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Review

The Role of Community Energy Schemes in Reducing Energy Poverty and Promoting Social Inclusion: A Systematic Literature Review

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Abstract: Sustainable energy projects can help societies reduce climate change's negative impacts. In the present paper, published studies regarding European community energy schemes (CESs) were analysed to investigate CESs' barriers and drivers towards including community members and, more specifically, vulnerable groups. This review followed the PRISMA guidelines to ensure transparency. Exclusion and inclusion criteria were defined to select the proper articles and books that were aligned with the scope of this review. A total of 143 publications from 2019 to February 2024 were considered and selected. Content analysis was used to outline the various definitions of energy poverty, vulnerable groups, and CESs as well as the different strategies and approaches followed by European countries to tackle energy poverty and increase public engagement in CESs. This research suggests that environmental citizenship is a concept that can bring individuals and society together to promote changes in energy-related behaviours. The outcome reveals factors that enhance community energy acceptance and social cohesion such as providing energy education or education for sustainability to community members, financial support, increased prosocial culture, and the participation of vulnerable groups in CESs. This can be achieved through various interventions to help community members, including vulnerable groups, understand sustainable energy behaviour and thus reduce energy poverty.

Keywords: community energy schemes; energy poverty; energy vulnerability; vulnerable groups; education for sustainability; environmental citizenship

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Citation: Boostani, P.; Pellegrini-Masini, G.; Klein, J. The Role of Community Energy Schemes in Reducing Energy Poverty and Promoting Social Inclusion: A Systematic Literature Review. *Energies* **2024**, *17*, 3232. https://doi.org/10.3390/en17133232

Academic Editor: Theocharis Tsoutsos

Received: 8 May 2024
Revised: 24 June 2024
Accepted: 28 June 2024
Published: 1 July 2024

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1. Introduction

One of the biggest challenges the planet is facing is climate change [1–3]. Due to the impact of climate change, several cities have implemented measures to reduce their carbon emissions [4–6], and renewable energy implementation is seen as one of the solutions to decarbonise energy systems and alleviate climate change [7–9]. In this context, in recent years, the EU has taken major steps to address energy poverty and promote energy citizenship as a transition to a low-carbon energy system [10–12]. Regarding these policies, the concept of energy transition involves shifting from fossil fuel sources to sustainable energy systems and renewable energy sources [13]. There is a growing interest worldwide towards community-driven renewable projects and decentralised energy generation. Decentralisation can help communities become self-sufficient in energy and improve their economic viability [14], and these initiatives can potentially reduce our reliance on fossil fuels and centralised energy systems [15].

By 2050, almost 50% of EU citizens contribute to producing renewable energy, and a significant portion, around 37%, might be from participation in citizen-led renewable energy communities [16]. Therefore, one way for individuals to contribute to the energy transition is by becoming part of community energy schemes [17]. By participating in community energy projects, they can learn how to engage in energy-saving behaviours

to increase the affordability of their energy bills while still achieving adequate heating, cooling, and lighting for their homes [10].

Policies and investments in smaller-scale energy systems can facilitate the move to cleaner energy sources, and the involvement of citizens, municipalities, and other public or private actors can drive this transition [15,18]. Community energy projects can potentially promote energy justice and democracy and alleviate energy poverty within communities [19,20]. Energy justice includes equal access to basic energy needs [21] and was initially defined as a theoretical stance addressing the distributional injustice of energy issues [22]. Later, it was developed into a concept that focuses on equitable participation in energy policy-making (procedural justice) and the recognition of the rights of vulnerable and disadvantaged groups to benefit from policies for inclusion in energy systems (recognition justice) [23].

This paper attempts to understand the main barriers and drivers to the participation of vulnerable groups in community energy projects. The focus is on vulnerable groups because the anticipated energy transition might widen the economic inequality gap if not addressed through adequate policies [14]. Further, only limited research has been carried out on the inclusion of vulnerable individuals in community energy initiatives, while it has been highlighted that community energy schemes that require an investment in access can hamper the participation of low-income households [23]. While these shortcomings are evident, both policies at the EU level and the scholarly literature [14,24–27] argue for the need for inclusive policies in the environmental and energy transitions. According to Pellegrini-Masini and colleagues [14], vulnerable individuals lack access to sustainable energy technologies because of their financial obstacles and low levels of energy education.

The main goal of the current study was to determine to what extent community energy schemes focus on vulnerable individuals in Europe and how they tackle energy vulnerability and energy poverty. This paper followed a comparative method to outline different perspectives on energy poverty and vulnerability and different definitions of community energy projects. This study is a systematic review of published research, following the PRISMA guidelines, to understand what barriers and drivers stand against the increased inclusion of vulnerable individuals in community energy projects and what strategies and policies might be considered to increase their participation.

2. Materials and Methods: The PRISMA Approach

The present study can be described as a systematic literature review targeting the topics of community energy schemes and energy poverty. This review emphasised the active role of citizens in community energy projects, and therefore we focused on papers including community members and vulnerable groups. We followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines in conducting this systematic review. PRISMA is recommended for systematic reviews that include both quantitative and qualitative studies [28].

Protocol and registration

We did not register the protocol for this review.

Eligibility criteria

We established specific criteria for selecting the appropriate books and articles. To achieve this, we created codes and subcodes to identify articles and books that aligned with our codes and our research objectives. The codes included identifying barriers and drivers that promote people's involvement in community energy projects, focusing on European case studies in their research, emphasising energy poverty and vulnerability in their research, and finally discussing variables affecting the participation of vulnerable groups in community energy projects. Table 1 outlines the criteria for including and excluding papers.

Table 1. Eligibility criteria filtration phase.

Phase	Criteria
Inclusion	• Articles and books published between 2019 and February 2024 • English language • Barriers and drivers to public participation in community energy projects • European countries • Energy poverty or energy vulnerability focus • Characteristics of vulnerable groups
Exclusion	• Duplicate articles and books • Language other than English • Off-topic articles and papers • Articles not published between 2019 and February 2024

Information sources

We searched through the Google Scholar search engine and the SCOPUS and Web of Science databases. We started the first round of searches in April 2023 and finalised them in February 2024 to include the latest publications in the related field.

Search strategy

We limited our research to English. We defined three main strings to find the relevant papers from 2019 until February 2024 (see Supplementary Material Table S1). For this part of our search, we limited our search in terms of years (2019 until February 2024) and document types (article OR review paper OR book). We also limited two databases to the subject area. On Web of Science, we limited our subject to environmental sciences, ecology or science technology, engineering, energy, and social science. Similarly, we limited the subject to energy, social science, environmental science, or engineering in SCOPUS. The following is an example of the strategy we followed for our selection process:

Keywords = 'community energy' OR 'community energy scheme' AND 'Europe' AND 'energy poverty'

Study selection

Figure 1 illustrates the study selection process. Following the search strategy phase, we reached 1115 articles and books for the first search phase. Upon reviewing the titles of selected books and articles, we excluded 330 studies with irrelevant titles unrelated to community energy and energy poverty. We then examined the keywords and abstracts of the remaining papers to ensure that they aligned with the scope of our research. Those that did not were excluded. Following this process, we identified 168 papers for a comprehensive analysis, including an evaluation of their methodology, literature review, discussion, and conclusion sections. After reviewing the full text, we selected 143 papers for further research. To do this, we created a list of variables in Nvivo along with their sub-variables to assess these papers (see Table S2).

Data collection process and data items

The data were collected using Nvivo-coding, which was designed for this review. The codes were refined through discussions among the review team to ensure consistency and comprehensiveness. Each included study was independently reviewed, and data were extracted on various aspects, including study characteristics (e.g., year of publication, country), type of study (e.g., qualitative, quantitative, review papers, mixed-methods), intervention characteristics (e.g., type of community energy project), and outcomes (e.g., measures of energy poverty reduction, empowerment indicators, barriers and drivers to developing community energy projects). To accomplish this, we imported the final publications into Nvivo-14 software and evaluated them based on our defined codes and subcodes for our research. For example, we defined variables for empowerment indicators and identified three sub-codes related to this, including community involvement (e.g., the involvement of the community, particularly of the residents, in the design and implementation of the community energy scheme), education and knowledge of energy

(e.g., available meetings and discussions in communities to enhance awareness), and the social and economic situation.

Moreover, to conduct a thorough literature review, this study focused on four interconnected concepts: energy poverty, energy vulnerability, community energy, and vulnerable groups. The initial phase involved systematically collecting and reviewing existing literature relevant to these concepts. This included a detailed analysis of each paper to grasp the precise definitions and conceptual frameworks of different authors. Following this, the literature was sorted into categories based on identified similarities and differences in the definitions and interpretations of each concept. This categorisation aided in a clearer understanding of the distinctions among the four concepts.

