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Review

Psychological and social factors driving citizen involvement in renewable energy communities: A systematic review

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ABSTRACT

Renewable energy communities (RECs) are pivotal in achieving European Union decarbonization goals and supporting developing countries in their energy transitions. They involve citizens, social entrepreneurs, and public authorities in clean energy production and consumption, emphasizing decentralization and participation. This review aims to synthesize current research on the psycho-social factors driving citizens' involvement in RECs, highlighting their multifaceted nature and diverse operational contexts. A systematic review was conducted following PRISMA guidelines. Scopus, Web of Science, Pubmed, EBSO Host and PROQuest were searched in February 2024 to identify relevant studies. Studies focusing on psycho-social factors influencing citizen participation in RECs were included, while others were excluded. Results were synthesized using qualitative methods, categorizing findings into key themes and patterns.

A total of 49 studies were included, encompassing over 3000 participants from various regions. Studies varied in methodological approaches, including case studies, surveys, and interviews. The review confirms RECs as complex, multilevel phenomena, requiring both macro-social and psycho-social considerations for successful implementation. Citizen participation and social factors like sense of community, trust, and social capital are identified as critical drivers, showing bidirectional relationships with REC success. The study highlights the importance of environmental attitudes and economic incentives in motivating participation. The evidence is limited by potential biases in study design and terminology differences may have excluded some investigations.

1. Introduction

1.1. Rationale

Renewable energy communities (hereinafter, "RECs") are collective entities where citizens, social entrepreneurs, and public authorities participate in clean energy production and consumption, emphasizing decentralization and citizen involvement [1,2]. From a policy perspective, renewable energy communities are considered a key pillar in achieving the decarbonization goals set by the European Union [3] and in enabling developing Countries in pursuing a just energy transition [4]. These initiatives represent concrete examples of energy democracy in action, as they aim to redistribute power and benefits within the energy sector while promoting social equity and community ownership [5].

Various psychological and social factors affect RECs. Environmental attitudes - the complex set of beliefs, values, and concerns regarding environmental protection - often drive initial participation [6]. The success of RECs is frequently built upon social capital, those resources and benefits that emerge from social networks and relationships within communities [7,8]. Projects are strengthened by community identity, defined as the shared sense of attachment, belonging and meaning that emerges from members' collective connection to and identification with a geographical place and its social fabric [9]. The development of RECs has also given rise to prosumerism, where community members take on the dual role of producing and consuming energy, fundamentally changing their relationship with energy systems [10].

In general, RECs are described as multifaceted and complex projects that can take diverse forms depending on the differing community contexts they are implemented [11,12]. This complexity arises not only

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from the coexistence of a strong local dimension [13] within a global energy transition process, but also from the fact that the model of renewable energy communities involves technological, economic, and social transformations. This leads to a fundamental change in how citizens engage with energy, shifting from individual passive consumers to active collective producers.

Within the last decade, RECs have been recognized as a well-established research topic with multiple disciplinary approaches. While some scholars emphasize the need to distinguish between renewable sources, distributed generation, and community-based energy production as conceptually independent aspects of energy communities [14], research on RECs spans across various disciplines, such as policy studies on energy regulatory framework and European momentum [15–17], climate and energy studies on RECs' environmental impact and technical aspects [18,19], economic studies on energy market and cost-benefits analyses [20,21], as well as social sciences and psychology studies [22–25], which will be explored in more detail next. Overall, from a psychological perspective, the investigation of RECs has mainly centered on individual motivations [26,27], individual drivers and barriers [28] and the role of emotions [29]. In specifics, considering the psychosocial literature, at least three main strands of research on RECs can be identified. First, numerous studies have focused on the social relations under which RECs are initiated and practiced, examining the diversity of actors involved [27] and the patterns of cohesion or fragmentation among local stakeholders [30]. Second, several researchers have investigated social acceptance versus opposition towards RECs and renewables [26,31]. Third, scholars have also examined the institutional and regulatory frameworks that enable the deployment of RECs [32]. Additionally, a smaller body of research has addressed the social and cultural resources and barriers related to RECs [26,33]. Regarding research methods and locations, a variety of approaches have been adopted, including multidisciplinary studies, case studies, and quantitative studies, conducted in diverse local contexts, such as urban and rural areas. In the view of this theoretical and methodological variety and considering the multiplicity of data and knowledge produced on this important subject, the present systematic review aims to contribute to systematize the psycho-social literature on RECs by identifying and discussing the psychological and social factors that may either foster or hinder RECs projects.

While several reviews have examined specific aspects of RECs, such as their technical implementation [34,35] or policy frameworks [17,36], to the best of our knowledge this is the first systematic review specifically focused on synthesizing the psycho-social factors that influence RECs' development and success. Previous reviews have touched on social aspects as part of broader analyses [36,37], but none has comprehensively mapped the psychological and social drivers and barriers across individual, community and macro-social levels.

1.2. Objectives

The overall aim of this review is to take stock of the knowledge about psycho-social factors that either favor or hinder renewable energy communities. For the sake of this purpose, psycho-social factors are meant as forces (e.g., social capital, social and institutional trust, participation, sense of community, disengagement) that may positively or negatively impact the start-up, the involvement and the engagement of citizens in RECs. It is the interest of this review to adopt a multilevel approach considering the individual, community and macrosocial level. Specifically, drawing on Bronfenbrenner's Ecological Systems Theory [38,39], our analysis addresses multiple systemic levels: individual factors correspond to the microsystem and intra-individual characteristics (such as personal attitudes, beliefs, and characteristics); community factors align with Bronfenbrenner's meso- and exosystem (encompassing local social dynamics and collective resources); and macro-social factors match his macrosystem level (covering broader societal conditions, policies, and cultural aspects that transcend specific communities).

The review was guided by the following research questions:

1) Which is the level of analysis of the studies on RECs? Do they focus on individual or community level? Or do they investigate the deployment of RECs from a macro-level perspective without reference to specific local contexts?
2) What are the psycho-social factors identified as facilitating or hindering individuals and communities to start up/participate in a renewable energy community projects?

