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BRIEF REPORT Open Access

Insights from a conjoint study on the attractiveness of energy communities

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Abstract

Energy communities are gaining prominence across Europe, but little is known about factors that motivate individuals to join them. This study investigates how social, legal, technical factors, as well as person-specific characteristics shape motivation to participate in ECs beyond financial considerations. Using a conjoint experimental design in an Austrian online survey ($N = 554$), we examined preferences across multiple EC profiles per person. Results indicate that participants slightly preferred ECs organized as associations over corporate or company-based entities, and favored comprehensive energy usage models (e.g., combining electricity and heating) over more narrowly focused applications. There was also limited evidence for a preference toward socially diverse communities. At the individual level, motivation to join an EC was most strongly associated with positive attitudes toward public service, followed by weaker effects of future orientation and biospheric values. We discuss the results in the light of emerging perspectives on energy citizenship, highlighting individuals as active contributors rather than passive consumers in the energy transition.

Keywords Energy community, Participation, Energy citizenship, Incentives, Green energy

1 Introduction

Energy Communities (ECs) increasingly become a topic of scientific and political debate in many parts of Europe as a decentralized form of energy management [1, 2] with the potential to democratize the energy market of the future. They are expected to play a pivotal role in the energy transition, contributing to a low-carbon, secure, affordable, and renewable energy system [3, 4]. In such ECs, different stakeholders like citizens, citizen associations, companies, or municipalities convene to locally organize their energy generation and consumption. However, the concept of EC is multifaceted and subject to varying interpretations across Europe [5, 6]. While some ECs fall under the formal categories of "Citizen Energy Communities" and "Renewable Energy Communities", as introduced by the European Commission in Directive (EU) 2019/944, others include more informal and grassroots initiatives that may not meet these specific criteria [7]. As a result, ECs can take on very different forms across different countries and contexts.

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This includes variations in governance structures, technological integration [8], legal and economic frameworks [9], geographical scale, and the kinds of actors involved [10]. Despite this heterogeneity, participation rates in such ECs have only increased marginally in Europe [11]. This raises an important question: How do people perceive these different compositions and profiles of ECs, and which characteristics make them more or less appealing for potential members?

In this article, we present data from a conjoint study in Austria investigating the preferences of people regarding several aspects of ECs, which might be attractive to them. This research was driven by the research questions, which social, legal or technical aspects of ECs are motivating factors for people to join an EC? Moreover, we also aimed at accounting for individual differences in people's motivation in general. Before we describe our research questions in more detail, we will describe the theoretical background and introduce relevant concepts based previous literature.

1.1 From energy citizenship to energy communities

In Europe, market prices for green energy devices, particularly photovoltaic, have decreased dramatically over the course of the last decades. Not only did this spark a public interest in making use of green energy, but also in striving for greater democratization of the energy market. Against this backdrop, the concept of energy citizenship has gained increasing attention as a form of decentralized, citizen-led energy management that seeks to reposition citizens from passive consumers to active participants in energy systems. Energy citizenship encompasses individual and collective actions through which citizens engage in the production, consumption, governance, and transformation of energy, often through initiatives such as energy communities, cooperatives, and local renewable energy projects. As Hamann et al. [12] argue, energy citizenship is closely linked to processes of empowerment and collective agency, enabling citizens to shape energy transitions while challenging established socio-technical and institutional arrangements. Similarly, Limbeek et al. [13] emphasize that energy citizenship extends beyond technological adoption and economic participation, involving democratic engagement, social learning, and the redistribution of decision-making power within energy systems. In this sense, energy citizenship represents a broader shift toward more participatory and inclusive forms of energy governance, where citizens collectively contribute to and influence the direction of sustainable energy transitions.

Despite these ambitions, the practical implementation of energy citizenship, particularly through ECs across Europe often falls short of its transformative and inclusive goals [14]. While ECs are frequently presented as vehicles for democratization, participation and empowerment, evidence suggests that marginalized and vulnerable groups remain underrepresented in many initiatives. Hanke and Guyet [15] show that participation in ECs is often skewed toward socio-economically advantaged groups with greater financial resources, technical knowledge, and social capital, thereby reproducing existing inequalities rather than overcoming them. Likewise, Koga et al. [16] highlight that many ECs struggle to actively engage disadvantaged populations and frequently lack targeted outreach strategies that would lower barriers to participation. As a result, the benefits of collective renewable energy projects, including economic gains, increased agency, and influence over local energy governance, are not distributed evenly across society. Hence, the literature points to a persistent gap between the normative aspirations of energy

citizenship and its realization in practice in the form of ECs. A better understanding of how ECs operate would be required, whom they include and exclude, and how they can more effectively contribute to a just and inclusive energy transition.

Austria is a prominent example for a country, where ECs seem to have become more viable for people: Directives from the EU level were implemented early into national law, enabling the establishment of ECs by private individuals, small and medium-sized enterprises, or local authorities without primarily aiming for profit. As participants benefited more from reduced grid fees, financial subsidies, and other support measures, approximately 1170 renewable ECs were established between 2021 and 24 and the number continues to rise.

Beyond sole market pricing, ECs may offer a broad scope of social, legal and technical dimensions to consider, which may or may not affect people's motivation to join an EC. They can create barriers for engagement for people beyond their specific preferences and attitudes, which will be addressed further below. We identified three dimensions of ECs that we consider relevant for people's decision to partake in an EC and which we want to focus on in this study [17, 18] and which were also highlighted in other research (e.g [19, 20]).

