Knowledge might not be enough: Acceptance of Energy Communities across the urban-rural divide

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Abstract

The transition towards a sustainable energy model requires broad consensus for success. This paper analyses the role of environmental conscience, (general and specific) knowledge, and social context on the acceptance of Energy Communities (ECs) in a sample of individuals living in urban and rural Catalan municipalities with and without Energy Communities. Regression estimates show that while having an environmental conscience has direct and positive, albeit small, effects on the acceptance of ECs, the effects of social context and specific knowledge of the ECs are larger and only arise through the urban-rural divide and differences in individual characteristics (education and labour status), respectively. In contrast, a general knowledge of climate agreements and environmental regulations does not change the acceptance of ECs, neither directly nor mediated by the urban-rural divide. Public policies supporting energy communities should prioritize removing legal barriers, target rural areas first, and tailor communication and education efforts to diverse social groups.

Keywords: energy communities, urban, rural, social perception

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1. Introduction

Energy transition can be understood as a "broad governmental strategy which aims to transform one system of energy production and consumption into a more sustainable one" (Anaïs Guerry, 2016, p. 195). This represents a major challenge for contemporary societies in a context of growing climate change effects caused by the accumulation of greenhouse gas emissions in the atmosphere. Since the fossil-centred energy model relies in an exhaustible "solar inheritance that that cannot be replenished on a civilizational time scale" (Smil, 2008, p. 204), there is a need to define a rational model of energy consumption and production that aims for a decarbonized economy.

Advances in energy transition move along two challenging dimensions (Galera Rodrigo, 2021). First, new technical solutions must be devised to change the current industrial mix. This entails diminishing or even eradicating carbon fuels while increasing the use of renewable energy sources. Second, new forms of organization must be developed within a new legal architecture for the energy system—this involves building an inclusive and resilient energy model based on decentralization and citizen participation (Cohen *et al*., 2021; Vikström *et al.*, 2025). Energy communities (ECs hereafter) are a prominent example of these advances (Melnyk *et al*., 2023).

In essence, ECs are groups of citizens associated for the production and distribution of renewable energy. Thus, they provide an organizational structure that allows the participation of citizens in the energy system within a democratic, flexible, and innovative framework that ensures the empowerment of people in energy issues, as well as stimulating the use of renewable sources of energy in a decentralized network. Technically, ECs enable consumption to adapt to the generation in a regulatory framework that grants the use of highly integrated, efficient, and smart energy grids. Socially, ECs give citizens a leading role within resilient energy systems and help to build support and trust in renewable energy facilities. This paper focuses on the latter aspect, i.e., the acceptability of these new forms of organising the production and distribution of renewable energy.

Although ECs are considered a key instrument for facilitating energy transition, they rely heavily on community engagement to ensure that all (public and private) efforts are moving in the same direction. Consequently, it is important to investigate which individual and contextual factors shape individual acceptance on these organisational solutions to the energy transition challenge (Cohen *et al*., 2023; Acosta *et al*. 2018; Steg and Vlek, 2009). In this investigation, the current paper makes two contributions to the literature (Rojas-Peña et *al*., 2024). First, we provide evidence from linear regression models of the impact that environmental conscience, knowledge and social context have on the level of acceptance of ECs using survey data from 984 individuals distributed in 11 and 7 Catalan municipalities with and without an EC, respectively. Second, we explore the argument that differences in residence area characteristics may alter our perception of the benefits and costs involved in ECs (and thus affect the acceptance of an energy transition process). As Calvert (2016: 110) points out, energy transition processes may vary across institutional scales and spatial areas, so that "various geographical imaginaries, spatial identities, and connections to place are co-productive with particular systems of energy provision". However, the literature shows ambiguous results, as some evidence suggests that the potential support is higher in urban

areas thanks to higher population density (Barbaro and Napoli, 2023) and agglomeration economies (Benzennou *et al*., 2023), while other studies suggest that the potential implementation and, therefore, the potential acceptance is higher in rural areas thanks to higher potential for renewable energy production due to site characteristics (Dumitraşcu *et al*., 2023). Yet some studies like Gerundo and Marra (2022) find that both urban and rural areas may gather required support whereas others like Kluskens et al. (2024) find urban / rural specificities requiring tailored policy approaches in the implementation of energy infrastructures. In this respect, Catalonia provides an interesting setting to explore the urban-rural divide in acceptance because of the strong core-periphery asymmetries in terms of income, public decision processes and governance (Rizzo, 2017).

The rest of the paper is structured as follows. The second section outlines the legal framework and characteristics of ECs in Europe and summarises the scarce literature on the social acceptance of ECs. We also present arguments to support the hypothesis that the urban-rural divide mediates the knowledge effects on acceptance. The third section presents the data, discusses the empirical methods, and analyses the results. Section four concludes the paper.