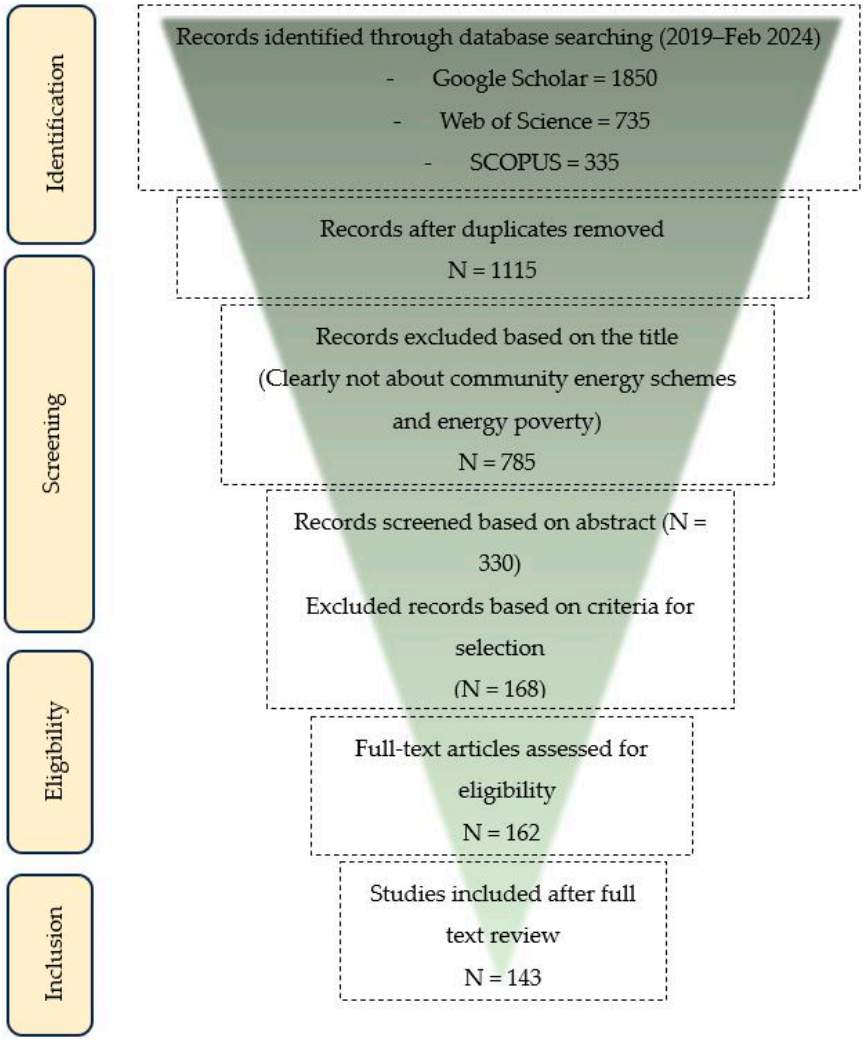

Figure 1. Flow diagram based on the PRISMA method.

Study risk of bias assessment

The main author designed the selection procedure through discussions with the second author to systematically analyse the data to minimise potential bias. They defined the study's objectives and the criteria for article selection. This process was carried out twice. In the first phase, the main author made an initial selection, and the results were validated through discussion among all researchers. During this stage, NVivo's codes and subcodes were applied to selected publications to ensure that they met the eligibility criteria. A second search yielded results similar to the first stage five months later. However, new publications were added to the search in order to include articles and books published until February 2024. Additionally, the research team obtained access to the complete

texts of all selected publications, enabling an in-depth analysis and significantly reducing potential biases. During the review and editing process, the co-authors commented on removing irrelevant papers that were out of the scope of the research. This process was performed multiple times in order to identify the most relevant articles and books for our research goals.

The PRISMA review used three databases—Google Scholar, Web of Science, and SCOPUS—to gain insights into the relationship between energy vulnerability reduction and poverty alleviation through community energy projects. However, there was a bias in the process, as the majority of the works were journal articles, with fewer contributions from books and other types of publications commonly found in the social sciences. Despite this, the reviewed articles met the necessary quality standards to address the research questions effectively.

As shown in Figure 2, the number of publications regarding community energy projects and energy poverty increased from 2019 to 2022, thereby showing an increasing interest in the scientific community, but then there was a decline in 2023. Out of the 143 included publications, 16 were found in both Google Scholar and SCOPUS, while 55 were only found in Google Scholar. The remaining publications were found in all three databases (see Table S3).

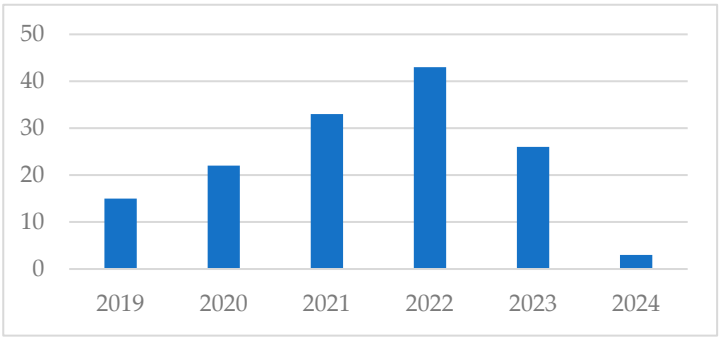

Figure 2. Publications per year.

A total of 58 articles were systematic literature reviews of community energy schemes and energy poverty. A total of 39 papers used a mixed-method approach, 27 papers used a qualitative approach, and 19 papers used a quantitative approach.

3. Results

3.1. Energy Poverty and Energy Vulnerability

Energy poverty is defined by several scholars [8,10,29–42] as a condition in which households are unable to afford sufficient heating, cooling, and lighting to meet their basic needs. Individuals may face energy poverty when they need to allocate more than 10% of their disposable income towards paying their energy bills [8]. In accordance with Castro et al. [30], energy poverty can refer to inadequate accessibility to energy services, and it appears to be related to household disposable income, the energy efficiency of residential buildings, and energy expenditures in developed countries [10,36,43–45]. Anais et al. [46] appear to support this view by emphasising the importance of the nexus of income, price, and housing to determine the state of energy poverty. Therefore, in developed countries and the EU, energy poverty is mostly linked to economic vulnerability and the affordability of energy services rather than to their lack of access or to scarcity of supply [10,47]. Other articles equate energy poverty to fuel poverty [32,36,48]. The term fuel poverty appears to have originated in the United Kingdom and thus focuses only on inadequate access to fuel for heating in winter [8,36].

There can be several strategies to alleviate energy poverty [49], and traditional methods to combat energy poverty, such as providing financial assistance and public funds to low-income groups [12,50,51], seem to be only part of the solution. Instead, innovative

approaches such as co-production (community energy schemes) and co-creation of services and policies appear suitable to mitigate energy poverty in communities [46]. Hanke et al. [29] define a relationship between energy poverty and energy vulnerability: 'Energy vulnerability often leads to energy poverty creating distinct living conditions that prevent vulnerable households from participating in and benefitting from energy transition' (p. 6). Moreover, vulnerability can result from inadequate energy infrastructure, impacting an individual's well-being [14]. It is assumed that energy poverty refers to a state at a specific time, while energy vulnerability is a dynamic condition that households may enter or leave due to changes in their life circumstances [10]. Also, Bouzarovski et al. [45] point out that energy vulnerability is related to factors such as income level, age, and gender. Further, several factors may impact energy vulnerability, such as the cost of domestic energy, substandard building quality, precarious tenancies, unstable income, and insufficient social and political support [52].

Various factors—such as demographic changes and geographic location, energy costs, energy technologies, the condition of housing, income, and public policies—can influence energy poverty. Out of the 143 articles, 31 of them do not mention specific variables for measuring energy poverty. In 25 articles, energy costs are identified as the main factor contributing to energy poverty. Leonhardt et al. [15] argue that off-grid communities have the potential to offer affordable energy services and play a significant role in the transition towards sustainable energy. Likewise, according to the analysis of Ceglia et al. [53], the use of renewable energy sources can reduce the overall cost of electricity. However, the high investment costs of renewable energy sources may act as a hindrance to their progress in rural areas and communities [5,54]. Similarly, fluctuating electricity bills and high energy prices can challenge vulnerable groups in combating energy poverty [8,10,36,38,39,47,55–58].