1.2 Social dimension

The social configurations of ECs can vary significantly, and this variation could play a crucial role in shaping individuals' willingness to join. Research has shown that community engagement and social dynamics are central to the success of such initiatives. For example, Lopes and Antunes [21] highlight how social acceptance and participation are closely linked to the degree of community involvement and the perceived inclusiveness of the project. A key differentiator among ECs is who initiates, owns, and participates in them. Some ECs are entirely resident-led, while others involve collaborations between citizens, local governments, and small or medium-sized enterprises. Studies suggest that ECs initiated by local residents, either alone or alongside public actors, tend to foster stronger motivation among potential members compared to communities established solely by external actors such as governments or corporations [22]. This may be because locally led initiatives offer more opportunities for interaction, political representation, and a sense of belonging [23, 24]. Another aspect that may vary between different ECs is the time people need to invest into the EC. While time commitment can foster social identification and a deeper sense of involvement, which makes the group feel more meaningful and less permeable [23], it can also present as a barrier, deterring participation from outsiders if they perceive it as too demanding. Furthermore, the diversity of an EC and its members might be a factor influencing people's perceptions of ECs. Although educational and income diversity can enrich group perspectives and broaden reach [25], it may also lead to lower perceived group cohesion and identity, which in turn can reduce motivation to participate [23, 26].

1.3 Legal dimension

Psychological research indicates that groups may be perceived as more motivated to engage in certain behaviors, if they are based on a legally binding contract among members, because contracts may signal social norms (i.e., what is the appropriate and actually practiced behavior, see [27]). In Austria, there are three legal forms that an EC can take,

each offering different structural and participatory features. An association is a common and accessible form, often used for non-profit and community-driven initiatives where decision-making is typically democratic. A cooperative places strong emphasis on joint ownership and economic participation, with members having both a financial stake and voting rights. Lastly, a limited liability company provides a more formalized and business-oriented framework, usually involving fewer members and a clearer hierarchical structure. These legal forms to organized behavior shape not only how ECs are governed, but may also influence how attractive and inclusive they appear to potential participants. For instance, one could argue that a company structure could be most attractive to people as clear hierarchies in obligations may be preferred. At the same time, association may have more benefits for more effective, trust-based exchanges among members [28].

1.4 Technical dimension

In addition to social and legal differences, ECs can vary significantly in their technological configurations, which concern aspects of the local grid and energy management, as well as specifics about the production and consumption of the energy (see, e.g. [18–20]). A common feature is the integration of renewable energy sources, often combined with small-scale energy storage systems to improve local energy autonomy and resilience. For example, some EC models aim to optimize microgrid efficiency by balancing environmental concerns, energy management needs, and economic considerations [29, 30]. Some ECs optimize their energy use by utilizing energy for multiple functions such as heating, cooling, and electricity while other ECs focus on a single, centralized purpose like electricity. Furthermore, ECs can also differ in how much control members have over technical operations. In some communities, systems are technically optimized, fully automated and managed exclusively by experts, while members themselves cannot interfere. On the other hand, some ECs grant members full control over technical functions, requiring active coordination and decision-making but ensuring greater privacy by avoiding automated systems. There are several of these technological design choices that not only shape how ECs operate but likely also influence who feels capable, secure, and motivated to participate.

1.5 Person-specific factors

Beyond the aforementioned factors, individual differences in attitudes, values, and related psychological characteristics are likely to play an important role in shaping people's motivation to join an EC. A substantial body of research demonstrates that such factors influence pro-environmental behavior in general and often explain engagement beyond financial incentives alone [31, 32]. Their relevance is also reflected in prominent theories of environmental behavior, such as the Value-Belief-Norm Theory, which emphasizes the role of underlying values and ecological worldviews as generalized orientations toward environmental issues that can motivate action (e.g [33, 34]), . Such psychological predispositions may be particularly relevant for forms of collective environmental engagement, including participation in ECs (e.g [24, 35]), . Whereas attitudes toward particular behaviors are often most strongly related to those behaviors, broader pro-environmental attitudes and values may capture more general individual differences that influence a wider range of environmentally relevant actions, including the willingness to participate in an energy community.

As awareness of climate change has grown over the past decades [36], so too has the appeal of models that combine ecological goals with local democratic empowerment, as reflected in European laws (Directive 2024/825 [37]), , which envision citizens moving beyond passive consumer roles and offer them a more agentic role in the energy system. The idea that people perceive rights and responsibilities to participate in shaping a just and sustainable energy transition and feel motivated to act accordingly is also known as *energy citizenship* [12, 38, 39]. In many ways, ECs are not just energy projects, but part of a wider cultural shift toward more sustainable, resilient, and community-oriented ways of living [40]. And indeed, previous research [41] indicates that the strongest motivations for people to become involved in ECs are rooted in both environmental motives (wanting to protect the environment) as well as communal motives for more social justice (wanting to be involved in a community).

For this exploratory study, we wanted to account for such person-specific effects by integrating a set of scales that, in our view, could further illuminate participants' motivation:

Biospheric values. Introduced by De Groot and Steg [42, 43], biospheric values should accompany basic values, seen as guiding principles of individuals. These principles imply a strong caring for nature and were used as predictor of several pro-environmental intentions and behaviors in the past [44–46]. As joining an EC functions as a means to more pro-environmental behavior, biospheric values may turn out as a relevant predictor.