2. Energy Communities: characteristics and acceptance

2.1 Energy Communities in Europe: legal framework

The model of local energy management through community structures has been gaining importance in the European energy sector since the foundation of *ElektrizitätsWerke Schönau* (EWS), an energy community in the German town of Schönau in 1994 (Guerry, 2016). In fact, the German model of "citizens' energy cooperatives" (*Bürgerenergiegenossenschaften*) has become a standard in the proliferation of ECs in the European continent since the early 2000s (Dóci *et al.*, 2015). Today, it is estimated that there are around 3,000 ECs operating in Europe (Abada *et al.*, 2020).

These ECs are "social and organizational structures formed to achieve specific goals of its members primarily in the cleaner energy production, consumption, supply, and distribution" (Guia and MacGill 2018, p. 95). This means that in principle they are groups of individuals associated with the pursuit of goals related to the supply and production of energy. However, there is a degree of heterogeneity with respect to the activities they carry out and the organizational and legal forms they adopt (Caramizaru and Uihlein, 2020). Most ECs are cooperatives that basically deal with the generation and supply of energy. Yet some only act as resellers, while others even manage the distribution. Also, some ECs include not only individuals, but also various forms of legal entities. Thus, we are seeing a legally protean, labile and open concept, which operates as an umbrella for various phenomena of generation and distribution of energy and is essentially defined by its link to energy supply and production in a context of decentralized collaboration (Moroni *et al*., 2019).

In fact, the regulatory framework of the ECs is still a matter of debate in several legal systems (Guia and MacGill, 2018). In the European Union, for example, ECs are considered in two pieces of energy regulation. Firstly, Article 2.11 of the Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for

electricity and amending Directive 2012/27/EU refers to citizen energy communities that "may engage in generation, including from renewable sources", but not exclusively restricted to these. Secondly, Article 2.16 of the Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources defines the renewable energy communities as those that own and develop "renewable energy projects". This discrepancy in the extent of the concept and the goals that ECs should pursuit illustrates the ambiguity with which the EU has incorporated these institutions in its energy regulation. In the specific case of Spain, the legal framework also lacks clarity and stability (Presicce and Cocciolo, 2021).

Both directives regulating energy communities refer to citizen involvement, using concepts as 'active participation' (Directive 2019/944) or 'local involvement' (Directive 2018/2001). In this sense, EU law seems to promote a vision of citizens involvement as a means to influence citizens in order to make them predisposed to change, rather than to actively participate in the transformation (Steg and Vlek, 2009). However, core democratic values of the EU can be tracked as well in both directives. The paragraph 43 of the preamble of the Directive 2019/944 underlines that energy communities can "help fight energy poverty through reduced consumption and lower supply tariffs" as well as enable "certain groups of household customers to participate in the electricity markets, who otherwise might not have been able to do so."

All in all, in the context of EU Law, energy communities appear as the most promising institutional solutions for providing social support to the process of energy transition. In this sense, in the context of the European Union, states with more ambitious decarbonisation policies, such as Denmark or Germany, have recognised that the transition towards a model based on renewable energies demands local action (Guia and MacGill, 2018). As long as the energy transition requires greater involvement of citizens, institutions and local companies in energy projects, energy communities provide the way to advance in this direction (Ivancic et al. 2019). Accordingly, developing energy communities EU law can provide tools for reinforcing a just and democratic energy transition (Jaria-Manzano, 2024).

2.2 Acceptance of Energy Communities

In a context where the energy landscape is changing, an imprecise regulatory framework may be an important hurdle for the implementation of ECs. Yet the major obstacle that ECs face is probably their acceptability: empirical evidence shows that a sustainable low-carbon transition process may generate heavy discontent and resistance in view of its practical implications (Sovacool, 2021; Palomo-Vélez *et al*., 2021). That acceptability issue is not exclusive of ECs, as it is also found to be a key point in terms of acceptability of any renewable energy infrastructure (Rojas-Peña et *al*., 2024). In this sense, recent contributions by Kanberger and Ziegler (2023), Mihailova et al. (2022), Wu et al. (2022) and Motz (2021) highlight an important heterogeneity in preferences across geographic areas, demographic groups and individual characteristics. It is consequently important that the transition towards a more sustainable model of energy production and consumption is based on an inclusive and resilient energy model. To be successful, the energy transition must guarantee both an equitable assumption of the benefits and costs involved and a steady supply of energy that satisfies society needs (Heffron and McCauley, 2016).

In this context, the development of community-managed decentralized projects for small renewable energy generation facilities provides "localized network[s] of electricity sources and loads that can be controlled to ensure reliable operation when the system is isolated or connected to another grid" (Wentz and Pappalardo, 2016, 102; Lowitzsch *et al*., 2020). ECs can then be seen as a key institutional tool for the implementation of a fair energy transition based on smart energy structures—a tool that addresses energy poverty while generating innovative strategies to advance collective resilience (Capellán-Pérez *et al.*, 2018; Melnyk *et al.*, 2023). It is important to stress, however, the role of the citizen involvement in the construction of ECs. This makes ECs unlikely to succeed without an a priori positive attitude of citizens towards them (Sovacool and Dworkin, 2014). Also, ECs are inspired by the ideas of consumer empowerment, energy citizenship and energy democracy (Becker and Naumann, 2017; Sovacool and Dworkin, 2015; Seyfang and Haxeltine, 2012), which further suggests that citizens' acceptance is a key aspect of ensuring their success. Ultimately, the acceptability of ECs arises from the acceptance of the energy, environmental, and social justice criteria that sustain the energy transition. Thus, it is not simply a matter of accepting an energy project, but of legitimising a real change in the governance of the energy model.