In 26 articles, the condition and quality of the dwellings are indicated as a significant variable in assessing energy poverty. Living in poor housing conditions can lead to energy-inefficient housing and a higher risk of energy poverty [10,36–38,42,47,49,52,56,59–63]. Meanwhile, energy technologies [8,38,47,57] such as accessibility to energy infrastructure [64] and smart technologies [65] can also mitigate energy poverty. Upgrading buildings with energy-efficient measures can reduce energy poverty and improve energy efficiency [66], and two examples of this are housing insulation and upgraded thermal energy systems [67]. The importance of income in addressing energy poverty is emphasised in 25 articles. Low-income households are often unable to afford sufficient energy services due to the high energy costs [29,37,45,47,56,68–70], while higher-income families can invest in renewable energy projects [71]. In addition, low-income households often find it very difficult to access the capital for the required investment, even if they could benefit financially by participating in energy projects facilitated by energy communities and supported by public or private financing schemes [18,72,73].

As mentioned above, demographic and geographical factors, energy technologies, and public policies are the other three variables for measuring energy poverty, and these are discussed in 16, 15, and 13 articles, respectively. Some papers highlight the impact of socio-demographic characteristics such as age, gender, educational level [19,74,75], and geographical location [19,39,56,57,76–79] on energy consumption patterns. According to Bouzarovski et al. [45], geographical distribution seems to be an important variable when investigating the availability of household energy poverty. Finally, from a policy perspective the presence of an energy-poverty-focused legal framework in a given country can provide specific measures to combat energy poverty [80,81].

3.2. Vulnerable Groups

Table 2 displays several types of vulnerabilities characterising vulnerable groups in communities based on the selected papers. Out of the 143 articles, only 82 of them identified vulnerable groups in their research. In most studies, low income was considered the most reported vulnerability, and gender was the second most-used variable to identify vulnerable individuals.

Table 2. Variables for categorising vulnerable groups in community energy schemes [1].

Variables	Explanation	Total Citation
Low-income families	Low-income and energy-poor households [1,5,6,8,10,29,32,36,38,41,42,46,47,51,52,56–59,62,67,69,70,74,77,82–96].	44
Gender	Energy poverty can show societal inequalities and can have a significant gender aspect [18,45,59,74,80,97,98]. Women tend to be more exposed to energy poverty [48,51,56,64,76,85,95,99–102].	18
Age	The elderly and children tend to be more sensitive to temperature changes, making them vulnerable [8,38,48,49,60,74,103]. Additionally, young individuals who face a language barrier may have limited access to information regarding the energy transition [58,60,64,74,95].	12
Low education	Vulnerable subjects can be described as individuals who lack sufficient education and understanding of renewable energies; as a result, they may not participate in societal efforts to transition to cleaner energy sources [1,2,19,49,93,95,101,104].	8
Disability	Groups with physical and mental disabilities are seen as energy-vulnerable [56,60,95]. They may suffer from energy poverty because of poor housing conditions [60].	4

[1] Some of the papers include more than one variable to define their vulnerable group. Therefore, they have been cited multiple times for different variables.

3.3. Community Energy Schemes

Community energy schemes are initiatives that can be either fully or partly owned and operated by local communities, and these projects have the potential to promote the use of renewable energy sources and enhance energy efficiency [10,105–107]. Community energy seeks the collaborative efforts of citizens in purchasing, managing, producing, and engaging in energy-related activities [2,104]. Local energy projects can involve citizens in implementing decentralised energy initiatives aimed at achieving sustainable energy production and consumption in their neighbourhoods [3,18,108]. Sustainable energy can be implemented through various means, such as improving home insulation, reducing energy consumption, utilising renewable sources, and regenerating housing and communities [60].

Energy communities can be '*communities of place*, *communities of interest*, and *communities of interest and place*' [76] (p. 665), where *communities of place* refers to communities whose individuals live in the same location and *communities of interest* refers to those communities that share a common interest in sustainable energy projects [76]. The definition of community energy can vary depending on the context. Hoicka et al. [59] consider energy communities to be a suitable strategy for reducing energy poverty and vulnerability by providing sufficient access to energy services for heating and cooling. Cunha et al. [109] consider the concept of community energy to be a means of promoting a green transition while simultaneously addressing multiple social and environmental issues such as climate change, economic inequality, and other socio-environmental injustices. Moreover, Koukoufikis et al. [96] define energy communities as democratic decision-making organisations established by different stakeholders, such as individuals, businesses, households, and local sectors, in order to generate, manage, and distribute energy resources in a community.

Communities of different sizes and purposes can engage in various activities such as energy generation, transmission, and energy efficiency enhancements in buildings [109,110]. Often, energy communities implement local renewable energy systems based on wind turbines and solar panels [110]. Furmankiewicz et al. [5] and Bashi et al. [35] mention three actors in community energy initiatives—community organisations, social entrepreneurs, and citizen participants—who collaborate to invest in energy production, sale, and distribution. Therefore, community energy projects require public support, acceptance, and participation in order to move the energy transition forward [17,111,112].

According to the literature, there are numerous advantages to supporting community energy schemes, such as increasing people's awareness of sustainable energy, thereby pro-

moting sustainable behaviours [104,113–115] and contributing to strengthening prosocial and pro-environmental local values [19]. Prosocial behaviour is defined as actions that benefit others, including but not limited to helping, cooperating, and donating to charity [116]. Moreover, as Pellegrini-Masini [112] mentions, 'pro-environmental behaviour is a behaviour that consciously limits negative consequences on the environment' (p. 17).

Another benefit of supporting energy communities is enhancing community-led actions, thereby increasing local engagement and leadership [105,117]. Engaging in community activities can improve social interaction, leading to a greater sense of inclusion and participation in community decision making [82,113]. Further benefits highlighted in the reviewed literature include employment and financial advantages [11,19]. Energy communities can engage low-income households in community projects [18,82,118] by reducing or eliminating the hurdle of the initial capital required to join the community. For instance, low-income housing associations can implement renewable energy projects at a scale that can reduce financial costs for tenants [82]. Table 3 shows four primary benefits of community energy projects in the 143 articles, with 77 of those articles emphasising the positive social impact within the community due to these initiatives.

Table 3. Positive outcomes of community energy schemes [1].

Outcomes	Explanation	Total Citation
Positive social impact	- Citizen empowerment [10,18,42,91,95,102,119–121] - Behavioural change [70,75,95,99,114,122–126] - They might build trust [71] and acceptance [51,96,102,112,124,127–130] toward sustainable energy - They might increase social cohesion [83,101,124,131,132] - Enhance energy justice and democratic energy decision making [19,31,56,110,115,133,134] - Public engagement as a result of citizens' awareness [82,95,96,104,135,136]	77
Environmental benefits	- Energy-saving initiatives may reduce emissions and protect the environment [5,15,124] - Green energy technology [6] and climate change mitigation [10,30,96,102,109,125,131,137,138]	33
Financial Benefits	- Tax free or feed-in tariffs to these projects [5,15,139] - Generating income for communities located near these projects [53,140] - Economic growth and job opportunities in local area [11,53,102,112,124,125,132,138,140–142] - Reduction on energy bills for residents because of local energy generation [76,93,94,96,131,143,144].	32
Innovation and learning	- 'Grassroots innovation' [46] (p. 6) for energy access to empower individuals and improve their quality of life. - Technological innovation to improve households' energy systems [46,52,77,102,145]. - Social innovation [96]: 'from consumers of energy to so-called "prosumers"' [53] (p. 4) - Increased energy education and awareness leading to community energy-saving behaviours [53,58,75,87,95,125,146]	26

[1] Some of the papers include more than one advantage of community energy projects. Therefore, they have been cited multiple times for different outcomes.

❖ The role of citizens in community energy projects

Energy citizenship is a concept closely related to environmental citizenship. Energy citizenship is used to argue for active participation in the field of energy within a framework of rights and responsibilities [147]. Further, it is used to describe practices to encourage pro-environmental behaviour, such as participating in renewable energy cooperatives [112].

According to the role of citizens in community energy projects, 'civic energy' [123] (p. 1) is a new concept that underlines the importance of civic engagement in these projects. The academic literature on civic energy can reveal the emergence of energy citizenship patterns in European societies, and according to Campos and Marín-Gonzále [101], these concepts can provide a useful conceptual framework to explain the role of citizens and other societal actors in the energy transition.

Savelli and Morstyn [125] mention in their study that people's behaviour is not set apart from social relationships such as communication with other individuals, families, friends, and community members, and all of these relationships may affect someone's personal choice. According to Dobson [148], the concept of environmental citizenship can be supported by changing our behaviour in a more sustainable direction, which should benefit both individuals and society as a whole. This mindset allows us to distinguish between what is good at an individual level and what is good for the community and to move towards a more sustainable future.