Public service attitudes. This concept depicts the individual inclination to be drawn to services benefiting the community [47, 48].[1] This way, it also relates to contemporary environmental research that highlights the importance of communal belonging and identity as driver to engage in environmental action [13, 35]. ECs provide a ground, where individuals can act in a community for the environment in a sustainable and long-lasting way.

Consideration of future and immediate consequences. People high in future orientation tend to value long-term outcomes and are therefore more likely to engage in future-oriented pro-environmental behavior, even when it involves short-term inconvenience [49, 50]. In contrast, those who consider immediate consequences more prioritize short-term personal benefits, a tendency that has been linked to higher individual greenhouse gas emissions across multiple life domains [51–53]. Engaging in an EC may therefore rather be related to the former than to the latter.

2 Study overview and research questions

We set out to investigate participants' preferences to join an EC based on the above discussed dimensions (i.e., the social, legal and technical dimension) and dependent on person-specific characteristics. Preference is understood as participants' motivation to join an EC based on what kind of aspects per dimension an EC entails. For instance, in regard to the legal dimension, its aspects are that an EC could have the form of a cooperative, an association or a company—and participants may find it more or less motivating to join an EC, when it has the form of a cooperative compared to a company or an association.

[1] Note that Witesman and colleagues describe many facets of public service attitudes, values and practices, including management styles and belief in better opportunities for citizens. We focus on the *attitudes* dimension for public service only (dimension APS, Table A5 in [48]).

We prepared profiles of ECs regarding all the dimensions (final set of profiles, see Table 1). These profiles were presented to Austrian participants in a quota-representative conjoint study to see, which aspects of an EC are particularly attractive: Based on quotas for demographic variables, we gathered a representative sample via an online panel provider. In the conjoint part of our study, we varied all possible profile combinations (i.e., all dimensions and their aspects) randomly and presented participants with a subset of them. For the dimensions and their aspects, we formulated the following exploratory research question as the main goal of this study (see preregistration: https://osf.io/s3f42/):

RQ1: Which (a) social, (b) legal or (c) technical aspects of an EC profile stand out as particularly motivating for people to join an EC?
We also pretested all profile aspects in small preliminary pilot study, checking for their clarity in the formulations and obtaining initial evidence for motivation ratings. The results, as shown in the next section, were then used for more specific hypotheses.

As a secondary goal, we also wanted to gain initial evidence for potential person-specific factors that may affect motivation ratings beyond the aspects of an EC. Hence, we formulated the following research question:

RQ2: Which person-specific characteristics explain higher motivation to join an EC?
Following the pilot study, we describe the specific methods of how we aimed at answering these RQs using the conjoint study method.

3 Summary of the pilot study and refinement of hypotheses

We set up a pilot study with the goals to (i) refine the clarity and intelligibility of how we formulated the dimensions and aspects in our profile descriptions in the main study and (ii) gain initial evidence for a motivation to join an energy community based solely on individual aspects of EC profiles. Importantly, in this pilot study, we presented all aspects individually and not in the context of other aspects of an EC profile. These exploratory goals were preregistered before the data collection (https://osf.io/9yd5m/).

Next, we set up an online survey which we send around in Austrian online forums and via email distribution lists to gather a convenience sample of $N = 50$ participants, which we achieved ($N = 50$, M_{age} = 42 years, SD_{age} = 14 years, n_{female} = 26, $n_{university\ degree}$ = 38). In the survey, we first obtained informed consent and gathered some demographic information. Second, we presented participants with the concept of ECs in a short paragraph. We also linked to more information by the Austrian Coordination Office for Energy Communities (see https://energiegemeinschaften.gv.at/). After an attention-check question, we directed participants to six pages that were always introduced the same way: "Imagine you are online on some webpages and you find an add by an Energy Community to join it. It advertises the following aspects regarding (…). How clearly understandable do you find these aspects and how motivated would you be to join the Energy Community upon reading these aspects?"

Specific features of the EC, that is, the aspects of several dimensions, were presented to the participants. They read all aspects of these dimensions and rated (i) if they found their *wording* clear, and (ii) if they felt *motivated* to join the EC, both on 7-point rating scales (from 1 "not at all" to 7 "very much").

Table 1 Final dimensions used in the main study

Dimension	Aspect 1	Aspect 2	Aspect 3
A (social)	Members of the energy community meet every six months for meetings. This infrequent exchange hardly leads to a sense of community among those involved.	Members of the energy community meet monthly for meetings. This frequent exchange strengthens the sense of community among the participants.	
B (social)	The energy community consists of households, house communities and/or small businesses.	The energy community is supported by a medium-sized company, which encourages citizens to participate.	In addition to various households, the municipality is also involved in the energy community and encourages citizens to participate.
C (social)	The members are mostly from middle and higher income brackets and show higher expertise in organizational and technical tasks.	The members are from lower, middle and higher income brackets and have varying levels of expertise in organizational and technical tasks.	
D (tech)	Technical aspects of the energy community are completely automated. Although they can be tracked using simple apps (e.g. on a cell phone), the technology is controlled and regulated by experts who have access to the members' data.	Technical aspects of the energy community are partially automated. They can be partially regulated via simple apps (e.g. on the cell phone). In addition, experts who have access to the data control and optimize other aspects.	Members have full control over the technical aspects. In order to optimize the settings, members must coordinate regularly. There is no automation (e.g. via apps), which ensures the protection of data.
E (tech)	The jointly generated energy is used for a central purpose - e.g. for electricity. This initially enables clear and transparent use, but is less efficient in the long term.	The jointly generated energy is used for multiple purposes – e.g., electricity, heating, cooling systems, etc. This is more complex at the beginning but more efficient in the long term.	
F (legal)	This energy community has the legal form of an association. Decisions are made by the general meeting and a board of directors, among others. There is no legally prescribed starting capital for new members. Making a profit may only be a secondary purpose. Profits generated are used for the community, but not for individual members. In the event of debts, the community is also liable with its assets, but not the individual members.	This energy community has the legal form of a cooperative. Decisions are made by the Board of Directors. There is no legally prescribed starting capital. Profits are not the aim of the community, but if these arise from the sale of renewable energy generated, they can be passed on to individual members. The individual members are liable for debts, not the energy community.	This energy community has the legal form of a limited liability company. Decisions are made by the general meeting. New members (shareholders) are required to contribute EUR 10,000 as statutory starting capital. Profits are distributed to the members in proportion to their contributions. The community is liable for debts with all its assets, but there is no personal liability of individual members.