The literature has identified several driving factors of the acceptance of ECs. As in the case of any other energy infrastructure, having environmental conscience may improve citizens' perception of ECs (Steg and Vlek, 2009). Also, Standal *et al.* (2023, p. 6) point to the importance of having access to "relevant and objective information" about the ECs. Being well-informed about ECs reduces the uncertainty about the projects (Cohen *et al*., 2023) and helps "to convince and recruit members" by overcoming the hesitancy "to leave the comfort of central energy systems or a lack of financial, temporal, structural and natural resources" (Acosta *et al*. 2018, p. 3). Lastly, several studies put the accent on the social context (Steg and Vlek 2009). Among them, Steg *et al.* (2021), stress the role of cultural diversity, whereas Tsagkari *et al*. (2022) refer to a sense of local pride that is related to an environmental conscience and Azarova *et al.* (2019, p. 1177) highlight "the social and group norm dynamics with respect to the leadership and participatory process".

2.3 The role of the urban-rural divide in shaping the effects of knowledge

Overall, it has been argued that the acceptance of ECs depends on three major factors. First, how much environmental conscience exists among the members of the community. Second, how much the citizens know about ECs and the energy transition. Third, the social context of the EC. There is, however, a lack of empirical evidence on the relevance of these factors that this paper seeks to address.

We also seek to explore the existence of heterogeneity in the effects that knowledge has on the acceptance of ECs. In principle, acceptance is conditional on knowledge: it seems hard to engage citizens on a particular environmental policy without a minimum (social) knowledge about it. In fact, many public policies seek to foster knowledge on a particular subject to boost acceptance and implementation.[1] However, we argue that the way this knowledge affects the

[1] Prominent examples of these practices include health campaigns on COVID vaccination programs (see, for instance, Tatar and Wilson, 2021) and the taxation of soft drinks (see, for instance, Buckton *et al*., 2018).

acceptance of such policies may be influenced by the characteristics of the residence area (see, among others, Li and Zhao, 2019; Hoff *et al*., 2013; Halkier *et al*., 2012), thus altering our perception of the energy transition to define alternative "energy geographies" (Calvert, 2016).

These mediating effects may arise from a number of reasons, including differential reliance on natural resources (e.g., rural and coastal areas linked to agriculture, forest exploitation and fishing activities), exposure to environmental risks (e.g., pollution, and noise in urban areas), economic opportunities (e.g., specialisation in fossil fuels activities and lower environmental concerns in deprived areas), and informational asymmetries (e.g., lower informational barriers in urban areas). Also, Devine-Wright (2007) discusses place-attachment attitudes that create emotional bonds and identity processes, West *et al.* (2010) point to misalignments with local cultural values, and Vikström *et al.* (2025) stress the role of local stakeholders' participation (see also Calvert 2016). While acknowledging the complexity of these relations, in this paper we focus on the urban-rural divide as a whole. One reason for this is the fact that ECs are mostly a locally driven initiative, and so the rural-urban dichotomy is particularly relevant. Rizzo (2017), for example, discusses the importance of the urban-rural gap in acceptance for regions peripherally situated, tourism-dependent, and/or reliant on its landscape to produce revenues (like, e.g., certain areas of Catalonia). Also, environmental conscience usually interacts with local engagement, which tends to be stronger in small-peripheral areas where factual knowledge about energy projects may be counterbalanced by engagement (Devine-Wright, 2007). Finally, a number of public environmental policies use this dichotomy because of its implications for both climate change and the distribution of the efforts and responsibilities required for energy transition.[2] In this regard, Calvert (2016) emphasizes the necessity of tailoring energy policies to specific contexts.

3. Evidence on the acceptance ECs

3.1 Sample

The survey used in this study was conducted in the Autonomous Region of Catalonia (Spain), where there are about 70 municipalities with (at least) one EC. The reasons for concentrating on this administrative area are twofold: some of the early adopters of ECs in Spain are located there (today they account for about 20% of the total in Spain) and the region has had a favourable legislative framework since 2019.[3] While the energy sector is mostly regulated at the national level in Spain, the Catalan institutions have provided specific normative arrangements with the goal to promote energy communities.[4]This supportive environment towards ECs is reflected in our survey data. First, out of the 1,840 individuals initially sampled,

[2] The rural divide may also alter the effects of the environmental conscience on acceptance due, for example, to spatial inequalities in terms of energy production and consumption (i.e., energy production is largely concentrated in rural areas, but it is mostly consumed in urban areas that do not suffer from the negative externalities of the production and transportation processes). We explore this possibility as an extension of our main results.