We opted for the systematic review method, as described in PRISMA Statement [40] and Prisma Explanation and Elaboration [41], in its extension for Scoping Review (PRISMA-ScR) [42], which provides specific guidance for conducting and reporting scoping reviews while maintaining the systematic and transparent approach of the original PRISMA framework. This extension was chosen as it is particularly suitable for mapping evidence in emerging fields where the literature is heterogeneous in methods and focus.

2. Methods

2.1. Eligibility criteria

The criteria for inclusion of studies in our review were established and refined through discussions among the authors and a calibration exercise was performed. This calibration exercise involved all authors independently applying the inclusion criteria to a sample of 20 papers, followed by a discussion to resolve discrepancies and refine criteria interpretation. While no language restrictions were placed, our search terms were in English, which may have limited access to non-English literature despite our inclusive approach. To be included in the review, papers needed to be: 1) published in accessible and peer reviewed journals; 2) full-text available; 3) explicitly focused on psycho-social factors of renewable energy communities, not just mentioning them in passing.

The literature search was not limited by time. While the earliest included study dates from 2008, we observed a significant increase in publications from 2020 onwards, reflecting the growing academic interest in the psychosocial aspects of RECs. The search was not restricted by language. Moreover, the search was not restricted to specific disciplines, as psycho-social factors are studied across various fields. The focus on psycho-social aspects emerged during the screening process through our inclusion criteria.

Papers were excluded if they focused on: 1) renewable energies and/or community energy, but not on RECs; 2) topics related to renewable energy sources, but not on RECs. Also, studies based on secondary data, such as reviews and meta-analyses, were excluded.

2.2. Information sources

We searched diverse resources to maximize the inclusion of all relevant studies. The list of sources that were searched, with a brief description, is presented in Table 1.

2.3. Search strategy

The search was conducted using different keywords, listed below, without any filters on Scopus, Web of Science and Pubmed, while on Proquest the search was limited to peer review studies as defined with the search code: “renewable energy communities” AND PEER(yes):

1. “renewable energy community” and “renewable energy communities”
2. “citizen energy community” and “citizen energy communities”
3. “community renewable energy”

Table 1
Databases and citation indexes searched for systematic review on psycho-social factors related to renewable energy communities.

Name	Interface/Platform	Coverage range	Search executed
Scopus	https://www.scopus.com/home.uri	1788 to present	02/19/2024
Web of Science Core Collection	Databases accessed through WoS: Emerging Sources Citation Index Science Citation Index Expanded Social Sciences Citation Index Arts & Humanities Citation Index Conference Proceeding Citations Index Book Citation Index	1900 to present	02/19/2024
Pubmed	Databases accessed through Pubmed: MEDLINE PubMed Central (PMC) Bookshelf	1966 to present selectively back to the year 1865, and very selectively back to 1809	02/19/2024
Proquest	Databases accessed through Proquest: ABI/INFORM Collection Acta Sanctorum Coronavirus Research Database Early Modern Books FIAF International Index to Film Periodicals Database Linguistics Collection Patrologia Latina Publicly Available Content Database	1700 to present	02/19/2024
EBSCO	Databases accessed through EBSCO: APA PsycArticles Psychology & Behavioral Sciences Collection	1894 to present	02/19/2024

The label 'Renewable Energy Community,' introduced and spread by the European Directives REDII and IEM, is currently used when referring to experiences of energy cooperation in which citizens, groups, enterprises and local authorities produce, consume, and share energy generated from renewable sources. In this review, we extended the search by using two additional expressions related to this type of cooperation, that is "citizen energy community" and "community renewable energy". By such a way we intended to capture contributions referring to previous experiences of energy cooperation or not falling within the regulatory definition but on which informative studies may have been conducted for the purpose of this review.

2.4. Selection process

The selection process was conducted independently by the authors. Duplicates were manually excluded with the support of automatic duplicate highlighting tool on MS Excel. After duplication removal, records were screened in a two-step process:

1) Abstract screening: based on the abstract, records focused on non-psycho-social factors of RECs (e.g., technical innovation, legal and policy analysis, financial aspects etc.), and records explicitly referring only to renewable energy sources instead of RECs or other local cooperation projects, were excluded. Records mentioning psycho-social drivers both for RECs and other local energy cooperation networks, records focused on collective action dynamics involved in energy transition, as well as multidisciplinary studies mentioning, among others, RECs' social and psychological dimension were selected for the full-text retrieval.
2) Full-text assessing for eligibility: based on the full-text, reports mainly focused on non-psychosocial aspects of RECs (e.g., legal, economical, technical) were excluded, as well as reports that addressed other issues and mentioned RECs or related psycho-social factors only in passing.

2.5. Data collection process

A data-charting form was jointly developed by the authors to determine which variables to extract. The authors independently charted the data, discussed the results and continuously updated the data-charting form in an iterative process.

We abstracted data on article characteristics, namely a) general objective and research questions; b-c) place and time of the study; d) design of the study (i.e., qualitative, quantitative or mixed method); c) number and type of participants involved; e) whether RECs members were selected as participants or RECs features were included as case study variables or not (i.e., the study investigated RECs but participants were not necessarily RECs members); f) psycho-social drivers, barriers and outcomes.

In line with recent methodological reflections in energy social science research [43,44], our systematic review methodology aimed to address several key methodological challenges. Given the multidimensional nature of RECs, we developed a coding framework that could capture evidence across individual, community and systemic levels while maintaining methodological rigor. The calibration exercise and explicit inclusion criteria were designed to ensure reproducibility and transparency, particularly important when synthesizing findings from diverse research designs and disciplines.

3. Results

3.1. Selection of sources of evidence

The selection and review process are displayed in the flow diagram (Fig. 1); details for each search keywords are listed in Table 2. The selection process was conducted independently by three authors. Each author independently screened the titles and abstracts according to the inclusion criteria. Discrepancies were resolved through discussion until consensus was reached. The same process was followed for full-text screening.

The search of the databases led to the identification of 2163 records, divided among different key search as follows: "renewable energy community/ies" $n = 1177$; "citizen energy community/ies": $n = 183$ and "community renewable energy": $n = 803$.

After duplication removal, records were screened in a two-step process: in the first step, records were screened on the basis on their abstracts, while during the second step the screening has been operated on the basis of the retrieved full-text report.