Among the 143 articles reviewed, 92 of them emphasise citizen and community organisations, such as non-governmental organisations (NGOs), as the primary actors in energy projects. For example, DellaValle and Czako [10] mention energy citizenship as a concept of actively including citizens in energy decision-making processes in order to increase their understanding of how to live sustainably. Moreover, 50 of the articles highlight the potential impact of supporting partners such as governments, municipalities, industries, and large corporations in community energy initiatives. McGoven [123] highlights civic energy as a concept that comprises municipal and citizen community energy projects to promote decentralised energy projects within a community.

3.4. Vulnerable Groups in Community Energy Schemes

Only 21 articles discuss vulnerable individuals and their active involvement in community energy projects [5,10,29,33,42,51,67,70,80,85,87,90,91,93–96,98,102,131,149]. Some studies underscored the significance of general community participation, prioritising this aspect over exclusive attention to the participation of vulnerable groups. Based on our analysis, the low-income group was the most commonly addressed vulnerable group among the reviewed papers.

For instance, Cunha et al. [51] argue that creating local energy communities can help promote social and environmental equality by providing affordable renewable energy sources for their members. They conducted 32 in-depth interviews across two cases, including Italy's 'Green Energy Community in Bologna' and Brazil's 'Income and Energy Generation Program in Juazeiro' [51]. Both cases involved social housing programmes within their local energy communities. The study suggested policy recommendations such as reducing energy bills to empower low-income families to provide adequate heating, cooling, and lighting for their homes. They also tried to demonstrate the importance of the 'learning and doing' approach at the national, regional, and local levels in order to develop an integrated energy plan [51].

Along this line, Goggins et al. [150] discuss the *SHARE* project (Social Housing Action to Reduce Energy consumption) as an initiative to increase awareness and promote behavioural changes towards sustainable energy consumption. Active from 2006 to 2008, this project targeted low-income households residing in social housing in ten communities across the United Kingdom and Ireland. Its primary objective was to help low-income families reduce their energy consumption and mitigate energy poverty. To achieve this goal, the *SHARE* project organised several forums and meetings where participants could exchange knowledge and experiences on energy-efficient heating systems, smart metering, and home heating and insulation options [150].

Furthermore, nine papers suggest that women can be considered vulnerable in community energy projects [45,48,59,63,64,80,97,98,102]. Cultural, social, economic, and political factors may affect women's participation in community energy projects [80]. Due to the gender pay gap in Europe, women may have less income to invest in renewable energy

communities than men [59,64]. Regarding social and cultural aspects of the role of women in community energy schemes, Tsagkari [102] points out that men and women have different energy requirements based on their social roles in a community. Women are generally responsible for caregiving and household tasks and are more focused on energy accessibility. Moreover, according to Petrova and Simcocke [98], older women residing in the inner cities of central Europe are often affected by energy poverty due to limited access to infrastructure services. They performed household interviews about energy poverty issues, such as women's and men's perceptions of energy behavioural shifts and the availability of energy services. The researchers found two crucial aspects for how gender affects energy poverty, namely, differing gender perceptions of energy poverty and the emotional impact of living in energy-deprived households [98].

Further, Furmankiewicz et al. [5] highlight how rural communities in Poland are deemed to be vulnerable due to inadequate insulation in their buildings and therefore might require significant investment in modernising thermal systems. Further literature [29,36,42,57] considers energy-poor households to be a vulnerable group and highlights their lack of awareness regarding activities to participate in community projects [29]. For instance, in several regions of Poland, including Podkarpacie, local authorities such as municipalities provide support to households with poor energy efficiency and enhance people's knowledge of energy efficiency and renewable energy projects [38]. Moreover, *Clean Air* is a national subsidy scheme in Poland that aims to reduce energy consumption and decrease sources of air pollution [38].

In addition, Hanke et al. [29] conducted surveys and interviews with 71 European renewable energy communities in countries such as the Netherlands, Belgium, Germany, Portugal, and Ireland to study the role of vulnerable groups in community energy projects. They found that energy-poor households need more knowledge about the definition of energy poverty and that renewable energy communities need more knowledge about the energy-poor people in their region and their needs [29].

3.4.1. Barriers to Community Energy Projects That Address Energy Vulnerability

Our review of the literature identified the most mentioned obstacles to achieving the goals of energy projects at the local scale. Some papers identified several barriers in their research, which were counted and reported in Table 4, and legal frameworks and financial barriers were the most common types of barriers among the 143 reviewed articles.

Table 4. Barriers to community energy schemes and decreasing energy poverty.

Barriers	Cite
Legal frameworks	53
Financial hurdles	35
Lack of knowledge	28
Technical issues	19
Unsuitable environmental conditions	18

We categorised legal framework barriers as the lack of clear planning for implementing community energy projects, and more specifically, a lack of local legislation towards developing community energy projects [35,53,65,131], a lack of clear legislation for leading the energy transition [1,103,144], and a lack of supporting policies [3,71,80,151]. Adding to the lack of supporting policies, a lack of clear guidelines and adequate regulations at the EU level can cause a barrier to developing community energy schemes [81,135,152]. Moreover, implementing centralised management of the current energy market and imposing stringent regulations may present a substantial challenge to developing energy initiatives in a community [135].

Financial hurdles, identified as the second most-frequently cited barrier, have been chiefly discussed as arising from high operating costs [5,18,62,103], difficulties in getting financial support [1,3,30,53,83,87,93,97,103,153], the high cost of grid connection [152],

high investment costs [3,63,65,67,93,103,118,129,135], and high taxation [16]. The financial aspect can thus be seen as a significant obstacle to achieving communities' energy transition. Moreover, the availability of cheaper non-renewable energy and high costs of infrastructural upgrades are other examples of such barriers [1,103]. For instance, budget constraints may prevent vulnerable groups from adopting energy-efficient technologies and reaping their long-term benefits [42]. Meanwhile, developing community energy projects can be difficult due to high investment costs and high interest rates for loans. Therefore, some communities may require assistance [103,154].

Further, based on our review, a knowledge gap and low awareness of the concept of community energy schemes among citizens, as well as insufficient awareness of sustainable behaviours, have been pointed out as barriers [6,16,18,65,67]. For instance, Dall-Orsoletta et al. [103] mention that limited environmental knowledge can be considered a barrier to developing energy initiatives at the local scale. Additionally, according to Dellavalle and Czako [10], accessibility to energy services and knowledge of energy-saving measures can influence energy-saving behaviours among citizens. For instance, there can be different types of households within communities, and some might choose to save energy regardless of financial incentives, while others consume more to meet their family's energy needs [10]. There is also an information gap about sustainable behaviour among vulnerable groups, such as residents living in remote areas [5] and people with migration backgrounds [64].

In addition, the lack of knowledge of renewable energy policies [80,155,156] and the lack of clear knowledge in some countries such as Denmark and Sweden to distinguish energy poverty from income poverty may lead to a misunderstanding of the vulnerability context in a community [96]. Horstink et al. [80] identified three gaps in renewable energy policies, namely, a lack of policies aimed at supporting citizen-focused collective renewable energy initiatives, a lack of legitimacy regarding co-operative models, and slow progress on democratising critical energy infrastructure. Also, a lack of policy knowledge when obtaining construction permits can hinder the development of renewable energy projects [156]. There can also be a discrepancy between social and energy policies regarding energy communities [96]. For example, in some instances, joining an energy community is viewed as an asset for members, including vulnerable groups, and this situation can put their access to social welfare programmes at risk [96].

In 19 articles, technical barriers were identified as a focal point of their research. These barriers include technical complexity related to the development of renewable energy and their infrastructure [80,103], such as technical challenges in integrating small-scale energy projects into the power grids [5,83] and a lack of equipment and expertise on how to develop community energy initiatives [103,135]. Moreover, Candelise and Ruggieri [18] note that one technical issue related to renewable energy communities is the lack of public access to information on grid assets and maps, which is only available to energy distributors.

The combination of physical and socio-environmental barriers is the least common type of barrier based on our literature review. This barrier can refer to the distinct characteristics and economic conditions of a community based on geographical distribution and social and cultural context. This makes it difficult to define a unique strategy and methodology to boost participation in community energy schemes [99]. As Klein [157] mentions, environmental change affects human societies differently based on their social structure and vulnerability. Regarding the social aspect, Torabi Moghadam et al. [85] mention the dominant involvement of men with higher incomes and education levels in community energy projects, leading to the exclusion of vulnerable groups such as low-income individuals, women, the elderly, and those who experience energy poverty. Moreover, the gender pay gap presents a challenge for women's participation in energy projects, as they may earn less [64].