[3] See the "DECRET LLEI 16/2019, de 26 de novembre, de mesures urgents per a l'emergència climàtica i l'impuls a les energies renovables" (https://portaljuridic.gencat.cat/eli/es-ct/dl/2019/11/26/16).

[4] See the "DECRET LLEI 24/2021, de 26 d'octubre, d'acceleració del desplegament de les energies renovables distribuïdes i participades" (https://portaljuridic.gencat.cat/ca/document-del-pjur/?documentId=913061).

40.6% claimed to know what an EC is. Second, on a scale of 1 to 10, three-quarters of the individuals declared a willingness above five to participate in an EC. However, when asked about their willingness to participate in five years' time, the figure dropped to half of the individuals.

There is no official register of ECs in Catalonia, which makes practically impossible to construct a representative sample. With this in mind, our sample of ECs was constructed following a two-step procedure. In the first step we selected 11 out of the 70 municipalities in Catalonia that had an EC. These were meant to be representative of the distribution by provinces and the population's rural-urban divide in Catalonia, which shows a roughly one-third rural and two-thirds urban distribution at the regional level. The selected urban municipalities were El Prat de Llobregat (64,000 inhabitants), Viladecans (66,000) and Reus (108,000), whereas the rural ones were Cardedeu (19,000), Isona (650), Taradell (6,800), Sant Pere de Torelló (2,500), Tona (8,500), Olost (1,200), Santa Eulàlia de Riuprimer (1,500), and Sant Julià de Vilatorta (3,200). Then we approximately matched these with 7 municipalities with similar population and localization that did not have an EC. The selected urban municipalities were Castelldefels (67,000), Vilanova i la Geltrú (68,000), Granollers (61,000) and Tarragona (138,000), whereas the rural ones were Montblanc (7,400), Gelida (7,900) and Cabrils (7,800). Figure 1 shows the spatial distribution of the 18 municipalities considered.[5]

[INSERT FIGURE 1 ABOUT HERE]

Once the municipalities were selected, we carried out a survey of 1,840 individuals older than 16 years distributed proportionally to the urban-rural populations of the selected municipalities and the existence or not of an EC. As a result, about 90% of the individuals in the sample were extracted from urban municipalities (half of them with an EC) and about 10% of them from rural municipalities (half of them with an EC). The margin of error was 1.2% at the 95% confidence level. The survey contained 26 questions, gathering information on personal characteristics (gender, age, education and labour status), the degree of acceptance towards ECs and its driving factors (environmental conscience, knowledge and the social context). Notice that due to missing and "don't know / does not want to answer" answers in the environmental conscience and knowledge questions the final sample used in the regression analyses consists of 984 individuals. The survey was conducted by phone in June and July 2023 and the mean duration of each survey was 8 minutes.

3.2 Data

Our dependent variable for the regression analyses is the level of acceptance towards ECs, which was defined in a 1 to 10 scale, from "totally against" (1) to "totally supportive" (10). Our main covariates are the measures of environmental conscience, knowledge, and social context. Environmental conscience is measured on the same scale as the level of acceptance towards ECs but applied to the level of acceptance towards *i)* the elimination of fossil fuels

[5] Most ECs included in rural municipalities tend to have been organised following a bottom-up strategy led by citizens and local stakeholders, whereas those in urban ones tend to derive from a top-down strategy led by the city council. Still, since there is no official register of ECs in Catalonia it is very difficult to determine what are the organizational characteristics of these ECs and whether these vary depending on the urban/rural profile of the municipality.

and *ii)* the production of energy from renewable sources. As for the measurement of knowledge, we considered both general knowledge on climate agreements and regulations (at different administrative levels), and specific knowledge on ECs.[6] Thus, knowledge of the Majors' agreement for Climate and Energy and of the ECs are both measured using binary variables, whereas knowledge of all four of the EU Climate Action, the Paris Agreement, the Spanish Climate Law, and the Catalan Climate Regulation are measured using a 1 to 10 scale, from "no knowledge" (1) to "perfect knowledge" (10). Lastly, we measure the social context using dummies for the existence of an EC in the municipality of residence, the province of residence (Girona, Tarragona, and Lleida, Barcelona being the residual category in the regression results) and whether the municipality was urban (Devine-Wright, 2007).

We also included a set of personal characteristics as control variables of our regressions, all of them obtained from the questionnaire. These were gender (female, nonbinary, and male, the last one being the residual category), age in years, age squared, the level of education attained (primary, secondary, university, without studies being the residual category) and labour market status (salaried, self-employed, student, unemployed and retired, "others", being the residual category as in out of the labour market).

[INSERT TABLE 1 ABOUT HERE]

Table 1 provide descriptive statistics of these variables for the final sample of 984 individuals, which basically consists of well-educated people (secondary and university studies) that live in an urban municipality of the province of Barcelona, are salaried or retired and are aged between 25 and 65 years. The gender breakdown between men and women is practically equal, since there is only one non-binary individual in the sample. Interestingly, the sampled individuals have a high level of acceptance towards ECs, with an average of nearly 8 on the 1 to 10 scale and with nearly 97% of the respondents declaring a level of acceptance of five or more. They also have a marked environmental conscience, since the average of our two measures is around 7 with respect to the elimination of fossil fuels and around 9 with respect to renewable energies (note also the low variability of these figures, as measured by the standard deviation). Lastly, most individuals are familiar with the concept of ECs, and this is irrespective of them living in an area with one (46% of those saying that they know what an EC is do not live in a municipality with an EC). In contrast, their general knowledge on climate agreements and regulations is relatively low (around 3-4 on a scale of 1 to 10).