The detailed outcomes of the pilot study can be found in Table S3 in the supplemental materials (https://osf.io/853pe/). Here, we focus on the two most important outcomes of this pilot study. First, most wordings were already clear to participants, as indicated by ratings in the upper part of the rating scale (above scale midpoint 4). However, ratings for the motivation were partly quite low (below scale point 3). Hence, we adapted a few formulations for the main study, which resulted in the final dimensions and their aspects presented in Table 1: We formulated three social subdimensions, representing (A) community exchange, (B) composition, and (C) member's socio-economic background; two technical dimensions, representing (D) automatization and data and (E) energy use; and one legal dimension of (F) the legal form of the EC.

Second, through the pilot study, large difference in motivation ratings were obtained for two aspects: Within the legal dimension (F), we found that participants strongly preferred (1) associations ($M = 5.62$, $SD = 1.46$) over (2) cooperatives ($M = 2.54$, $SD = 1.84$) and (3) companies ($M = 3.24$, $SD = 2.06$). And for the energy use dimension (E), we found that participants strongly preferred (2) comprehensive energy use ($M = 5.06$, $SD = 1.79$) instead of (1) limited energy usage (e.g., only for electricity) ($M = 2.80$, $SD = 1.67$).

Based on these results, we could formulate two specific hypotheses for RQ1 for the main study:

H1: The legal EC form of an association leads to higher motivation ratings compared to the form of a cooperative and a company.

H2: A more comprehensive use of energy in ECs leads to higher motivation ratings than a more specific use (e.g., only for electricity).

4 Methodology of the conjoint study

4.1 Online Set up

This study was set up in *LimeSurvey* [54] and experimental software *PsychoPy* via the online surface *Pavlovia* [55], where the former is suited for general surveys and the latter is suited for more complex experimental online designs, including conjoint studies. We spread this survey via the panel provider *talk* (see https://talkonlinepanel.com/at) among the Austrian population. In LimeSurvey, we presented participants with a consent form, followed by several demographic questions (see Table S1).

Afterwards, we briefly introduced them to the main part of study by first describing the concept of ECs. This information was adapted from the website of the Austrian Coordination Office for Energy Communities (see https://energiegemeinschaften.gv.at/), which contains a comprehensive overview of the situation of ECs in Austria, and which we also linked to. Specifically, they read: "In an energy community, at least two partners (e.g., households, small businesses, municipalities)—and potentially up to several hundred members—join together to collectively produce, store, consume, and, if applicable, sell energy. The members rely on renewable energy sources, for example through solar panel systems installed on a multi-unit residential building or a housing block."

Next, they were briefly introduced to the set-up of the conjoint part, where we showed them a hypothetical example of two EC profiles, including the rating scales to familiarize them with the look of the upcoming task. An attention check question verified

participants had read the information on the ECs before. We then forwarded them to the conjoint part in PsychoPy.

On five pages, participants read about two profiles of ECs, rated which EC they felt more motivated to join (DV1 for each EC: "How motivated would you feel to joint this EC?", 1 = "not at all motivated", 7 = "very motivated") and made a dichotomous choice which profile they preferred (DV 2: decision; 0 = not chosen, 1 = chosen). These profiles were randomly drawn from a pool of all possible profiles, which were 216 unique combinations based on six dimensions with two to three aspects each. They are all shown in Table 1 (see original German version in Table S2 and the depiction of EC profiles in Figure S1).

Afterwards, participants answered additional questions on person-specific questions, which we tested as factors in further analyses. These included their biospheric values (*bios;* two items; example item: "I firmly believe that people should take care of nature; environmental protection is important to me." [46]), their future and present orientation (consideration of future and immediate consequences, *cfc* and *cic;* three items each; example item: "When I make a decision, I think about how it might affect me in the future." [46]), as well as on their attitudes towards public service (*psa;* six items; example item: "Meaningful service to society is very important to me." [47, 48]). We also had participants self-evaluate their competence regarding the EC topic on a single item following the conjoint part ("I felt informed and competent about the previous energy community questions, so I was confident in my answers."). All items were answered on 7-point rating scales (1 = "completely disagree" to 7 = "completely agree") After the conclusion of the survey, participants were sent back to the panel provider. The complete variable list can be found online: https://osf.io/853pe/.