Finally, a barrier that might decrease the interest in renewable energy for some sectors of society, particularly those that resist believing in human-made climate change, refers to the waste that renewable energies might generate [83]. Renewable energy sources such as solar panels and wind turbines can be beneficial for the environment, but they can also

produce harmful waste. For instance, solar panels can release rare earth metals, which can be dangerous for the environment. Similarly, the composite materials used in wind turbine blades can also create waste that is harmful to the environment [158].

3.4.2. Drivers of Community Energy Projects Addressing Energy Vulnerability

Table 5 presents the drivers cited in the selected articles for developing community energy projects and decreasing energy poverty and energy vulnerability. Community involvement was identified as the primary driver in 65 papers. Policy support and financial viability are mentioned in 42 and 34 articles, respectively. It is noteworthy that some papers recognised multiple drivers, so they are counted based on their mentions.

Table 5. Drivers that facilitate community energy schemes and eradicate energy poverty.

Drivers	Cite
Community involvement	65
Policy support	42
Financial viability	34
Technical feasibility	24
Prosocial behaviour	17
Physical and social environment	17
Expertise and human resources	13

Based on our literature review, community engagement can play a crucial role in promoting the understanding and adoption of energy transition and sustainable energy systems [127,159–161]. Grignani et al. [127] mention that engaging people in renewable energy projects helps them understand the importance of these projects in decreasing energy poverty and increasing their participation in the energy decision-making process. The involvement of citizens in energy decision making can have a significant impact on community response and the adoption of green solutions in communities [161].

Moreover, an energy project or citizen-led initiative appears more likely to generate social acceptance and trust within the community energy schemes [5,17,64]. Shortall et al. [19] suggest that trust is one of the main components for enhancing citizens' willingness to participate in community energy projects. Some papers [19,127,135] indicate that using participatory strategies, such as workshops, training sessions, focus groups, or community events, can foster trust among citizens and increase their willingness to participate in a community energy project. For instance, Pellegrini-Masini [112] surveyed residents living near wind farms in Scotland and emphasised the importance of trust and sharing information about renewable energy projects to enhance community acceptability.

Moreover, Dall-Orsoletta et al. [103] and Shortall et al. [19] argue that citizen empowerment in decision making and social goals (including education and social integration) are two key factors that can improve social acceptance and well-being within a community. Active participation can be a driver to reach governance in the decision-making process [82,127,133]. There are different levels of active participation, ranging from collaboration to co-decision and empowerment, and citizens can participate in group strategies such as workshops or community events in order to have a voice in their community [19]. Achieving democratic energy systems can be facilitated by inclusive decision making [110,133]. By prioritising these factors, communities can enhance the acceptance and garner support for community energy schemes [54,59,162].

Policy support (such as government policies and legislation frameworks) can play an important role in enhancing community energy schemes across countries [15,38,71,79]. It is recommended that laws be updated to promote the growth of communities [35]. As an example, there is well-defined legislation to provide financial support for community energy schemes in Germany, such as low-interest loans and compensations [35,53,71,163]. Policymakers can design new policies, such as policies related to enhancing energy conservation [9], to support community energy schemes, and these new policies can act as drivers

to enhance renewable energy production and promote energy efficiency and people's engagement [17]. In addition, understanding the context of vulnerability in a community can help policymakers and community project leaders understand the risks, motives, and incentives for vulnerable groups to participate in community energy projects [93].

Turning to the financial aspect, 34 papers mention financial drivers such as providing loans for citizens, specifically low-interest loans for vulnerable groups, in order to financially support their participation in community energy projects [93] and to support co-ownership of energy communities [9,18,19,53,71,82,103,135,164]. They can also play important roles in facilitating vulnerable groups' participation in community energy schemes and in decreasing energy poverty. For instance, as Di Silvestre et al. [165] mention in their paper, the Renewable Energy Act (REA) in Germany ensured that households generating renewable energy received fixed incentive tariffs for 20 years, and as a result, households were highly motivated to install photovoltaic panels on their rooftops and either supply the excess electricity to the grid or use it themselves. Moreover, according to Hanke and Lowitzsch [93], direct subsidies for energy-vulnerable households can increase their income and incentivise their participation in community energy projects. Therefore, financial support such as subsidies or bill payment support to vulnerable groups can help them pay their energy bills and decrease energy poverty in a community [12,39].

Technical developments in energy services, such as improving energy efficiency in buildings [36,166], promoting the reliability of electricity in remote areas [166], advanced metering infrastructure [77,83,100], and the use of combined heat and power systems [36], can act as another driver to eradicate energy poverty and accelerate the transition to sustainable energy development in a community. As found in Motsch's study [83], a grid connection and advanced metering infrastructure can enhance the potential for sharing energy among community members.

Prosocial behaviour appears to be a further driver, and social collaborations within a community can accelerate the transition to sustainable energy systems [103]. In this regard, changing the attitudes in communities can enhance the use of renewable energy production and diminish the use of fossil fuels [5]. Community energy projects have the potential to gather residents to boost social integration in a community and provide accessibility and affordability for them, especially for vulnerable groups [30].

Furthermore, the physical and social environment can greatly contribute to the advancement of community energy initiatives, and the unique social, cultural, geographical, and economic dimensions of a community can influence the implementation of specific energy solutions in that area [104,160]. Furmankiewicz et al. [5] highlight the significance of the intersection between energy and the environment to increase social inclusion in community energy projects by organising local events and providing local jobs, especially in rural communities. Moreover, adopting gender-inclusive language can increase the involvement of women in community energy projects [64].

Thirteen papers mention the importance of developing human resources expertise within communities. In the study of Horstink et al. [80], it is recommended to have expertise in energy projects to reduce costs on consultants for a community energy project. With regard to Poelzer et al. [167], people's knowledge and expertise can facilitate the development of community energy projects; however, there may also be a lack of knowledge within the community regarding energy services, which could result in a reliance on external support for the maintenance and operation of these services.

To sum up, based on our review of barriers and drivers, only 35 of the 143 articles focus on identifying barriers and drivers for including vulnerable groups and how to empower them in community energy projects. The most-cited barriers include lack of precise planning in implementing community energy projects and the role of vulnerable groups in these projects, lack of financial support, and lack of knowledge about sustainability among vulnerable groups, which may hinder their active participation in these energy projects. On the other hand, trust in the project plan and project leaders, information-sharing in communities, educational tools to increase awareness of sustainable energy behaviour,

supporting policies for vulnerable groups to join energy communities, and supporting policies to empower this group to be able to speak their mind in their communities can act as drivers to enhance the vulnerable individuals' participation in community energy projects.

3.5. National Context

This section provides a summary of examples from the most frequently mentioned countries at the European level. It also includes community energy projects and instances of local and national projects aimed at mitigating energy poverty and vulnerability across European countries based on the selected papers. Based on the reviewed papers, during the 1970s and 1980s, citizen movements in Denmark, Germany, and the Netherlands advocated for the increased use of renewable energies and collective decision making [18,20,71,78,81,86,168]. Some papers indicate Germany, Denmark, and the United Kingdom as the most notable countries in developing energy communities [15,87]. Figure 3 shows the geographic focus of the selected papers. Based on the content analysis of the selected articles, the United Kingdom and Germany are referred to 46 and 37 times, respectively. In this analysis, we summarise the community energy projects and energy poverty approaches in some countries based on the selected papers.