3.3 Empirical model and results

We estimate the importance of environmental conscience, knowledge, and social context on the acceptance of ECs using a log-linear model estimated by ordinary least squares. However, we also provide results from a Poisson specification estimated by maximum likelihood that allows for a direct interpretation of the coefficients as variations on the average level of acceptance (Wooldridge, 2010). We expect measures of environmental conscience and

[6] The distinction between "specific" and "general" knowledge seeks to explore the importance of the former in acceptance studies (e.g., Cohen *et al*., 2023; Standal *et al*., 2023; Acosta *et al*., 2018). Notice also that our measures of general knowledge might also be interpreted as proxies for "contextual knowledge" (Devine-Wright, 2007) and that the variables considered to measure knowledge correspond to proxies for perceived rather than factual knowledge.

knowledge to show positive coefficients in our regressions (Brambati *et al*., 2022). As for the social context, we expect a positive effect on the dummy indicating that the municipality is an EC because geographical proximity to EC experiences favours social acceptance (Radtke *et al*., 2022). In contrast, we do not have a clear a priori expectation about the effects of the urban-rural and provinces dummies. Still, knowledge flows in small communities (e.g., rural municipalities) are mainly driven by face-to-face interactions, which favours trust across social contacts, whilst in bigger areas (e.g., urban municipalities) these social interaction flows face higher barriers. This suggests that the potential benefits of ECs are more easily transmitted in rural communities, so the social acceptance should be higher, On the other hand, implementation of new tools to drive energy transition usually takes place in urban areas, which may boost acceptance in such areas. Lasty, we expect that education (Azarova *et al*., 2019; Koirala *et al*., 2018) and participation in the labour market (Koirala *et al*., 2018) boosts social acceptance of ECs, as it favours knowledge acquisition about energy and environmental issues. We also expect women (Vogel *et al*., 2023; Lazoroska *et al*., 2021) and younger people (Brambati *et al*., 2022) to be more prone to acceptance, although there is some empirical evidence that female acceptance is lower (Azarova *et al*., 2019).

The first column of Table 2 provides estimates of our baseline specification, which includes as covariates our measures of environmental conscience, knowledge, and social context as well as the set of personal characteristics. As expected, our results support that having an environmental conscience helps to accept the implementation of ECs in one's own municipality (Steg and Vlek, 2009). In contrast, none of the general knowledge variables regarding environmental institutional initiatives (i.e., knowledge about Major's Agreement, Paris Agreement, EU Climate Action, Spanish Climate Law, and Catalan Climate Regulation) has a statistically significant effect. Also, the indicator for the specific knowledge of ECs shows a negative and significant effect. Lastly, social context variables and personal characteristics are generally not statistically significant, the exceptions being the province of Lleida and the non-binary person indicator. The lack of significance of the other individual categories is consistent with the conflicting results found in the literature (Vogel *et al*., 2023; Lazoroska *et al*., 2021; Azarova *et al*., 2019).

[INSERT TABLE 2 OVER HERE]

The second column of Table 2 provides estimates of an extended specification in which we account for the mediating effects of the urban-rural divide (Calvert, 2016; Rizzo, 2017). To this end, we include as additional covariates the products of the knowledge variables and the urban-rural dummy (e.g., Major's Agreement x Urban). Also, we explore the possibility that the (positive) effect of living in a municipality with an EC is predominant in rural areas where social linkages are stronger by including the product of the EC dummy and the urban-rural divide (in this case, a rural municipality without an EC being the residual category). These additional covariates, however, do not alter the main conclusions extracted from our baseline specification. This means that, while a general knowledge of climate regulations and agreements does not seem to make any difference in the acceptance of ECs, those individuals with higher environmental conscience (and those living in a mainly rural province as Lleida) have on average higher levels of acceptance of ECs. Also, estimates support the hypothesis that rural communities, particularly those with an EC, have on average higher acceptance. Lastly, the hypothesis that the urban-rural divide mediates in the effect of knowledge is clearly

rejected: none of the products of the knowledge variables and the urban-rural dummy are statistically significant. In fact, since the coefficient associated with the specific knowledge of ECs is no longer statistically significant, this implies that we find no evidence supporting knowledge as a driving factor of the acceptance of ECs.