1. Abstract screening: from the initial set of record ($n = 1464$), 1246 records were excluded because they did not meet the selection criteria (see "Selection process" for further information). Records whose abstract mentioned psycho-social drivers both for RECs and other local energy cooperation networks, that is records focused on collective action dynamics involved in energy transition, as well as multidisciplinary studies mentioning, among others, RECs social and psychological dimensions were sought for full-text retrieval ($n = 216$).
2. Full-text assessing for eligibility: of the 216 records selected in the first step, 11 records' full-text were not retrieved and then excluded. The remaining 205 reports were then subjected to the full-text screening and 157 of them were excluded because they did not meet the eligibility criteria: 75 were focused on non-psychosocial aspects of CER (e.g., legal, economical, technical) and 82 were

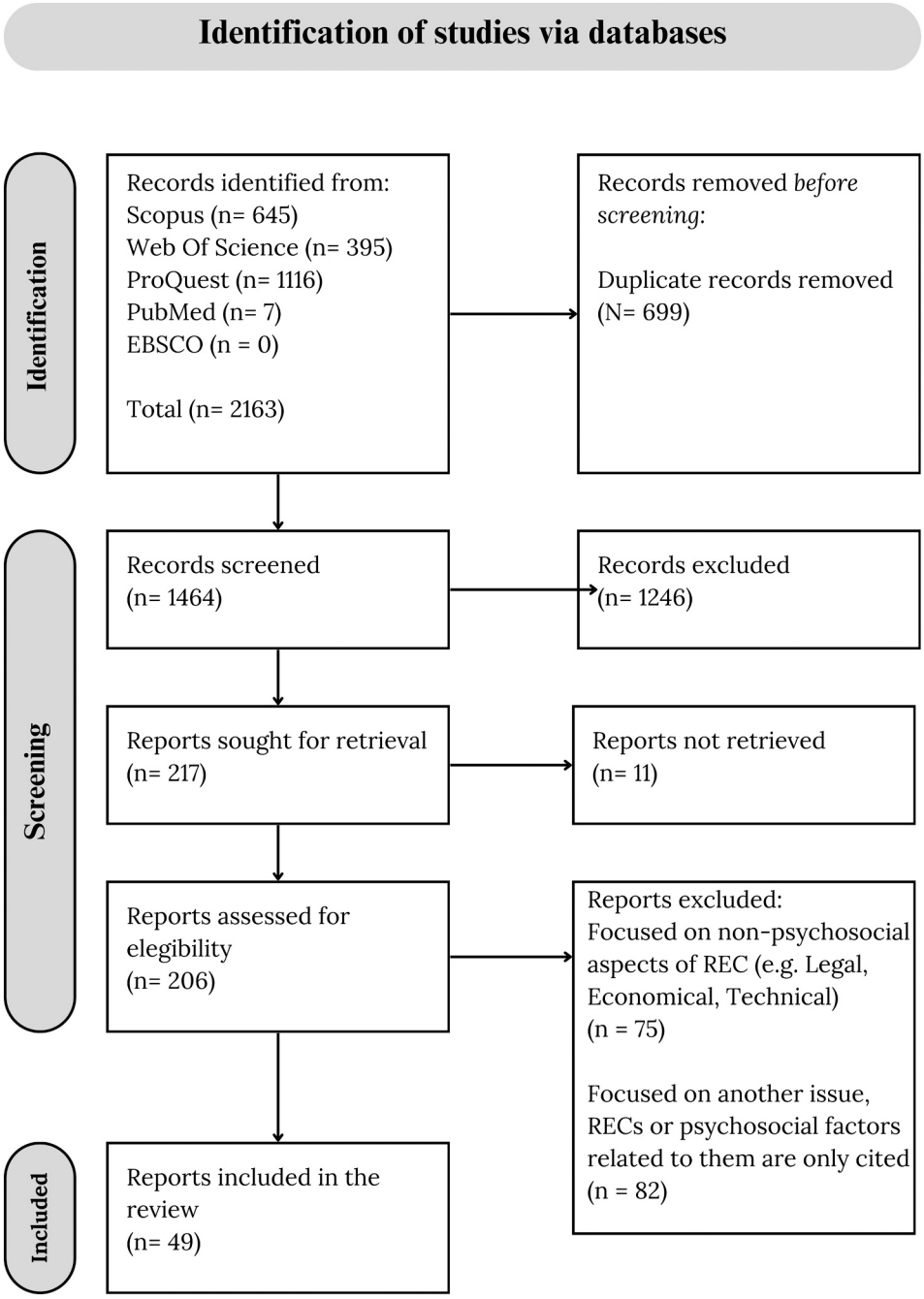

Fig. 1. *Flow diagram of the review process (based on the PRISMA model included in Page* et al.*, 2021).*

Table 2
Review process detailed for each keyword.

Keyword	Identification		Screening					Review
	Identified	Duplicates	Excluded	Selected for full-text retrieval	Not retrieved	Assessed for eligibility	Excluded	Included
"Renewable energy community" (-ies)	1177	302	742	133	9	124	95	30
"Citizen energy community" (-ies)	183	124	53	5	1	5	5	0
"Community renewable energy" (-ies)	803	273	451	78	1	76	57	19

Table 3
List of the sources of evidence included in the review.