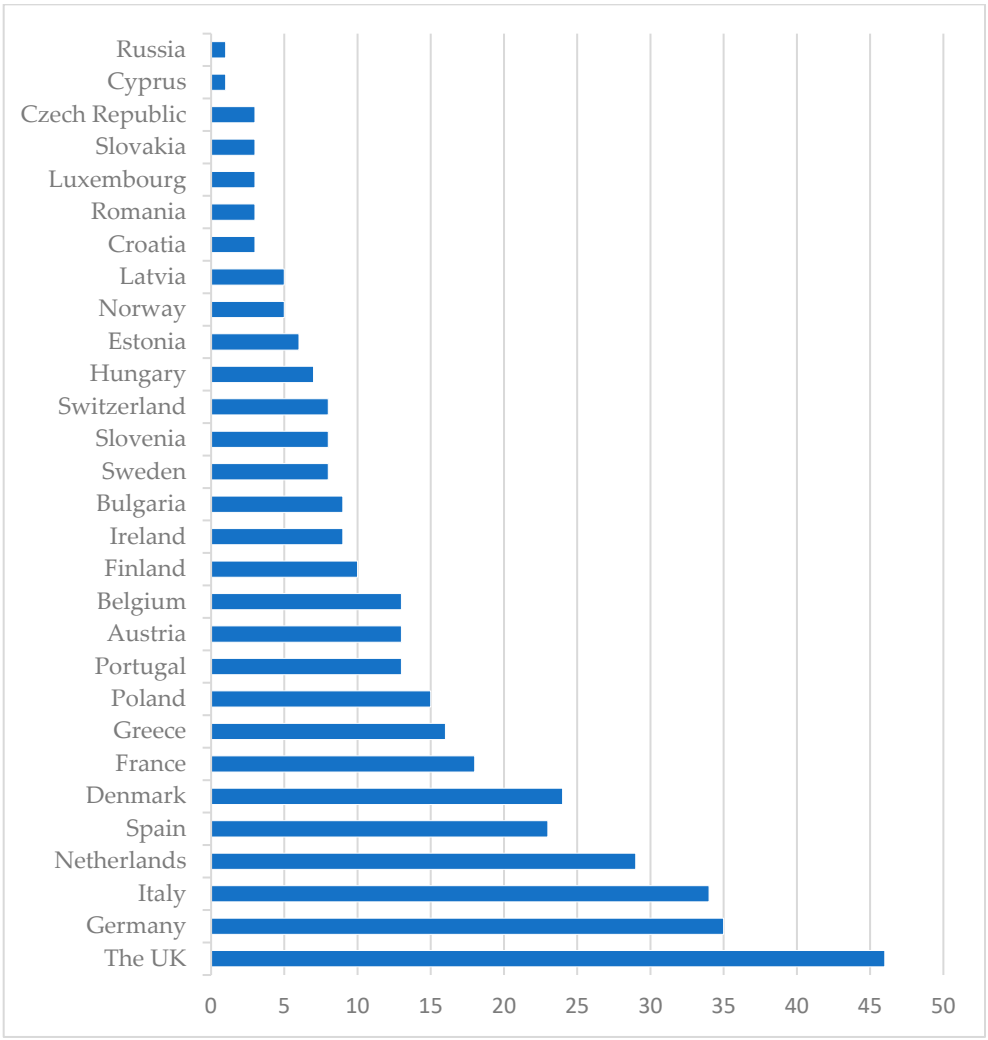

Figure 3. Geographical focus of the selected papers.

3.5.1. The United Kingdom

The United Kingdom has implemented various strategies to move toward energy transition. These strategies include promoting renewable energy systems like incorporating

solar design on buildings, promoting community energy schemes, and installing wind turbines in communities [66,84]. There are some examples of energy communities in the United Kingdom. For instance, *energy cafés* have been set up in London to facilitate the sharing of knowledge and experiences related to local energy contexts. Community members run these cafés [46], and thus they can be considered as one of the ways to enhance energy education and community engagement in society.

A scheme called *Cosy Homes* aims to address energy poverty among low-income families and disabled groups in Lancashire, United Kingdom. The project involves various stakeholders, such as the local authority, energy suppliers, private companies, and local community members. This project tries to provide subsidies for energy-efficient measures to vulnerable households [95]. A further example is Nottingham City Council that owned a public energy company called *Robin Hood Energy* that offered low-cost energy to vulnerable households from 2015 to 2020 [46]. In 2018, the company declared that it provided 100% renewable energy and financially supported elderly persons during the cold seasons to help them pay their fuel bills [169].

3.5.2. Germany

German cases are, after the United Kingdom, the most researched cases in our article selection, with 37 articles devoted to the investigation of German cases. Energy cooperatives, the most common type of energy communities in Germany, appear to rely mostly on local solar photovoltaic installations [170]. From 2006 to 2013, there was a significant rise in community energy initiatives, including energy cooperatives devoted to developing community energy storage systems [170]. It is assumed that communities with a higher level of education are more likely to engage in community energy projects in Germany; further, the greater engagement seen in Germany might be because the country has a rich history of cooperatives and work-based associations that have the potential to foster and develop energy communities [154].

In some instances [35], community energy projects in Germany are owned by individuals and small companies. The energy communities can benefit from self-consumption tariffs, which allow them to sell excess electricity to nearby users [80]. In summary, it is evident from the papers that citizens in Germany have been actively participating in energy projects since the early twentieth century [127], and these projects tend to be small and local [170]. Meanwhile, the German legal and social framework, including the Renewable Energy Sources Act, energy market liberalisation, and decreasing nuclear electricity production, seem to be favourable to fostering community energy projects and bottom-up initiatives [127].

Turning to energy poverty in Germany, the federal government does not seem to have a specific definition for this term and considers it as part of the overall definition of poverty [47]. However, community energy projects in Germany can empower vulnerable groups by providing low-cost renewable electricity to mitigate energy poverty [47]. For instance, *Mieterstrommodell* is a scheme that allows households in multifamily houses to sell local energy directly to nearby tenants, resulting in lower electricity prices [46,171].

3.5.3. Italy

Energy communities are regarded as suitable to promote democratic participation, support sustainable energy transition, and encourage decentralised local energy production in Italy [142]. Community energy projects in Italy involve a range of technologies, including photovoltaic panels on buildings [127], thermal insulation [165], and hydroelectric power plants [172]. In regions such as Trentino and Lombardy in northern Italy, biomass power plants are also common [170]. Examples of energy cooperatives in Italy aimed at reducing electricity costs for families while promoting local development and encouraging energy-saving behaviour can be traced in the reviewed literature [173].

3.5.4. The Netherlands

The energy communities in the Netherlands include renewable energy production and energy efficiency and are often financially supported by crowdfunding platforms [38]. The Netherlands' local and regional policies can facilitate a democratic and decentralised energy transition [173]. Municipalities and provinces are often responsible for energy transition, such as developing wind parks or solar farms, and the public sector and companies work together to develop sustainable energy plans for communities [173]. The renewable energy projects undertaken in the Netherlands emphasise achieving environmental objectives rather than primarily addressing the issue of energy poverty [130]. Mulder et al. [174] described energy poverty in the Netherlands as originating through a combination of high energy costs and low energy efficiency in dwellings.

3.5.5. Spain

Over the last decade, the cost of producing electricity through photovoltaic panels has become comparable to the grid purchase price in Spain [175]. Hearn and Castaño-Rosa [63] argue that Spain's large number of sunny days can enhance photovoltaic energy production. In addition, a change in the country's legislation (Royal Decree 244/2019 [176]) led to a cut in photovoltaic self-production taxation, facilitating the development of community energy schemes in Spain. In fact, generating energy through solar panels can be cheaper than purchasing from the grid, and this provides an incentive towards a growing decentralised energy production in communities [63].

Moreover, using solar panels on rooftops can help to alleviate energy poverty, and empowering vulnerable groups, such as low-income families, through Positive Energy District projects and social tariffs appears to increase household energy efficiency [63]. An example of a local intervention can be seen in the *Barrio Solar* project in Actur, Zaragoza, which aims to promote shared consumption of solar energy in neighbourhoods by installing photovoltaic plants for communal use [95]. This community project aims to support low-income families and energy-poor households by reducing their energy costs by approximately 30%. To achieve this goal, 10% of the energy produced by the photovoltaic system is allocated to families who struggle with energy poverty. As part of this initiative, the *Barrio Solar Office* was established to organise workshops and provide advice on energy and sustainability to the residents [95].

3.5.6. Denmark

Since the 1970s, Denmark has experienced a significant increase in community energy initiatives focused on wind farms [165]. In this country, 40% of the energy production is supplied by wind energy [177]. However, solar energy has been increasingly deployed in Denmark. For instance, in the town of Marstal, located on the island of Ærø in Denmark, citizens came together to establish a heating network that includes a solar thermal collector and underground heat storage [152]. The Ærø Energy and Environment Office is a local institution that promotes the use of renewable energy sources, and they have developed a vision for Ærø Island called 'Renewable Energy Island' (p. 6) to increase awareness of renewable sources [152]. Moreover, Avedøre Green City, Denmark's largest community energy scheme, is an example of collaboration between citizens, companies, organisations, and institutions [178] and was established in Hvidovre municipality in Copenhagen [179]. This community project installed sixty solar panels to heat water for residents [180]. Also, in 2021, two electric vehicle charging stations were installed powered by solar panels on the station's roofs [180].