Columns (3) and (4) of Table 2 explore two extensions of the results reported in Column (2). First, to investigate the origin of the negative effect of specific knowledge of ECs we found, we included cross-products between the corresponding indicator variable and all the personal characteristics. It turned out that only the cross-products with education and labour status were statistically significant. Hence, to facilitate the analysis of the coefficients, we kept only these to obtain the results reported in Column (3) of Table 2.[7] While most of the results reported in Column (2) remain largely unchanged, this specification reveals that knowledge of what an EC is mediated by education and labour status. On the one hand, the coefficients of education and labour market status show a positive level of acceptance for those individuals who, while not having any knowledge of the EC, have secondary and university studies and are self-employed or studying. Also, the coefficient of the indicator of knowledge of what an EC is shows a positive level of acceptance for those individuals without studies and out of the labour market that do not know what an EC is. On the other hand, the interaction effects show a negative level of acceptance for those individuals that, while having knowledge of the EC, have primary and secondary studies and are not in the "others" category of the labour market status.

Second, to explore the possibility that the rural divide may also alter the effects of environmental conscience (Devine-Wright, 2007), we extended the specification used in Column (3) with the products of the rural-urban indicator and *i*) the level of acceptance towards the elimination of fossil fuels and *ii)* the production of energy from renewable sources. As reported in Column (4), these products were not statistically significant, which questions the hypothesis that spatial inequalities in terms of energy production and consumption may alter the effects of the environmental conscience on acceptance. Also, we find some differences with respect to the results reported in Column (3). First, we no longer find the urban-rural divide in the effects of living in a municipality with an EC. Second, we now find a positive level of acceptance in those individuals that do not have any knowledge of the EC and have primary studies.

Third, age (positive) and its square (negative) are now statistically significant variables (Azarova *et al*. 2019), thus suggesting that older people have higher levels of acceptance (at a decreasing rate), which contrast with the inconclusive results found in previous studies (Koirala *et al*., 2018). Lastly, since we are using a Poisson specification (the results were broadly similar using the log-linear model), the magnitudes of the coefficients reveal important differences in the impact of the three factors considered. To illustrate, while increasing the level of acceptance towards renewable energies by one unit is expected to increase the average level of acceptance towards the ECs by 0.06 (on a scale of 1 to 10), being a municipality in Lleida and knowing what an ECs is may increase the impact with respect to

[7] Estimates from the specification that included products involving gender and age were largely similar to the ones reported here and are available on request.

the residual category 2 and 10 times that of the acceptance towards renewable energies, respectively.

4. Conclusions

Social acceptance is key for the success of the energy transition process. However, there is limited evidence on the determinants of such acceptance. This paper focuses on the case of ECs, a prominent organizational example of energy transition. Thus, we seek to fill this gap in the literature by providing estimates from log-linear models using data from a survey carried out in 2023 on 984 citizens living in Catalan municipalities, with and without an EC.

Our main findings can be grouped around the effects of these three factors. First, we find that environmental conscience is the only factor that shows direct effects on the acceptance of ECs. However, the magnitude of these effects is smaller than those associated with the other two. Second, a general knowledge on climate agreements and regulations is (statistically) irrelevant when it comes to explaining variations in the acceptance of ECs. In contrast, the specific knowledge of the ECs turns out to be statistically significant when we account for the mediating effects of education and labour status, with negative (positive) effects generally associated with (lack of) knowledge. Thus, contrary to what is generally accepted, knowledge may have a negative effect on the acceptance of ECs in particular, and the energy transition in general. Third, the effects of social context only arise through the urban-rural divide: acceptance of ECs is higher in rural areas where there are already active ECs, although the specific mechanisms behind such differences in acceptance are unclear (and should be a matter of future research). This suggests the existence of some spatial (and possibly social) divide between cores and peripheries.

From a public policy perspective, our results indicate that all three factors should be considered for a successful implementation of these collaborative initiatives in energy production and consumption, especially considering the need to involve rural areas in the energy transition process. However, they also reveal some important trade-offs. On the one hand, policies aiming at increasing the level of environmental conscience (e.g., informative campaigns) may have a clear effect on individual's acceptance, but variations in the levels of acceptance associated to these policies will tend to be small. On the other hand, policies aiming at increasing (specific) knowledge may have a large impact on acceptance but show large variations across groups of individuals (rural vs urban communities, educated vs non educated, etc.) that may jeopardise the success of such policies. Addressing this heterogeneity probably requires *i)* that the initial implementation of ECs concentrates on rural areas; *ii)* that the (later) implementation of ECs in urban areas uses additional resources to counterbalance the potentially stronger barriers; *iii)* that additional efforts are made with specific groups of individuals, i.e., public campaigns have to be tailored to reach different groups of people in different ways. In any case, all these efforts must consider the legal and regulatory barriers already existing to the implementation of ECs, and which could have a negative effect on acceptance. Solving these ones should be a priority and a starting point for policy makers.

