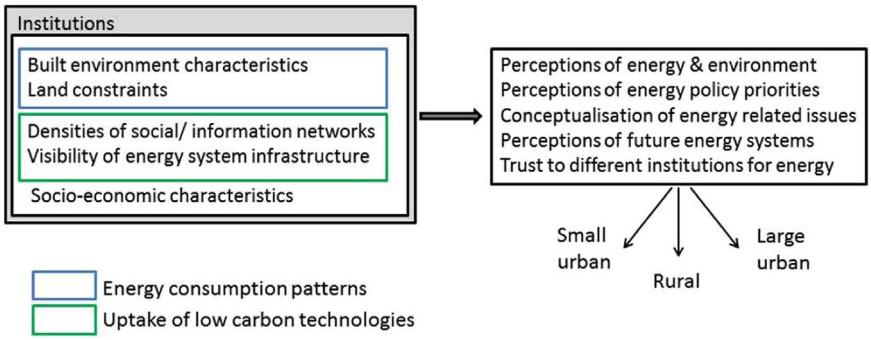

Fig. 1. Conceptual model of spatial factors influencing energy attitudes and perceptions.

cal contexts is neglected. Similarly, it has been overlooked whether and how the public's priorities on energy related matters correspond to the pillars of European energy policy i.e. decarbonisation, security of supply, and affordability. As low carbon transitions will introduce another layer of geographical heterogeneity [24,25] on top of existing socio-economic differences, it is imperative for geographers and planners to examine how today's economic and energy relations will be reshaped and what future possibilities in terms of economic growth, equality and efficiency might emerge.

The present study contributes to existing knowledge in two ways. First, it develops a conceptual framework to explain why attitudes and perceptions are likely to differ in rural, small urban and large urban areas. The research thus far has focused on cities' roles in driving transition to a low carbon economy [26]. By focusing on end users' conceptions and perceptions of energy related matters beyond cities to include rural areas, we offer unexplored avenues for future research. Secondly, we then test empirically the nature and scope of these differences using a large European survey data with nearly 16,000 observations. We employ binary and ordered probit regression models with country fixed effects. Our results highlight that urban householders are less likely to think of energy as a nationally important issue compared to their rural counterparts. On the other hand, large city residents are less likely to perceive renewables to play a significant role in the future energy system. Compared to rural residents, they are more likely to prioritise national energy policy on protecting the environment, guaranteeing a continuous supply of energy, and less around guaranteeing low prices for consumers.

The paper is structured as follows: Section 2 contextualizes energy in a spatial context. Section 3 presents the methods and data used in the analysis. The results of the econometric analysis are presented in Section 4. A discussion of the results is provided in Section 5 while the last section is devoted to conclusions.

2. Energy in a spatial context

By drawing from the literature on the analysis of energy consumption patterns and uptake of low carbon technologies, this study suggests that built environment characteristics, land constraints, densities of social and information networks, and visibility of energy system infrastructure[2] will lead to different energy attitudes and perceptions across rural, small urban and large urban areas for empirical testing.[3] These factors will not only generate differences **between** these geographical areas but also be laid on top of existing socio-economic differences **within** them (Fig. 1).

Cutting across numerous disciplines from environmental psychology, sociology, economics to engineering, along with different research methods and techniques [for a recent review, see [27]], the study of domestic energy consumption and management is quite broad. In this study we limit our attention to studies that use quantitative methods to explain energy related attitudes, perceptions and behaviours.

A significant number of studies ignore the spatial context where individuals are located and focus on the influence of socio-economic factors. Sardianou [28] highlights the importance of income and family size in explaining differences for undertaking energy conservation activities. A recent cross-country analysis, based on 5000 observations from across 11 countries in Europe, reports different motivations to undertake energy efficiency and conservation activities between families with young children versus those with high share of elderly population [17]. While the former are largely influenced by environmental concerns, the latter are driven by a desire for financial savings with lower levels of technology adoption. Another study, focusing on nine OECD countries with a sample of over 9000 observations, analyses whether environmental concerns have an effect on reducing demand for energy and undertaking efficiency investments [29]. The authors report that environmentally more conscious householders are more likely to reduce their energy demand and install energy efficiency retrofits. On the other hand, high-income households tend to be less concerned about environmental problems and tend to curtail less, but are more likely to invest in energy efficiency. Using binary probit regression models, Sardianou and Genoudi [15] reveal that middle-aged and highly educated people are more willing to adopt renewable energy sources whilst marital status and gender do not play statistically significant roles. In addition, Karytsas and Theodoropoulou [14] highlight that public awareness of renewable energy sources can contribute to the acceptance of renewable energy.

Yet, built environment characteristics and land constraints such as housing densities, types of buildings, provision of amenities are shown to influence demands for energy. Shammin et al. [8] report that suburban and rural living is 17–19% more energy intensive than urban living in the U.S. Nichols and Kockelman [9] differentiate between embodied and operational (day-to-day) types of energy demands and show that suburban neighbourhoods — characterised by detached single-family homes — consume 320% more embodied energy than a densely developed neighbourhood consisting mostly of low-rise- apartments and duplexes. Further results from this study show that day-to-day activities consume 150% more energy in the former than the latter and that suburban areas consume 160% more total life-cycle energy (per capita) than urban areas. The influence of geography on energy consumption patterns has been reported for Europe as well. In the UK, Druckman and Jackson [30] highlight the key variables of type of dwelling, tenure, household composition, income and rural/urban location for driving different energy consumption patterns. Wiedenhofer et al. [31] analyse the effect that the influence of urban form, income and demographics have on energy consumption patterns in Austria by combining spatially resolved household expenditure data with an input–output model. Results show that

[2] Conceptually we recognise the importance of institutional context in deriving these differences as well. However, given the quantitative nature of the dataset and lack of relevant variables in it, this wasn't included in the analysis.

[3] Throughout the paper, we use large cities, large urban areas and large urban communities interchangeably, unless otherwise stated. As discussed in detail in the next section, some attributes on energy saving behaviours were included as explanatory variables in the estimation.