ID	Citation	Place of the study	Participants (N)	RECs member participants (yes/no)	Study design
1	[45]	Germany, The Netherlands, the United Kingdom, Belgium, Switzerland, Poland, France, Albania, Slovenia, Hungary, Italy, Bulgaria, Portugal, Spain, Greece	212	No	Quantitative
2	[46]	Portugal, Spain, Belgium	55	Yes	Conceptual
3	[47]	Germany	12	Yes	Qualitative
4	[48]	Germany, Spain, Croatia, France, Italy, Portugal, Romania, United Kingdom	34	Yes	Qualitative
5	[27]	Portugal, Spain	55	Yes	Quantitative
6	[49]	United States	195	No	Quantitative
7	[50]	Spain, Portugal	66	No	Quantitative
8	[51]	Germany	6	Yes	Qualitative
9	[52]	the Netherlands, Germany	41	Yes	Qualitative
10	[53]	Germany	15	Yes	Qualitative
11	[54]	Flanders (France, Belgium, Germany)	727	No	Quantitative
12	[55]	Bulgaria	5	Yes	Qualitative
13	[56]	the Netherlands, Germany	41	Yes	Qualitative
14	[57]	Italy	19	Yes	Qualitative
15	[58]	China	1058	No	Quantitative
16	[59]	the Netherlands	31	Yes	Mixed-method
17	[60]	Sweden	13	Yes	Qualitative
18	[61]	Germany	12	Yes	Qualitative
19	[62]	Serbia	N/A	No	Quantitative
20	[63]	France	30	Yes	Qualitative
21	[64]	Belgium, Croatia, France, Germany, Italy, the Netherlands, Portugal, Spain, United Kingdom	198	Yes	Quantitative
22	[65]	N/A	N/A	No	Conceptual
23	[66]	Poland	40	Yes	Mixed-method
24	[67]	Poland, Slovenia, Estonia, Belgium, Austria, France, Greece, Spain, Denmark, Netherlands, Italy, Sweden	N/A	Yes	Qualitative
25	[68]	Belgium, The Netherlands, Italy, Poland, Estonia, Spain	206	Yes	Quantitative
26	[69]	Belgium, Estonia, Italy, the Netherlands, Poland, Spain	6	No	Qualitative
27	[28]	Italy	601	No	Quantitative
28	[70]	Germany	9	No	Mixed-method
29	[71]	Norway	12	Yes	Qualitative
30	[72]	Germany	45	Yes	Qualitative
31	[73]	Poland	32	Yes	Qualitative
32	[74]	Indonesia	8	Yes	Qualitative
33	[75]	Nigeria	24	Yes	Qualitative
34	[76]	China	300	No	Quantitative
35	[77]	Spain	66	No	Quantitative
36	[78]	Thailand	26	Yes	Qualitative
37	[79]	Vietnam	17	Yes	Qualitative
38	[80]	Australia	29	No	Qualitative
39	[81]	Romania	379	No	Quantitative
40	[82]	Germany	77	Yes	Qualitative
41	[32]	Italy	17	Yes	Qualitative
42	[83]	United Kingdom	48	Yes	Mixed-method
43	[84]	Portugal, Spain	55	Yes	Quantitative
44	[85]	United Kingdom (Scotland)	19	Yes	Qualitative
45	[86]	Germany, Denmark	N/A	Yes	Qualitative
46	[87]	United Kingdom	317	No	Mixed-method
47	[88]	Germany	15	Yes	Qualitative
48	[30]	United Kingdom	264	Yes	Mixed-method
49	[89]	Ireland	181	No	Quantitative

Note. N/A: study not including any participant.

focused on other issues (e.g., acceptance of energy projects), while RECs/local cooperation projects were cited only in passing.

3.2. Characteristics of the sources of evidence

Studies included in the review ($n = 49$) (Table 3) mostly dated from 2020 to 2022, distributed as follows: 2020 ($n = 7$), 2021 ($n = 15$) and 2022 ($n = 9$). They had predominantly a qualitative design ($n = 26$) and in most cases ($n = 23$) used small samples (from 5 to 40 participants). The greater part ($n = 33$) of studies involved RECs members. Most studies were conducted in Germany ($N = 14$), followed by Spain (n = 9) and Italy (n = 9), with almost all of the studies conducted in the European continent ($n = 40$) and a very few in Southeast Asia ($n = 5$), and in North America, Australia and Africa (n = 3).

3.3. Results

3.3.1. Outcome variables

Before examining the drivers and barriers of RECs, we first analyzed how different studies operationalized RECs' success through their outcome variables. This analysis helps understand what factors were considered important for RECs' development at different levels and provides context for understanding the relevance of different psycho-

Table 4
Summary of the outcome variable considered in the studies.

Level	Outcome variables	Studies
Individual	Willingness to participate / continuous individual participation	[27,46,48,50,54,58,60,66,83]
	Willingness to invest /motives of prosumer / share resources / acceptance being a prosumer / Interest in energy sharing and social curiosity	[45,49,52,62,76,77,90]
	Consumer behavior change strategies / Energy attitudes or behavior	[70,81]
Community	Community acceptance of community-led energy projects	[30,63,71,85,87,89]
	Achievement of a 100 % sustainable local energy system; creation of ECs in local contexts; successful sustaining of ECs at a local level	[51,53,75,80,85,88]
Macro-system	ECs contribution to transition process / development and upscaling of ECs across different contexts / lessons from successful case studies / successful mainstreaming of prosumerism / energy citizenship / gender inclusiveness	[28,32,48,55–57,59,61,64,65,67–69,72,74,78,79,86]

social drivers and barriers. The studies included in the review investigated a variety of outcome variables (Table 4).

3.3.1.1. Individual outcomes. At the individual level, the willing to participate and continue to be a member over time [46,48,50], to invest economic resources in the community [45,49,52,62,76,77,90], and to change oneself energy behavior [70,81] were investigated as individual-level outcome variables.

3.3.1.2. Community outcomes. The outcome variables considered at the community level were: successful establishment of an EC in a local context [30,63,85,87,89], community-level achievement of a 100 % sustainable local energy system, and community effectiveness in maintaining an energy community over time [51,53,75,80,84,85,88].

3.3.1.3. Macro-systemic outcomes. At this level, the issue of RECs was conceptualized in terms of deployment of RECs across different contexts and their contribution to the global transition process, through successful mainstreaming of prosumerism, energy citizenship and RECs' gender inclusiveness [48,55–57,59,61,64,65,67–69].

3.3.2. Drivers

Drivers are defined as factors that facilitate RECs development and implementation. A distinction can be drawn between pre-existing resources (e.g., environmental attitudes, social capital), discussed in this section, which create favorable conditions for RECs, and successful features, analyzed in Section 3.2.4, which emerge during implementation and contribute to RECs' effectiveness. The different levels of the outcome variables considered in the studies reflected on the identification of a variety of resources and obstacles towards RECs projects. Resources can be distinguished in two categories: a) comprises environment-related attitudes and beliefs, and individual dispositions and social characteristics, as well as community features and macro-systemic processes (Table 5); b) consists of RECs' features, expected benefits and risks (Table 6).