Finally, it is worth noting that our research suffers from two (related) limitations arising from the characteristics of the region and data we analyse. First, we expect our results to be

representative of a mature implementation of ECs in a European region, but they are not necessarily valid for alternative geographical areas in which the ECs are still an incipient phenomenon. Second, the fact that we analyse a cross-section of individuals precludes dynamic analyses on the evolution of ECs (this we leave for future research). Also, while we acknowledge that acceptance is a complex multidimensional phenomenon, we consider only three major factors that have been put forward in the literature. First, the level of environmental conscience that exists among the members of the community. Second, the level of knowledge of the energy transition in general and ECs in particular. Third, the social context of the ECs, which here we argue may interact with knowledge along the urban-rural divide.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Table 1: Descriptive statistics

Variables	Mean	St. Dev.	Min.	Max.
Level of acceptance towards EC	7.87	1.92	1	10
Level of acceptance towards elimination of fossil fuels	7.06	2.63	1	10
Level of acceptance towards renewable energies	9.06	1.57	1	10
Know Majors' Agreement	0.18	0.39	0	1
Knowledge of Paris Agreement	3.85	2.49	1	10
Knowledge of EU Climate Action	4.03	2.35	1	10
Knowledge of Spanish Climate Law	4.03	2.47	1	10
Knowledge of Cat. Climate Reg.	3.90	2.45	1	10
Know what an EC is	0.73	0.44	0	1
Municipality is an EC	0.52	0.50	0	1
Urban area	0.88	0.33	0	1
Province				
Tarragona	0.23	0.42	0	1
Lleida	0.00	0.05	0	1
Gender				
Women	0.50	0.50	0	1
Nonbinary	0.00	0.03	0	1
Age	51.50	16.09	16	88
Education				
Primary	0.13	0.34	0	1
Secondary	0.40	0.49	0	1
University	0.46	0.50	0	1
Labour status				
Salaried	0.51	0.50	0	1
Self-employed	0.07	0.25	0	1
Student	0.05	0.22	0	1
Unemployed	0.05	0.22	0	1
Retired	0.27	0.44	0	1

Note: Own elaboration from survey data. Definitions of these variables can be found in Section 3. Sample size is 984 observations.

Table 2: Determinants of the acceptance of Energy Communities

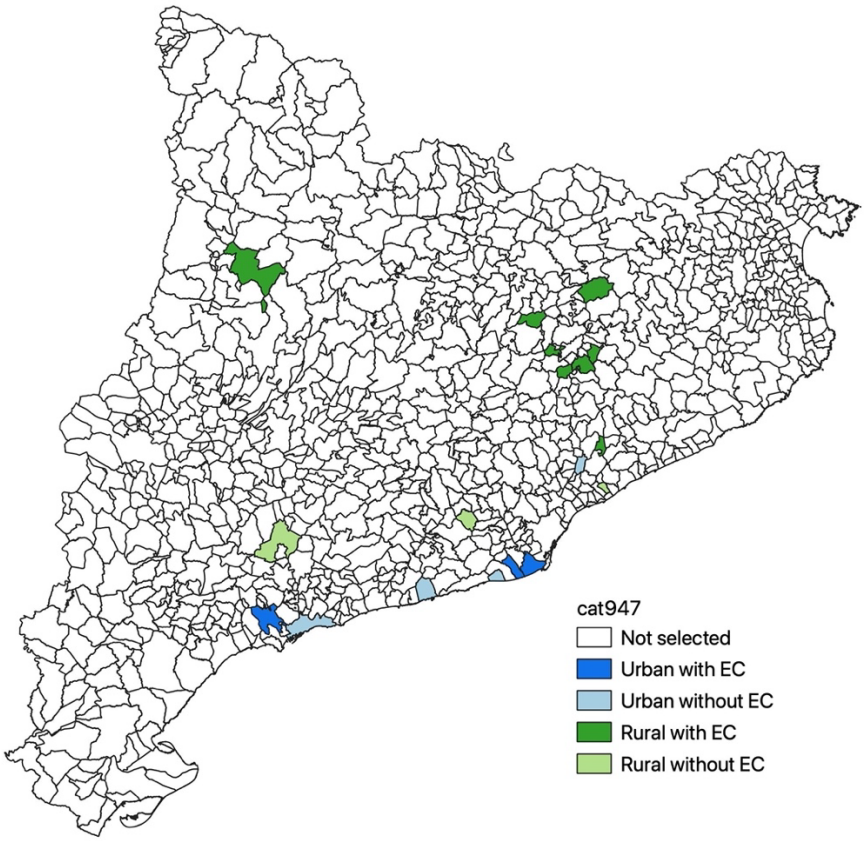
Variables	(1)	(2)	(3)	(4)
Environmental conscience				
Elimination Fossil Fuels	0.0203***	0.0201***	0.0195***	0.0226**
	(0.0045)	(0.0045)	(0.0045)	(0.0094)
_____ x Urban				-0.0068
				(0.0101)
Renewable energies	0.0748***	0.0746***	0.0746***	0.0610***
	(0.0115)	(0.0114)	(0.0112)	(0.0203)
_____ x Urban				0.0007
				(0.0216)
Knowledge				
Majors' Agreement	0.0380	0.0065	0.0013	-0.0036
	(0.0249)	(0.0592)	(0.0596)	(0.0505)
_____ x Urban		0.0353	0.0406	0.0427
		(0.0643)	(0.0648)	(0.0541)
Paris Agreement	0.0091	-0.0047	-0.0026	-0.0056
	(0.0066)	(0.0121)	(0.0121)	(0.0101)
_____ x Urban		0.0145	0.0137	0.0146
		(0.0134)	(0.0135)	(0.0108)
EU Climate Action	-0.0018	0.0083	0.0075	0.0034
	(0.0070)	(0.0168)	(0.0170)	(0.0148)
_____ x Urban		-0.0107	-0.0125	-0.0072
		(0.0187)	(0.0188)	(0.0159)
Spanish Climate Law	0.0075	0.0063	0.0056	0.0047
	(0.0088)	(0.0218)	(0.0218)	(0.0177)
_____ x Urban		0.0012	0.0023	-0.0009
		(0.0235)	(0.0236)	(0.0188)
Catalan Climate Regulation	-0.0092	0.0098	0.0099	0.0022
	(0.0076)	(0.0201)	(0.0202)	(0.0165)
_____ x Urban		-0.0210	-0.0208	-0.0084
		(0.0216)	(0.0216)	(0.0175)
Know what an EC is	-0.0472**	-0.0120	0.7187***	0.5917***
	(0.0236)	(0.0753)	(0.1972)	(0.1283)
_____ x Urban		-0.0365	-0.0514	-0.0339
		(0.0793)	(0.0800)	(0.0495)
Social Context				
Municipality with EC	0.0011	0.1150*	0.1074*	0.0591
	(0.0201)	(0.0623)	(0.0629)	(0.0441)
Urban municipality	-0.0108	0.1486	0.1603	0.0956
	(0.0319)	(0.1250)	(0.1262)	(0.2233)
Municipality with EC x Urban		-0.1298**	-0.1233*	-0.0679
		(0.0655)	(0.0659)	(0.0469)
Province Tarragona	-0.0025	0.0028	-0.0014	-0.0050
	(0.0236)	(0.0242)	(0.0240)	(0.0179)
Province Lleida	0.0843*	0.2447***	0.2118**	0.1247*
	(0.0470)	(0.0942)	(0.0964)	(0.0668)