3.5.7. Portugal

Between 2015 and 2018, Portugal faced high energy prices, which might have led to an increase in energy poverty. In response, policies have been implemented to make low-cost, accessible, and modular solar panels available to everyone [181]. In Portugal, companies that support NGOs, and thus indirectly support vulnerable groups in partici-

pating in renewable energy installations, have been studied. For instance, *Coopérnico* is a company that specialises in providing solar installations to NGOs working with vulnerable households [29].

3.5.8. Poland

Poland is devoting policy efforts towards implementing renewable energy sources at the local level through a policy requiring municipalities to define projects to support households and economic actors in implementing renewable energy projects [38]. For instance, in 2019, a programme called *Stop Smog* was introduced to assist municipalities in co-financing the installation of renewable energies for households at risk of energy poverty. The programme provided full coverage of the cost of installing renewable energy sources [38].

3.5.9. Austria

Citizens in Austria can act as prosumers and sell any surplus energy to their neighbours [3]. One example of active community participation in energy projects is *OurPower*, the first energy co-operative in Austria. It was founded in 2018 by 19 individuals interested in the energy transition. *OurPower* encourages community members to share their thoughts and feedback on their plans by following innovative approaches such as 'thinking aloud' (p. 71) during meetings and discussions [182]. The co-operative's platform enables the direct sale of energy production from renewable sources like solar panels to neighbours and friends at a fair price. *OurPower* has various groups of members, including women and young individuals, who exchange their knowledge and experiences about the energy crisis and energy transition within their community [182]. In the same vein, financial assistance for electricity (*VERBUND*) is available in Austria for vulnerable groups, which can help them save on energy costs and device replacements [46]. Energy consultants in this scheme try to advise energy-poor households on saving energy by using energy-efficient appliances and insulating doors and windows, among other things [183].

3.5.10. Slovenia

Luče, a remote village in northern Slovenia, has become the first community to be self-sufficient in local energy systems. The village is part of the Horizon2020 initiative project called *COMPILE*, which aims to increase the use of renewable energy sources [184]. Despite the weak connection to the grid in Luče, they could install photovoltaics for households and community batteries, thereby reducing electricity costs in the area [184,185].

Furthermore, the non-governmental association called *Focus* (Association for Sustainable Development) has implemented a project called *REACH* to decrease energy consumption in energy-poor households in Slovenia. As Živčič and Tkalec [57] defined it, 'REACH (Reduce energy use and change habits) is an IEE-funded project (2014–2017) aimed at reducing energy consumption in low-income (energy poor) households' (p. 100). This project aims to enable vulnerable households in the Pomurje and Zasavje regions in Slovenia to change their energy consumption habits to become more efficient and sustainable. It also involves local actors and decision-makers at the national level to suggest measures aimed at reducing energy poverty and providing potential solutions to address this issue [57].

4. The Role of Education in Inclusive Sustainable Energy Communities

The results described above show that raising awareness and knowledge about energy projects and sustainable energy behaviour can be one of the key factors in increasing people's involvement in community energy projects, especially among vulnerable groups. Moreover, our analysis of different experiences related to awareness and community education about energy projects across European countries suggests that education can motivate community members to actively participate in community energy projects.

This section focuses on the main barriers and drivers affecting inclusive energy communities based on selected publications and supplementary searches. In some in-

stances [53,96,186,187], the role of increased awareness of sustainable energy development topics within communities has been emphasised, and this can enhance sustainable attitudes and encourage greater participation in community energy projects. Non-formal renewable energy education has been used in local communities to increase people's awareness and train individuals about sustainable energy [188]. Improving educational tools and increasing awareness of energy systems can encourage active citizen participation in community projects [16,17,110]. According to Hanke et al. [29], vulnerable households have priorities other than actively participating in energy projects, and thus they may be unwilling to participate. They suggest that enhancing people's knowledge about renewable energies and encouraging them to participate in collective energy decision making can help improve their participation in community energy schemes [29].

Moreover, participating in environmental education and training may lead to changes in environmental behaviour [189], and environmental education and education for sustainability are processes that aim to create responsible individuals who can contribute to sustainable development [161]. In one of the UNESCO reports [190], education for sustainable development has been defined as 'an emerging but dynamic concept that encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future' (p. 5). Therefore, sustainability education can empower citizens to take an active role in their communities [121] and work towards a better future. For instance, according to Koukoufikis et al. [96], transparent information on energy bills and giving advice on promoting energy-efficient services would help vulnerable households understand energy-related problems in their everyday lives.

To facilitate the community's sustainability goals, Kioupi and Voulvoulisa [191] suggest a participatory conceptual framework that involves collaboration between various stakeholders, including community members, learners, educators, and other groups. Community energy projects can also encourage active engagement in the transition to sustainable energy while fostering positive changes in behaviour and reducing energy consumption within local communities [114]. Turning to potential educational aspects of community energy projects, energy education tools can enhance people's involvement in these projects and, more specifically, increase vulnerable groups' awareness of how they can participate in community projects and let them have voices in energy decision making. According to Mullally et al. [192], various methods such as workshops, surveys, discussions, awareness events, and media coverage can improve people's participation in community projects by increasing their knowledge of the sustainable environment. General awareness of renewable energies [16,18,91,100,193] can lead to increasing the social acceptance of community energy projects [79,160].

Therefore, education can instil ethical principles for sustainability [194] that enable the development and support of sustainable development by fostering the growth of knowledge, skills, attitudes, and values [195]. Nevertheless, community members may need to be provided with incentives to adopt and use renewable energy technologies, and the effectiveness of these incentives can vary depending on citizens' age, level of education, and attitude [82].

- ❖ A theoretical framework conceptualising the leading factors towards inclusion of vulnerable groups in community energy schemes

In Figure 4, we propose a theoretical framework based on the reviewed literature. Far from being exhaustive, the framework aims to provide a basis for future research and indications for policy practitioners working on generating policies for the inclusion of vulnerable groups in sustainable energy projects. Several factors are suggested to foster the inclusion of vulnerable groups, and we divide them into four categories based on the literature, namely, financial support, education for sustainability, prosocial culture and social capital, and participation in community energy projects.