4.2 Participants and power

We planned a diverse sample of the Austrian population, provided by an online panel provider (in our case Talk Online, https://talkonlinepanel.com/at). In our preregistrati on, we registered a sample size of a minimum of $N = 540$ participants (and up to 600, see preregistration: https://osf.io/s3f42/). This would provide sufficient statistical power ($1\text{-}\beta \geq 0.90$), while keeping a low alpha error probability ($\alpha \leq 0.05$), for a conjoint study with five comparison tasks (i.e., profile pages to rate), where each dimension has a maximum of three aspects, and where the anticipated average marginal component effect is small, $AMCE = 0.05$. Point estimates that fall below this threshold, will be interpreted as null effects.[2]

Via the panel provider, we motivated $N = 2011$ people to click on the link to the study, of which $N = 1085$ reached the conjoint part. Of those, $N = 641$ completed the conjoint part.[3] There were some incomplete cases and several doublets, presumably because some participants started the study multiple times. We only counted the first trial, which left us with a final sample of $N = 554$. This sample consisted of 49% women ($n = 271$), 35% participants had a high school degree or college degree ($n = 195$), 52% came from the countryside with less than 10 000 residents in their area of living ($n = 287$). Their average

[2] The alpha and beta error should be minimized in a prospective study. Conventionally, they are set to $\alpha = 0.05$ and $\beta = 0.10$. When calculating a sample size, one should also assume small effect sizes (i.e., AMCEs in this case), to assure that such effects are not "missed". This naturally leads to relatively large sample sizes (i.e., $N > 500$).

[3] This dropout of 40% of the participants was expected as there was much information to read and process when going through the EC profiles [56].

age was $M = 49.39$ years ($SD = 16.94$, min = 18, max = 85). All further demographic information is available in Table S1.

4.3 Analysis approach

We conducted descriptive analyses and built the mean composite scores for the scales following a reliability analysis (see Table 2). These descriptive statistics entailed the We then conducted the conjoint analysis, using all participant ratings to assess the motivation to join ECs for each dimensional aspect. Potential effects were then double-checked with the dichotomous decision variable. The resulting AMCE scores functioned as effect size to be compared. We also calculated interactions of dimensions to assess whether motivation ratings on some dimensions would be larger or lower depending on the scores of other dimensions. To asses individual-level differences, we additionally calculated multilevel models with the composite scores as predictors (similar to [56]). These analyses were conducted using *R* [57] and the packages *cjoint* [58], *lme4* [59], and *jmv* [60].

5 Results of the conjoin study

5.1 Descriptive statistics

Descriptive statistics and correlations are depicted in Table 2. Main results for the conjoint study for the motivation rating are depicted in Fig. 1A and B. The average scores for each aspect of the dimensions varied within one scale point ($3.5 < Ms < 4.5$), which had the grand mean of $M = 3.80$ (see Table 2) and the median was identical for each aspect, equating with the scale midpoint ($mdns = 4$). Hence, there was little variation in these means.

5.2 Testing research question 1

When looking at the aspects per dimensions, we found evidence for effects in line with our hypotheses: Specifically, we found evidence for H1 that participants were less motivated to join an EC when it had the legal form of a cooperate or a company compared to when it was an association (see Fig. 1B and D, dimension F). We also found evidence for H2 that participants preferred it slightly more when the generated energy of an EC could be used for a variety of purposes (see Fig. 1B and D, dimension E). In both cases, the statistically significant point estimates surpassed the predetermined threshold, $AMCEs > 0.05$.

For the other dimensions, we did not find consistent evidence for an effect. Particularly, in dimension C, motivation ratings seemed to be somewhat larger when the

Table 2 Descriptive statistics and Pearson correlations

	N	M	SD	Mdn	Min.	Max.	*r*				
							1.	2.	3.	4.	5.
1. motivation mean	554	3.80	1.05	4	1	6.40					
2. bios scale ($r = 0.75$)*	552	5.84	1.17	6	1	7	0.17				
3. psa scale (α = 0.91)	553	5.39	1.17	5.50	1	7	0.32	0.71			
4. cfc scale (α = 0.83)	548	5.10	1.11	5	1	7	0.24	0.58	0.63		
5. cic scale (α = 0.80)	549	3.21	1.32	3.33	1	7	− 0.08	− 0.42	− 0.37	− 0.42	
6. competence	552	4.99	1.44	5	1	7	0.17	0.32	0.29	0.28	− 0.10

$r = 0.08$ is $p = 0.08$; all other correlations are $p < 0.02$; * scale consists of two items only; bios = biospheric values, psa = public service attitudes, cfc = consideration of future consequences, cic = consideration of immediate consequences; α refers to reliability coefficient Cronbach's α; motivation mean refers to the mean of all ten motivation ratings per participant