Variables (cont.)	(1)	(2)	(3)	(4)
Individual characteristics				
Woman	-0.0051	-0.0070	-0.0078	-0.0120
	(0.0204)	(0.0204)	(0.0204)	(0.0145)
Nonbinary	-0.3998***	-0.3947***	-0.3839***	-0.4163***
	(0.0485)	(0.0496)	(0.0551)	(0.0464)
Age	0.0073	0.0069	0.0068	0.0066*
	(0.0060)	(0.0060)	(0.0058)	(0.0036)
Age Squared	-0.0001	-0.0001	-0.0001	-0.0001*
	(0.0001)	(0.0001)	(0.0001)	(0.0000)
Primary Education	-0.0831	-0.0863	0.1040	0.2222***
	(0.1377)	(0.1481)	(0.0924)	(0.0711)
_____ x Know EC			-0.3980***	-0.4453***
			(0.1042)	(0.0808)
Secondary Education	-0.0333	-0.0348	0.1608**	0.2303***
	(0.1356)	(0.1460)	(0.0754)	(0.0617)
_____ x Know EC			-0.4074***	-0.4281***
			(0.0900)	(0.0716)
University Education	-0.0134	-0.0158	0.1993**	0.2609***
	(0.1359)	(0.1463)	(0.0777)	(0.0643)
_____ x Know EC			-0.4369***	-0.4538***
			(0.0900)	(0.0738)
Salaried	-0.0134	-0.0091	0.1847	0.0810
	(0.0629)	(0.0627)	(0.1446)	(0.0830)
_____ x Know EC			-0.3070*	-0.1686*
			(0.1578)	(0.0945)
Self-employed	0.0235	0.0233	0.2664*	0.1526*
	(0.0684)	(0.0683)	(0.1509)	(0.0906)
_____ x Know EC			-0.3620**	-0.2152**
			(0.1665)	(0.1046)
Student	0.0508	0.0536	0.2955*	0.1761*
	(0.0799)	(0.0799)	(0.1547)	(0.0945)
_____ x Know EC			-0.3868**	-0.2428**
			(0.1629)	(0.1046)
Unemployed	0.0370	0.0447	0.2426	0.1178
	(0.0732)	(0.0734)	(0.1513)	(0.0922)
_____ x Know EC			-0.3081*	-0.1635
			(0.1684)	(0.1094)
Retired	0.0104	0.0103	0.2073	0.0987
	(0.0852)	(0.0846)	(0.1696)	(0.0924)
_____ x Know EC			-0.3124*	-0.1769*
			(0.1651)	(0.0977)
Adjusted R-squared	0.20	0.20	0.21	

Note: Columns (1) to (3) provide results from a log-linear model estimated by ordinary least squares and Column (4) from a Poisson model estimated by maximum likelihood, both using 984 observations. Robust standard errors in parentheses. The asterisks denote statistically significant coefficients at the 1% level (***), 5% level (**) and 1% level (*). A constant term is included but not reported.

Figures

Figure1: Municipalities included in the survey



Source: own elaboration.