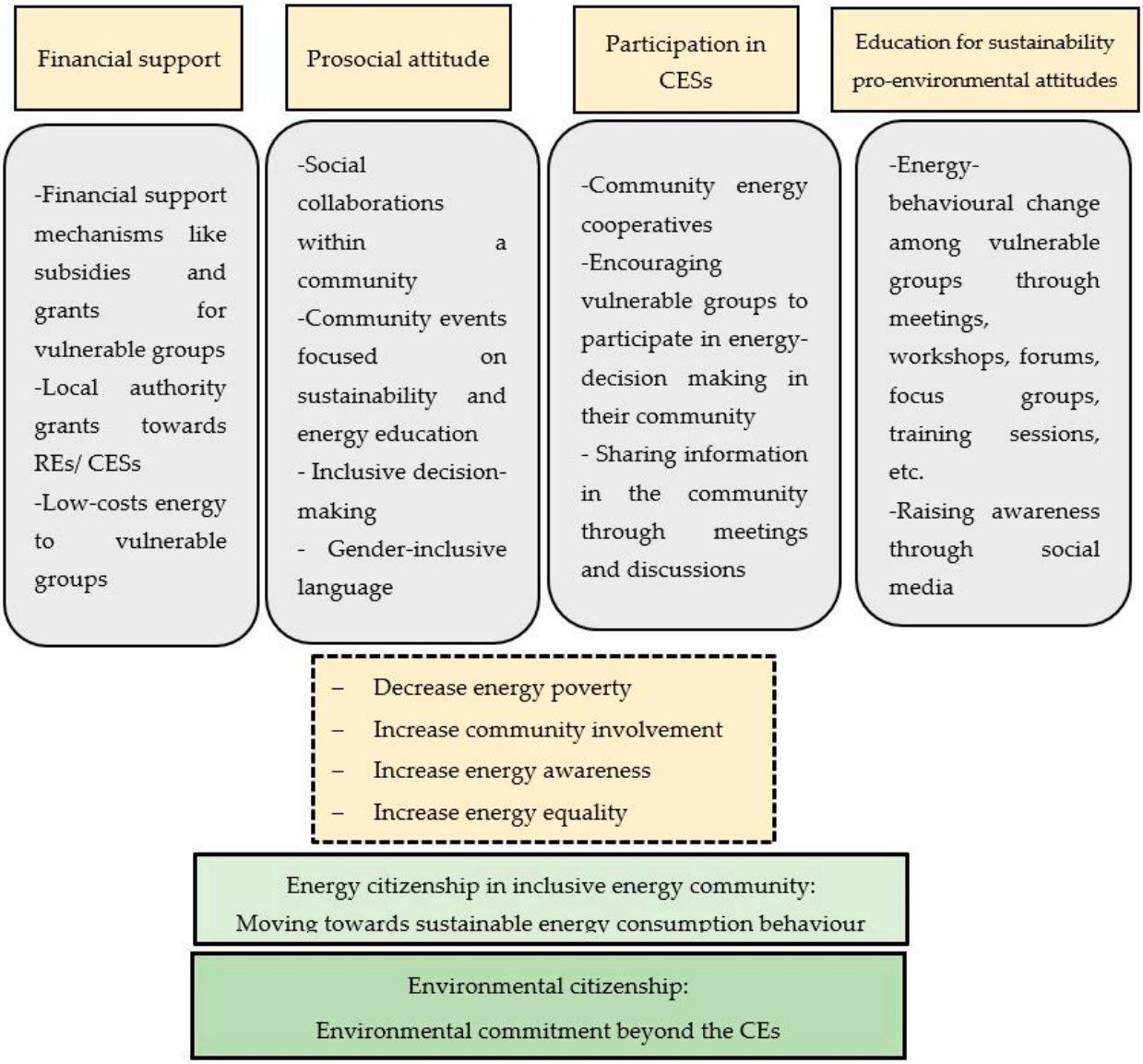

Figure 4. Conceptualising the leading factors towards inclusion of vulnerable groups in energy communities.

Financial support can vary from subsidies on energy-efficient measures such as the *Clean Air* national subsidy scheme in Poland [38] or the *Cosy Homes* subsidy scheme in the United Kingdom [95], financial assistance for electricity to energy monitoring, and co-financing of renewable energies. Installing renewable energy projects in communities can potentially engage more vulnerable groups to take advantage of these clean energies. For instance, based on our review, solar roof projects in social housing can be seen as a way to provide local energy for vulnerable groups, and this approach can be found in Denmark, Spain, the Netherlands, and Germany, to name a few. Moreover, low-cost energy-efficient measures such as LED lighting, insulated windows and doors, and timers for electric boilers can help vulnerable households alleviate energy poverty [94].

It is also important to foster a prosocial attitude in which vulnerable groups are encouraged to participate in community events and collaborate. Two strategies are suggested to incentivise these groups to have a voice in community energy projects, namely, inclusive decision making and gender-inclusive language. For example, national projects aimed at supporting vulnerable groups, such as *Energia su Misura* in Milan, tried to help vulnerable groups by reading and monitoring their energy bills and giving advice about consumption

behaviour at community events in order to increase these groups' knowledge about energy vulnerability [95].

Turning to the engagement of vulnerable groups in community energy projects, information-sharing can enhance trust between vulnerable groups and project leaders as well as trust in the project plan, and this approach can be seen in the example of the *energy cafés* in the United Kingdom. The fourth factor is education for sustainability, which focuses on awareness-raising and energy behavioural changes. Media; group meetings; focus groups; and workshops with residents, specifically vulnerable groups, can foster energy projects within communities and diminish energy poverty through a behavioural shift in energy consumption. Promoting a change in behaviour towards renewable energy sources can be seen as one of the keys to achieving a sustainable future [82]. Shortall et al. [19] found that behavioural shifts can decrease energy consumption and boost energy efficiency. In this regard, media and social media can raise awareness about energy transition and renewable energy, leading to a shift in public perception towards sustainable development [75].

As mentioned by Ali et al. [75] in their research, people's perceptions and attitudes towards sustainable development can greatly influence public behaviour towards energy transition and renewable energy development. They have also highlighted the significance of public perception as a concept that is closely linked to education and awareness levels regarding renewable energies. As an example, in Germany, the focus is on educating people about energy sustainability to increase their involvement in energy decision making. According to Finnegan [196], energy education primarily focuses on educating individuals about their energy consumption behaviour and environmental impact.

By providing knowledge about energy-related issues, citizens are better equipped to understand the importance of the situation and the potential consequences of their actions; additionally, by highlighting potential solutions, citizens are empowered to take meaningful steps towards reducing their energy consumption and adopting more sustainable practices [19]. Meanwhile, as Pellegrini-Masini et al. [197] discuss, energy equality can be reached by providing equal opportunities to use energy services and accessibility to energy facilities. The authors argue that energy education can promote energy equality by increasing accessibility to energy services and empowering people to participate in the decision-making process.

To sum up, the factors mentioned above could result in vulnerable groups becoming more involved in community energy projects. This could increase their knowledge about sustainable energy behaviour and how they can address energy vulnerability. They might also provide accessibility to energy services, resulting in greater energy equality and decreasing energy poverty in communities. Energy citizenship is a concept that can be promoted within a community to encourage active participation in energy transition. This involves raising awareness about energy and promoting pro-environmental attitudes among citizens. By doing so, a sense of environmental commitment can emerge within the community, which incentivises both individual and collective actions towards sustainability. Ultimately, this approach can help energy communities move towards a more sustainable future.

5. Conclusions

This literature review considers to what extent vulnerable groups take part in community energy projects and which strategies can be implemented to enhance their participation and decrease energy poverty in communities. The results of this review show that low-income households and women are the most-cited vulnerable groups in the 143 papers that were analysed. We have provided some examples of energy project strategies in different countries. Based on the selected articles for our review, we have categorised various aspects of the barriers and drivers of community energy schemes that address energy poverty.

On the one hand, a lack of a legal frameworks for establishing local energies in communities, financial burdens such as high investment and operational costs, and a lack of

knowledge regarding sustainable energy behaviour are common barriers in communities. These barriers lead to low engagement of citizens, especially vulnerable groups, in community energy projects. On the other hand, community involvement, policy support, and financial viability are the most frequently cited factors that can contribute to the active participation of citizens in energy projects. To foster community involvement, it is essential to establish trust in the project plan and project leaders, ensure transparency during the projects, and spread knowledge and awareness about sustainable energy behaviour. From a policy standpoint, well-defined regulations on generating and distributing energy can encourage local energy development within a society. Additionally, subsidies and financial support in the form of loans for low-income families to install renewable energy sources, such as solar panels, in their homes can significantly engage them in community energy projects.

Based on the selected papers, financial support, prosocial culture, participation in energy decision making, pro-environmental attitudes, and education for sustainability can foster community engagement and boost social integration and acceptability in communities. Increasing awareness and knowledge about sustainable living and community involvement can encourage people to adopt better energy consumption practices. Through the influence of these factors, vulnerable groups can be encouraged to participate in energy communities. Also, by implementing a vision of environmental citizenship through enshrining environmental rights and legislative duties, inclusive sustainable communities that benefit individuals and communities can be encouraged.

Community energy projects prioritising inclusive decision making and gender-inclusive language can be crucial in enhancing social inclusion. These projects encourage the active involvement of community members, particularly vulnerable groups, in energy decision-making processes. This inclusive approach fosters social inclusion by enabling community members to participate in workshops, meetings, discussions, and surveys related to sustainable energy attitudes. Additionally, project leaders can leverage social media coverage and online discussions to increase community awareness and knowledge of sustainable energy practices.

Moreover, community energy projects can reduce energy poverty by strengthening community ties and fostering mutual support. By providing equal access to energy services for all community members and distributing local energy within the community, these projects can help combat energy poverty and vulnerability. The installation of renewable energy services at a local scale can also raise awareness about sustainable energy behaviours, such as energy conservation, and promote pro-environmental and prosocial attitudes (see Section 4).

This literature review shows that more research should be conducted to determine the driving forces behind enhancing the role of vulnerable groups in energy communities in order to alleviate energy poverty. In particular, purposeful policy schemes to promote inclusive energy communities should be implemented at the national, regional, and local levels in order to overcome those barriers that low-income and marginalised groups face with regards to financing and access to information necessary to start or participate in a community energy scheme. How different types of such policy schemes, possibly involving both public and private actors, might prove successful in our societies should be of primary concern to achieving a socially inclusive energy transition.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/en17133232/s1. Table S1: Search string for the first phase of the research; Table S2: Codes and subcodes in Nvivo-14; Table S3: The list of papers for systematic review. References [198–203] are cited in the supplementary materials.

Author Contributions: Conceptualization, P.B.; methodology, P.B.; software, P.B.; resources, P.B. and G.P.-M.; writing—original draft preparation, P.B.; writing—review and editing, P.B., G.P.-M. and J.K. All authors have read and agreed to the published version of the manuscript.

Funding: Pariman Boostani is funded by the Department of Teacher Education at the Norwegian University of Science and Technology and ACCTING (AdvanCing behavioural Change Through an INclusive Green deal) European Research project (under grant agreement no. 101036504).

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflicts of interest.

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