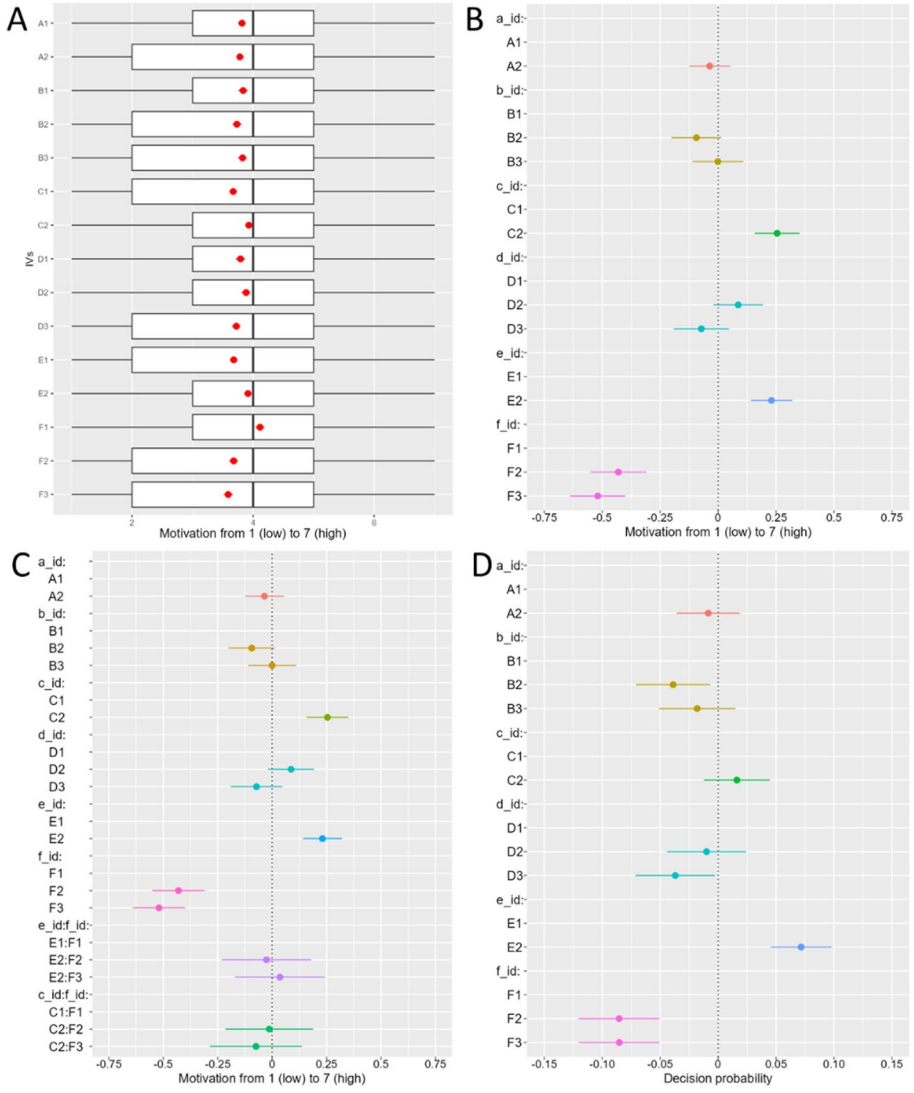


Fig. 1 Main results of the conjoint study. **A** box plots for all motivation ratings; boxes represent the IQR with the median in the middle; red estimates are means with 95% confidence intervals (see Table S4); **B** AMCEs with 95% confidence intervals for motivation ratings with aspect 1 being the reference category; **C** AMCEs for motivation including interactions of significant dimensions (see Table S5); **D** AMCEs for decision to join the EC; point estimates larger than 0.05 are considered relevant; see Table 1 for aspects A1 to F3

composition of the EC was more socio-economically diverse (Fig. 1B), but this effect did not show for the dichotomous decision (Fig. 1D). For dimensions A, B, and D, all estimates were even more closely clustered together. Finally, no interaction effect was found for the significant estimates (Fig. 1C), indicating no detectable moderation effects of these dimensions.

For additional data exploration, we tried to identify auxiliary effects. First, we created a subset of those people, who carefully conducted the study based on their time of completion ($n = 395$). That is, we excluded participants who either took too little or too much time to finish the study (less than 30 and more than 180 s per conjoint page). Second, we looked at a subset of people, who evaluated themselves as competent in terms of ECs (self-evaluation ratings ≥ 5; $n = 362$).