3.3.2.1. Individual variables. There is a widespread consensus among studies in considering environmental values, attitudes and beliefs as important drivers for joining an energy community [27,45,47,48,52,54,56,62,64], fostering environmental awareness and thus the willingness to change consumption behaviors [54,67,81]. Other psychological dispositions such as altruism and novelty seeking [49], as drivers, along with the willingness to participate in RECs [55]. At this

Table 5
Synthesis of identified RECs' drivers.

	Drivers	References	Level of outcome variable[1]		
			I	C	M
Individual	Environmental attitudes and awareness and pro-environmental values and behavior	[27,45–48,52,54,56,62,64,65,81,84,87]	X	X	X
	Awareness and openness to change energy consumption behavior	[54,67,81]	X		X
	Altruism	[49]	X		
	Novelty seeking	[49]	X		
	Gender and income (e.g., women, lower income)	[50]	X		
	Willingness to participate	[55]			X
Community	Change of energy system (being independent from producers and other countries, promoting local and reliable energy supply)	[27,46,64,65,71,72,76,84,87,90]	X	X	X
	Social cohesion (neighborhood cohesion, previous social relations, strong social network)	[56,61,65,70,72,88]	X	X	X
	Local acceptance for renewables	[27,46,47,54,55,76,81]	X		X
	Sense of community and community identity	[46,58,65,70,74,79,84,86]	X		X
	Social trust	[30,46,50,84,88]	X		
	Perceived community competence to cooperate	[45,50,62,74]	X		X
	Presence of local champions (trusted initiators, investors, network of enthusiastic people, mayor as a facilitator)	[51–53,56,61,65,72,88]	X	X	X
	Institutional trust (local and national)	[49,50,55]	X		X
	Place attachment	[28,46,52,53]		X	X
	History of cooperativism	[56,57,61,69,79]			X
	Subjective norms (for mid-term and later adopters)	[58,76]			
	Influence from other communities	[65]			X
Macro	Supporting regulatory framework	[70]	X	X	
	New energy business models	[47]			X
	Financial subsidies	[47,65]			X
	Inconsistent energy policies	[65]			X

Note.
[1] I = Individual; C = Community; M: Macro-systemic.

Table 6
Synthesis of successful RECs' features and expected benefits.

	Success factor	References	Level of outcome variable[1]		
			I	C	M
Features	Local based investment, ownership and control over technology and property	[28,65,84,86,89]		X	X
	Transparent and collective project development, communication and governance	[47,51,56,59,62,63,65–68,71,74,75,78,86,87]	X	X	X
	Access to local human resources	[47,78]		X	X
	Collaboration among a wide network of stakeholders (e.g. local institutions, investors, leaders and collective action movement)	[47,56,57,61,67,75,79,88]		X	X
	Common vision shared by the members	[61,78]			X
	Social embeddedness of ECs in community (local trust and support, community acceptance, local based key actors)	[30,46,47,61,65,67,89]	X	X	X
	Critical approach to government sustainability policies and connection with climate change movement	[59,61]			X
	Institutional support	[47,65,68,78,79,83]	X		X
	Competence support (energy companies, scientific institutions)	[57,60]	X		X
	Context-oriented technology (e.g. unobtrusive, providing local-drive solutions)	[30,59,89]		X	X
	Knowledge and skill collective learning process	[59,63]		X	X
	Investment on renewable and upscaling	[67]			X
	Promoting the use of technology in RECs	[59]			X
	Low-risk business model	[61]			X
Expected benefits	Expectations of material and immaterial benefits	[51,65,66,83]	X	X	X
	Local benefits	[27,30,47,67,71,74,84,86,89]	X	X	X
	Social benefits (enhancing sense of community, community identity, bridging social capital etc.)	[27,46,47,52,59,64,66,86,87]	X	X	X
	RECs provide services beyond energy	[61]			X
	Economic incentives and cheaper energy price	[28,45,47,48,52,62,70,78,84,87,90]	X	X	X

Note.
[1] I = Individual; C = Community; M: Macro-systemic.

level, socio-demographic variables, such as gender and income [50] were explored in relation to RECs participation.

3.3.2.2. Community variables. At the community level, specific environmental variables are identified as drivers for the creation of and participation in RECs were the local willingness to become independent of large energy suppliers in favor of more reliable local production [27,46,47,64,65,71,72,90], and the acceptance of renewable energy sources [27,46,47,54,55,76,81]. Social cohesion, in terms of pre-existing social relations and strong social networks [56,61,65,70,72,88] and the presence of "local champions" (e.g., trusted initiators, investors or a group of enthusiastic people) [51–53,56,61,65,72,88] emerged as important factors. Physical and social place attachment [28,52,53,84], and sense of community and community identity were also identified as relevant antecedents [27,46,58,65,70,74,79,86], as well as social trust [27,30,46,50,88], institutional trust [49,50,55], perceived community competence to cooperate [45,50,62,74] and subjective norms [58,76].

3.3.2.3. Macro-systemic variables. Although our review included only studies specifically focused on psycho-social drivers, a set of non psycho-social variables also emerged as significant drivers of RECs, such as a supporting regulatory frameworks [70,71], the spread of new energy business models [47], the availability of financial subsidies [47,65], the unpredictability of traditional energy prices, and inconsistent governmental energy policies [65].

3.3.3. Barriers

Barriers represent pre-existing contextual obstacles to RECs development (e.g., low community cohesion, lack of environmental awareness), discussed in this section, while adverse features, analyzed in Section 3.2.5, emerge during implementation (e.g., poor communication processes, high technical complexity). This distinction has important implications for intervention strategies, as pre-existing barriers may require different approaches than emerging adverse features.

Psycho-social factors that hinder energy communities were consistently less explored in the selected works. As for the drivers, barriers

Table 7
Synthesis of social obstacles.