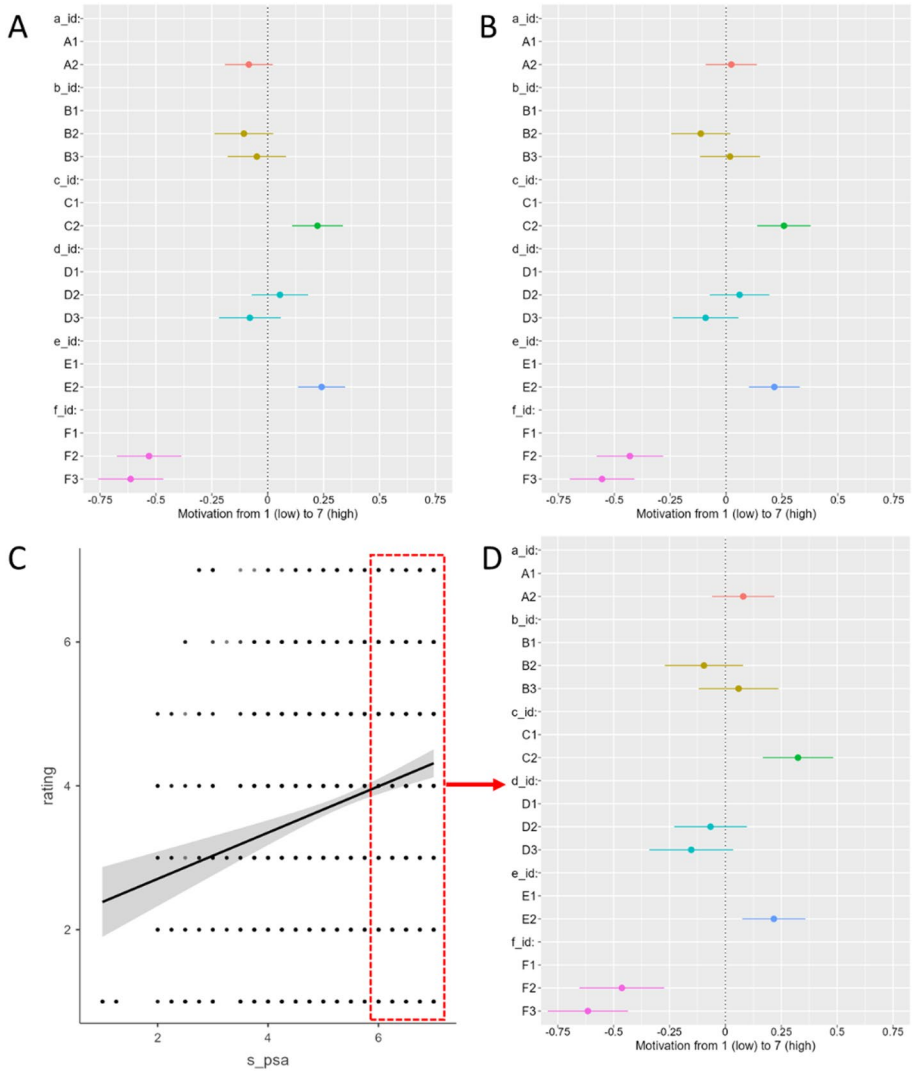


Fig. 2 Further analyses. **A** AMCEs motivation for a subset of careful readers (less than 3 min and more than 30 s per page); **B** AMCEs motivation for a subset of knowledgeable participants; **C** fixed effect of public service attitudes in a multilevel linear model; **D** AMCEs for participants in the upper tercile of public service attitudes (see also Table S6; for lower tercile results see Figure S4)

In both cases, the pattern of the motivation ratings largely confirmed the previous results (see Fig. 2A and B). Significant differences showed in dimension C, E, and F. The results from the dichotomous decision variable confirmed that differences were only present in dimension E and F (see Figure S4), but not in dimension C. The inconsistent results for dimension C are noteworthy: people indicate a higher motivation for more diverse ECs, but are not decisive when making a dichotomous choice.

5.3 Testing research question 2

Next, we conducted multilevel models for the person-specific predictors by nesting the ten participant ratings for the EC profiles in participants. We then run four models for each composite score. As a result, we found that public service attitudes (psa) were associated positively with motivation to join an EC, $b = 0.321$, $p < 0.001$. Also, biospheric values (bios) and future orientation (cfc) showed positive, but smaller effects, $bs \leq 0.112$, ps

< 0.05. These results confirmed the correlations with the mean of all profile ratings (see Figure S2; see also Table S7 for numeric details).

From the strongest predictor, psa, we created tercile bins and took the upper bin, i.e., the participants with the strongest ratings in favor of psa ($n = 229$), which were also above the mean of the motivation ratings to join an EC (see Fig. 2C). We reran the analysis for RQ1 with these participants to see, if the results would vary for them. However, the pattern of results remained identical for this subset of participants (see Fig. 2D).

6 Discussion

ECs rise in popularity in many European countries. Because of that, we were interested to know what drives people's motivation to join ECs beyond economic factors such as financial incentives. Particularly, diverse social, legal and technical aspects of ECs could contribute to people's decision to join, as do individual person-specific inclinations. We set out to gather evidence using a conjoint study that is suitable for identifying preferred aspects among several dimensions. Confirming preliminary results from our pilot study, we found that two particular aspects of ECs stood out: the legal entity of an association was slightly preferred over other legal forms of ECs (i.e., a corporate or a company); and on the technical side, a comprehensive usage of energy was preferred over a focused usage. There was also some evidence that a more socially diverse EC is preferred over an EC that only harbors upper-class people, which is in line with previous literature that found a link between diverse neighborhoods and collective action [24]. In regard to person-specific factors, particularly positive attitudes towards public service were related to motivation to join an EC, followed by weaker effects for cfc, as well as for bios.

Associations might be most attractive as they often provide participants with formally more agency and influence over internal decisions, compared to corporate or company structures. This is interesting as associations also do not necessarily provide possibilities for individual gains from energy production surplus. Potentially, the risk liabilities were seen as least pronounced in associations. Similarly relevant is the finding that people prefer EC structures for a comprehensive use of produced energy, not just a single focused use. Hence, it can be inferred that ECs that cover both electricity and heating for all purposes for one's household seem to be attractive as people do not have to manage several systems in parallel.

On the side of the person-specific variables, public service attitudes stood out as the strongest predictor for the motivation to join an EC. This is plausible as engagement in an EC requires coordination and cooperation with other members. The social features of an EC presume their appreciation by individuals: the organization of energy production also needs a level of social organization, including, who provides which number of photovoltaic installations and how exactly the energy is distributed among member households. In the same vein, future orientation in one's decision making and behavior and values in line with the environment partially contributed to the motivation to join an EC. This is not surprising as joining an EC requires an initial individual effort to achieve change. Positive future outcomes, in this context, local green energy production independent from large suppliers including financial benefits for all community members may only accumulate and fully unfold over time.