	Barriers	Study	Level of outcome variable		
			I	C	M
Individual	Low income and unemployment	[81]	X		
	Ageing population	[81]	X		
	Lack of time and interest	[83]	X		
	Alternative energy sources as a rebel initiative	[90]	X		
Community	Disengagement	[48,66]	X		
	Low level of stakeholder support	[48]	X		
	Lack of experience in carrying out social innovation projects	[48]	X		
	Distrust in national and local governments	[55,66,67,90]	X		X
	Gender stereotypes and gender divide in energy sector	[60]	X		
	Corruption	[62]	X		
	Disempowerment, perceived low competence in managing energy transition	[62,79,83]	X		X
	Lack of community spirit in big cities / low level of cohesion	[65,70,88]	X	X	X
	Low level of institutional support	[28]			X
	Emotional place attachment	[85]		X	
Macro-system	Lack of public environmental awareness and concerns	[65]			X
	Innovative actions are not tailored on real cases	[67]			X
	Unclear definition of the local energy cooperation model	[47]			X
	Mismatch between the federal level and the regional/local level	[47]			X
	Absent or unconducive legal framework	[48,70]	X		X
	Political opposition to energy transition by right-wing governments	[90]	X		

Table 8
Adverse RECs feature, risks and unsatisfied benefit expectations.

	Adverse factor	Study	Level of outcome variable		
			I	C	M
RECs' features	High initial cost	[47]			X
	Technical and bureaucratic complexity	[47,67,72,81]	X		X
	Lack of co-ownership	[66]	X		
	Lack of equal access to decision-making	[67]			X
	External stakeholder as the head of the EC / social distance between key actors and citizens	[71,88]		X	
	Low level of community involvement in the meetings	[71,75]		X	
	Unloyalty to REC's own narrative	[72]			X
	Single actor project	[75]		X	
	Lack of access to the information needed	[48,65,75]	X	X	X
	High reliance on voluntary work	[30,47,60,65,88]	X	X	X
	Informal coordination	[88]		X	
Risks/low benefits	Uncertainty of clear energy price in EC and investment return	[28,47]			X
	High financial risk / Riskiness	[27,47]	X		X
	Low economic and social incentives	[88]		X	

were grouped as follow: a) environment-related, individual, community and macro-systemic adverse antecedents (Table 7), and b) negative RECs features and expected risks/insufficient benefits (Table 8).

3.3.3.1. Individual variables. Low income, unemployment, old age [81], and personal lack of time and interest [83] were identified as barriers to citizens' involvement in RECs. Van Klingeren & De Moor [90] highlighted that supporting energy from renewable sources can be interpreted as a subversive act, also in response to political parties and representatives.

3.3.3.2. Community variables. Low level of community cohesion and community spirit was identified as an obstacle [65,70,88]. Community disempowerment and low level of perceived community competence [62,79,83], as well as distrust in national and local governments [55,66,67,90], were the most recurrent barriers identified both for individual participation in RECs and their multiplication across contexts. Emotional place attachment was considered to reduce community acceptance of energy projects since it could bring people to overestimate the environmental impact of technologies [85]. Low level of institutional support was considered as preventing the diffusion of energy communities [28], while corruption [62], disengagement [48,66], low stakeholder support, lack of experience in carrying out social innovation projects [48], and gender stereotypes and gender divide in the energy sector [60] were identified as disincentives to citizens' engagement in REcs.

3.3.3.3. Macro-systemic variables. Obstacles at this level are mainly identified by studies that focused on the development of RECs as an energy model among different contexts. A lack of public environmental awareness and concern [65] and political opposition to energy transition by right-wing governments [90] were identified as a barrier to the rise of energy communities and individual participation to them. Boulanger and colleagues [67] noted that innovative actions as described and implemented in projects funded by EU are not tailored on real cases, so it is very difficult to transfer them to other territories. It was also highlighted [48,70] that the lack of legal framework or an unconducive legal framework is an obstacle both for individual participation and for the deployment of the model. Finally, mismatch between different administration level (e.g., federal, regional and local is identified as hindering factor for RECs diffusion.

3.3.4. RECs' successful features

Many studies focused on the lessons learned from successful energy communities' projects and the possibility to transfer them to other community contexts. In this regard, a huge part of the drivers identified is related to the characteristics of energy communities, in terms of planning process, organization, and inter-relatedness with local communities and institutions (Table 6).

Transparent and collective project developing, as well as perceived inclusive and just governance and communication are considered to be fundamental features to assuring success to RECs [47,51,56,59,62,63,65–68,71,74,75,78,86,87]. Another factor that frequently emerged was the embeddedness of energy projects in local communities, that is, whether local communities accepted, trusted and supported the project, either because there were key actors or because it was a bottom-up project [30,46,47,61,65,67,89].

A group of studies highlighted the importance of the local social fabric sustaining the creation and maintenance of RECs, such as the existence of a wide network of collaborative stakeholders [61,67,75,79] in which local institutions, investors, leaders, municipalities and collective action groups are able to efficiently cooperate [47,56,57,88]. Local based investments, local ownership and control over technology and property were also identified as key [28,65,84,86,89], as well as using unobtrusive technologies to provide solutions to local problems [30,59,89]. Moreover, the employment of local human resources [47,78] and collective learning processes aimed at enhancing local knowledge and skills also emerged as valued factors [59,63,68].

Institutional support from local and national government [47,65,68,78,79,83] and competence support from scientific institutions or energy companies [57,60] were considered to be an important drivers too. Finally, one more set of RECs' facilitators included: (a) economic and financial aspects, such the adoption of low-risk business models [61], the investment of profits in new renewable plants and other upscaling operations [67], and the promotion of technology use in RECs [59], and (b) social factors, namely a common shared vision [61,78] and a connection with climate change movements, or a critical approach to governmental sustainability policies [59,61].

3.3.4.1. Expected RECs' benefits. The expectation of potential benefits resulting from the creation of RECs was listed among the crucial incentives to promote the citizens' willingness to participate, achieve community sustainability targets, and deploy RECs. Studies cited expectations of unspecific material and immaterial benefits [51,65,66,83], and benefits specifically produced to local contexts [27,30,47,67,71,74,84,86,89], such as economic incentives and cheaper energy cost [28,45,47,48,52,62,70,78,84,87,90]. Others highlighted expected social benefits, such as enhanced sense of community and community identity, stronger bridging social capital, and improved ability to "bringing people together" [27,46,47,52,59,64,66,86,87]. The provision of local services not only strictly related to energy supply was also cited as an expected benefit [61].