In general, the effects of positive attitudes towards public service may reflect that positive beliefs related to the community and society as a whole become more pronounced

among many people [61]. This growing sense of engagement challenges earlier assumptions about the public's role in the energy transition. In the past, people have mostly been seen as passive consumers, whereas newer approaches acknowledge their potential role as prosumers and active energy citizens [12, 37, 38]. That way, EC involvement can be seen as both antecedent and consequence of energy citizenship, just as other forms of pro-environmental behavior can take both roles [62, 63] On one hand, they can act as a starting point by providing individuals with concrete opportunities to exercise their rights and responsibilities in the energy transition. On the other hand, through participation and involvement, ECs can shape their members' attitudes and motivations in favor of a sustained support. This reasoning would be in line with research suggesting that individuals involved in ECs tend to engage in more pro-environmental behaviors compared to those who are not [35, 64].

That way, involvement in ECs can become a societal vehicle towards strengthening energy citizenship. A promising pathway would lie in the role of socially-oriented prosumers, that is, citizens who not only consume energy but also generate it and who are interested in public services [65, 66]. As owners of green energy technologies, such as photovoltaic systems, socially-oriented prosumers possess valuable technical resources and social motivation that can be mobilized once they join an EC. When motivated by social as well as economic objectives, these actors may act as champions of their EC, who facilitate the inclusion of vulnerable and underrepresented groups, for example by further developing fair sharing models for surplus energy, reducing financial barriers to participation, or advocating for more equitable governance structures. Such efforts could help extend the benefits of green energy within ECs beyond households with sufficient financial resources, gradually including more vulnerable or marginalized groups. Looking ahead, the increasing engagement of socially-oriented prosumers could contribute to a more inclusive form of energy citizenship beyond currently existing barriers [15, 16] in the long run. By fostering collective agency, strengthening local solidarity, and expanding opportunities for democratic involvement in energy governance, ECs that are led by socially-oriented prosumers may play an important role in realizing the transformative potential of energy citizenship in the coming years.

7 Limitations and future research

Our study did not come without limitations. First, although our sample indicated to feel somewhat competent on the topic of EC, a follow-up study should account for what participants already know about ECs specifically. After all, despite high subjective competence ratings, it is possible that participants overestimate their knowledge in this domain with potentially detrimental consequences for green behavior [67].

Second, we did not include financial factors among the dimensions for the conjoint study. We did so because financial factors are a common focal point in such setups and likely distract participants from other aspects that bear importance as well. In our case, we deliberately focused on social, legal and technical aspects. However, a recent study on the broader topic of renewable energy projects [68] showed that minimal initial investments, lower capital commitment periods and higher annual return in investments may increase the participation rate.

Third, our results show, that all EC aspects were rated as moderately attractive to the people on average: Ratings for the motivation to join clustered closely along the scale

midpoint, but came with variation in both directions. While not uncommon for more complex conjoint studies, only considerable higher average ratings of aspects, would usually reflect noticeable higher preferences or motivations (as can be seen in financial factors too, see [51]). On the contrary, average ratings close to the scale midpoint may indicate that many people likely did not yet concern themselves with a decision to partake in an EC actively. Hence, the effects we found may be stable, consistent, but likewise small.

Future research should seek to replicate the present findings across different European countries and institutional contexts. In this regard, it will be interesting to see, if ECs, which have the legal form of an association and which provide energy for all (instead of a subset of) relevant purposes, are equally much preferred in other countries. While our results suggest that public service attitudes are the strongest predictor of individuals' motivation to join ECs, the relevance of such (and related) motivations may vary depending on national regulatory frameworks, energy markets, and socioeconomic conditions. In some countries, economic considerations such as energy prices, income levels, and access to financial support schemes may constitute more significant barriers or incentives for participation than in others.

Comparative cross-national studies would therefore help identify the extent to which such psychological drivers of energy community participation are universal or context-dependent. Such research could also provide valuable insights into how different legal, economic, and social environments facilitate or hinder inclusive forms of energy citizenship. By identifying the factors that encourage broader participation, particularly among groups that are currently underrepresented, future studies could inform policymakers in designing regulatory frameworks and support mechanisms that make energy communities more accessible and attractive to a wider range of citizens. Ultimately, fostering greater participation in energy communities has the potential to accelerate the diffusion of renewable energy technologies, strengthen democratic engagement in energy systems, and contribute to broader climate change mitigation efforts.

8 Conclusions

This conjoint study was conducted to explore factors that motivate joining an EC. It revealed that ECs that allow comprehensive energy use and that have the legal setup of an association are most attractive. These effects were accompanied by person-specific factors: Public service attitudes, future orientation, and biospheric values contributed to participants' higher consideration to partake in an EC. Most effects were comparably small in nature, but potentially exemplified that engagement in energy projects that empower individuals in the role as prosumers is a viable route for future energy generation.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1007/s43621-026-04182-w.

Supplementary Material 1.

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Author contributions
HB prepared and revised the materials, conducted the pre study and main study, conducted the analysis for both studies, and wrote the manuscript; JH, RB and KC gave feedback on the study design and suggested corrections in the manuscript; EM provided input for the theoretical background; CRA provided technical support to set up the conjoint study.

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Data availability
All materials, anonymized data, and codes are available from the Open Science Framework: https://osf.io/853pe/. All studies were preregistered before data analysis: Main study: https://osf.io/s3f42/; Pilot study: https://osf.io/9yd5m/.

Declarations

Ethics approval and consent to participate
Studies reported in this article were approved by the local Ethics Committee at the University of Graz (identifier: GZ. 39/44/63 ex 2020/21) in accordance with the § 2 (4) Statute of the Ethics Commission. Informed consent to participate (in line with the General Data Protection Regulation of the European Union) was obtained from all participants.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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