3.3.5. Adverse RECs features

Since a significant portion of the studies included in the review involved actual RECs members, it is unsurprising that several barriers were identified related to the characteristics of these RECs, as well as the risks or insufficient benefits they entail (Table 8).

Inherent characteristics of RECs identified as a barrier were: high technical and bureaucratic complexity [47,67,72,81], high reliance on voluntary work [30,47,60,65], informal coordination processes [88] and high initial investment cost [47]. Are other problematic characteristics were project-specific and traceable back to specific management

choices. Although declined in different ways, all pointed to the inadequate involvement of RECs members and poor communication processes: lack of co-ownership of the energy plants [66]; project run by a single actor [75]; external stakeholder as the head of the REC and/or social distance between key actors and citizens [71,88]; lack of equal access to decision-making [67]; low level of community involvement in the meetings [71,75] and lack of access to the information [48,65,75]; inconsistency between the narrative of the energy community and the choices and actions implemented [72].

3.3.5.1. Potential risks and insufficient benefits. The riskiness of investment required for RECs was mentioned as discouraging citizens' participation and the macro-systemic deployment of RECs [27,47]; in addition, other studies highlighted that the deployment of RECs is hindered by the inability to define the cost of energy within an energy community, as well as by the time with which the investment is returned [28,47]. Finally, Von Bock & Polach et al. [88] pointed out that potential benefits of RECs may not be sufficiently attractive to communities.

To provide a comprehensive overview of the factors influencing RECs' development and success, we synthesized our findings into a multi-level framework (Table 9). This synthesis categorizes the key elements identified in our analysis into drivers, barriers, and critical success factors across individual, community, and macro-systemic levels. While drivers represent the enabling forces that foster REC participation and development, barriers encompass the challenges and obstacles that hinder their implementation. Critical success factors highlight the essential elements that contribute to RECs' long-term viability and effectiveness. This framework underscores the complex interplay between different analytical levels and factor types, demonstrating how RECs' success depends on the alignment of multiple elements, from individual motivations to systemic conditions. The synthesis reveals how psycho-social dynamics at different levels can either facilitate or impede REC development, emphasizing the importance of adopting a holistic approach in understanding and promoting these initiatives. [TABLE 9 HERE]

4. Discussion and conclusions

Recently, RECs have increasingly attracted the interest of scholars from diverse disciplinaries, including social psychology. Several studies in the field have addressed the psychosocial factors that may either foster or impede the design, start-up and implementation of RECs. Our review adds to this strand of research by proposing a rigorous systematization of the psychosocial literature addressing this topic with a particular focus on the level of analysis and the factors that may either promote or hinder the development of RECs.

Table 9
Synthesis of multi-level factors influencing RECs.

Level	Drivers	Barriers	Critical factor success
Individual	Pro-environmental mindset Change readiness Social motivations Participatory attitude	Socio-economic constraints Resistance to change Resource limitations Disengagement	Personal commitment Direct benefits perception Technology ownership Investment capacity
Community	Social capital Leadership presence Trust networks Place attachment Local embeddedness	Social fragmentation Institutional mistrust Management inexperience Gender inequalities Governance issues	Collective governance Stakeholder integration Knowledge sharing Social inclusion Community empowerment
Macro-systemic	Policy support Business innovation Energy independence Financial incentives	Regulatory uncertainty Implementation gaps Political resistance System complexity	Institutional alignment Context adaptation Risk management Economic sustainability Technical competence

RECs are an emerging topic of study and research, characterized by a complex and multifaceted nature [11,12]. The results of our review confirmed this evidence, further highlighting that RECs are a multilevel phenomenon. In specifics, although our primary focus regarded the psycho-social dimensions which are relevant for RECs project, the review results underscore that macro-social factors are pivotal for the start-up and implementation of RECs projects. RECs are models defined and regulated by national or supranational normative frameworks [91] but their organization and implementation are settled at local level [13]. Indeed, along with the perspective of Community Psychology, the ecological-systemic approach [38,39] appears to be the preferable option for studying RECs, as it not only acknowledges the existence of different system-level components but also their mutual influences [92,93]. As shown in previous research examining community responses to continuous challenges, community functioning emerges as a dynamic property forged through diverse relationships between a set of capacities that together contribute to enabling or constraining adaptive responses in different ways, depending on the context [94].

Furthermore, citizens' participation emerged as a significant driver of the implementation of energy communities' projects [55,61,67]. Our review indicates that the success of a REC relies heavily on the active and inclusive involvement of its members with research highlighting how women's leadership in renewable energy initiatives can contribute to advancing both energy democracy and social justice goals [5]. Where citizen engagement and participation are limited, RECs face significant challenges [48,66]. In this regard, sense of community [46,65,74,79,86], bonds of trust [25,95], and social capital [88], act as key social leverages for the construction of a solid social and relational texture that is essential for the developing successful energy cooperation initiatives. At the same time, the review suggested that these factors cannot be fully considered as either drivers [56,61] or outcomes of RECs projects [47,86,87]; rather, they are components of a bidirectional relationship where social drivers are akin to promote and sustain community energy cooperation experiences and, at the same time, successful REC initiatives are likely to strengthen social ties and sense of belonging of members of a territorial community [52,59]. For instance, in several cases [28,52,63], pre-existing social networks initially facilitated REC formation, while the successful implementation of REC projects subsequently strengthened these networks and created new social bonds. Similarly, community trust in local institutions often enabled REC initiatives, which in turn enhanced institutional credibility through successful energy management [37,58]. The importance of trust and fairness perception as key drivers of acceptance has been confirmed also in other energy transition contexts, where local stakeholders and procedural justice significantly influence public support for renewable energy infrastructure [96].

Individual and collective attitudes towards the environment and sustainability emerged as significant factors driving citizens' motivation to join a REC [45,46,72]. Research from developing contexts suggests that environmental awareness, access to services, and social inclusion are key determinants of citizen engagement in energy communities, with socio-economic status playing a mediating role [97]. This underscores the importance of considering both environmental and social equity factors in REC development. On the one hand, this evidence suggests that people who have environmental concerns and are more sustainability-oriented are also more likely to actively participate in a REC project. On the other hand, the same result highlights a potential critical issue with Renewable Energy Community (REC) projects. Specifically, individuals who do not hold pro-environmental attitudes or show interest in sustainability are likely to be influenced by other types

of incentives, such as economic ones. In this regard, it is crucial to devise comprehensive strategies that not only emphasize environmental benefits but also include economic incentives to engage a broader audience in REC initiatives.

The review revealed that drivers were explored more extensively than barriers. It was not uncommon to notice that several factors were taken as either barriers or resources, depending on their level (i.e., low vs. high) (e.g., social cohesion/low social cohesion; wide network of stakeholders/single actor project; local and collective ownership/lack of co-ownership). Only very few studies [50,81], acknowledge that the same factor (e.g., low income) can act simultaneously as both a driver and a barrier in accordance with the surrounding circumstances. Additionally, a closer examination of the identified drivers reveals that there are some that might have potential unexpected side-effects. This is evident in the case of place attachment. Despite evidence indicating that it generally promotes community engagement in RECs initiatives [28,52,53,84], its affective component may lead citizens to overestimate the potential negative environmental impacts of RECs projects, ultimately resulting in opposition to their implementation. Furthermore, several studies [85] emphasize the importance of adopting innovative models to design and implement RECs; however, some researchers [67] make claim that the innovative models developed for RECs are often not tailored to real cases with the consequence that innovation might also pose a barrier to RECs implementation.

This review provides a systematic overview of current knowledge regarding the psycho-social factors that promote or inhibit renewable energy communities (RECs) at various levels. It is important to note that both the subject of this review and the actual experiences of RECs are still rapidly evolving. Apart from countries that have been pioneers in this area (e.g. Germany, Denmark and The Netherlands) and have enacted decrees to regulate this cooperative model and facilitate its implementation, RECs can generally be considered a relatively new phenomenon. This likely explains why much of the available literature focuses on factors that primarily enable or hinder the initial stages of RECs (such as establishment and participation), with less attention paid to factors sustaining long-term individual and group participation, and the effects of either filled or unfilled citizens' expectations. While our review reflects this European-centric development of RECs, recent studies have increasingly explored these initiatives across diverse geographical and cultural contexts worldwide. Research has documented REC implementations in rural India [98], South Korea [99], Sub-Saharan Africa [100], Brazil [101] and Indigenous communities in Canada [102], as well as developing regions like Mayotte [97]. These emerging studies suggest that the psycho-social dynamics of RECs may manifest differently across cultural contexts, as community energy initiatives adapt to and reflect diverse local needs and cultural frameworks. Furthermore, the conceptual distinction between renewable sources, distributed generation, and community-based energy production [14] suggests that future research should carefully consider how these different aspects interact and contribute to REC success across different contexts, from Indigenous communities [102] to developing regions [97].

We are aware that the present review is susceptible to several biases. Firstly, the review utilized only English search terms, thereby excluding studies that lacked English titles and abstracts. Secondly, it is possible that this review may have excluded studies pertaining to energy cooperation experiences analogous to renewable energy communities but described using terminology that differs from the key terms employed in our search criteria. Moreover, our methodological approach faces limitations acknowledged in recent energy social science literature [43,44]. The focus on peer-reviewed literature may have excluded valuable practitioner insights, while the rapid evolution of RECs means more recent developments may not be fully captured. Although our systematic approach attempted to analyze findings across multiple levels, the complex interactions between individual, community and systemic factors may not be fully represented through a review methodology. The limitations identified in this review have several important implications for interpreting and applying our findings. The focus on English-language publications may have led to an underrepresentation of experiences and insights from non-English speaking regions, particularly from the Global South where community energy initiatives often take different forms than in Europe. This linguistic bias could affect our understanding of how cultural and socio-economic contexts influence REC development. Additionally, the predominance of European cases in our sample reflects the region's early adoption of REC policies but may limit our understanding of how these initiatives function in different regulatory and cultural environments. These limitations suggest that the drivers and barriers identified may be most applicable to European contexts and similar socio-economic settings. Future research should actively seek to include perspectives from diverse linguistic and cultural contexts to develop a more comprehensive understanding of RECs' psycho-social dynamics across different global settings. Despite these limitations, our review highlights some interesting implications for future research and intervention. Overall, it indicates that it is essential that the process of creating and implementing a REC duly considers the relevance of citizens participation and includes strategies to promote ownership and active engagement of citizens [48,60]. A focus on the economic and social sustainability of the RECs projects can be an important guide for encouraging active participation of citizens in community energy transition processes. In addition, it is worth mentioning that adopting a person-centered approach [103] to studying citizens' motivation to participate in RECs initiatives would entail examining how different motivations combine with each other beyond a mere pros-versus-cons logic. Following recent methodological recommendations in energy social science research [43], our systematic review design, while appropriate for mapping the current state of knowledge, presents certain limitations for both understanding and generalizing findings. The cross-sectional nature of most included studies limits our ability to track how psycho-social factors evolve over time and interact with changing contextual conditions. Additionally, the heterogeneity in how different studies operationalize and measure key concepts like ‘community participation’ or ‘social capital’ presents challenges for synthesizing findings across studies. While our findings suggest several consistent patterns in how psycho-social factors influence REC development, caution should be exercised in generalizing these patterns beyond the contexts studied, particularly given the predominance of European cases in our sample. The generalizability of our findings may be strongest for regions with similar institutional frameworks and socio-cultural characteristics to those represented in our review. Future research would benefit from greater methodological diversity, particularly through longitudinal designs that can better capture the dynamic nature of community energy initiatives. Enhanced focus on research design transparency, standardized measures of key psycho-social constructs, and careful attention to contextual factors would strengthen the field's empirical foundations and improve the generalizability of findings across different settings. Furthermore, future review work could systematically focus on a single category of drivers or barriers at a specific level of analysis (e.g., individual, community, society). Moreover, future works could include studies on energy cooperation experiences that, while not labeled as ‘energy communities,’ could offer valuable insights into the psychosocial factors that facilitate or hinder the development of RECs.

CRediT authorship contribution statement

Evelyn De Simone: Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Alessia Rochira:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Fortuna Procentese:** Writing – review & editing, Funding acquisition. **Carmela Sportelli:** Writing – review & editing. **Terri Mannarini:** Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization.

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Declaration of competing interest

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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