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Energy communities in Sweden: the case study of Sätra, Västerås

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ABSTRACT

The urgent need to combat global warming has highlighted the significance of transitioning towards environmentally friendly energy sources. Acknowledged by the European Commission as a valuable approach for facilitating this transition, the energy community model offers promise to districts and cities seeking sustainable solutions. This paper focuses on the district of Sätra in Västerås, Sweden, and explores the potential of operating as an energy community. The study considers Sätra's economic, social, and technical circumstances, as well as Sweden's regulatory framework. The methodology consists mainly of interviews with specialists and urban actors, as well as reviewing the literature and relevant documents. The findings highlight various political, technical, social, and economic barriers that hinder the establishment of an energy community in Sätra, such as the absence of a clear definition for energy communities, intermittency of renewable energy sources, low awareness among residents and marginalization of some social groups, and insufficient funding for initiatives. To address these barriers, the study proposes several incentives and mitigation strategies. These include developing a comprehensive definition of "energy community", establishing an umbrella organization to coordinate efforts, raising awareness among stakeholders, and securing adequate funding. The valuable insights provided by the current study on the establishment of an energy community in Sätra and the proposed incentives and mitigation strategies serve as a basis for further exploration and implementation, paving the way for a sustainable and resilient energy future in the district and the country.

Keywords: Energy Communities, Regulatory Framework, Social Mitigation Strategies, Economic incentives.

1. INTRODUCTION

Climate change and global warming have highlighted the urgent need for energy security and fundamental changes in our energy systems, including a transition to renewable energy. While renewable energy sources offer a sustainable alternative to fossil fuels, the nature of renewable energy poses infrastructural challenges, particularly with the power grid. The integration of renewable energy into existing energy grids requires significant investments in new infrastructure and technology to manage intermittent energy flows and ensure the grid can support and balance energy supply and demand. Energy communities can serve as a solution to the infrastructural challenges posed by the transition to renewable energy [1,2]. These communities, which involve local actors such as households, businesses, and public entities working together to produce, store and distribute renewable energy, can help ensure energy security and a stable supply of energy. By pooling resources and expertise, energy communities can create more resilient and efficient energy systems that are less dependent on the traditional grid infrastructure [3]. This can also lead to increased community engagement and empowerment in the transition to renewable energy, while helping to reduce carbon emissions and mitigate the effects of climate change [4].

Sweden has long been a pioneer in the transition to renewable energy sources, aiming to achieve a sustainable and environmentally friendly society [5]. The country's commitment to reducing its carbon footprint [6] has led to the emergence of energy communities, which are groups of citizens, local businesses, and public entities collaborating to generate, store, and distribute locally-produced renewable energy [4]. These energy communities exemplify the decentralization of energy systems and the active involvement of citizens in the energy transition process.

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This paper focuses on the development and potential of energy communities in Sweden, with a particular emphasis on solar electricity production in Sätra, a district in Västerås. As Sweden experiences increasing demand for clean energy and decentralized systems, it is crucial to understand the role of local communities in contributing to the country's energy goals. The objective of this paper is to evaluate the feasibility of establishing a successful energy community in the area. The study will also explore the opportunities and challenges associated with the implementation of energy communities in the Swedish context, as well as the policy and regulatory frameworks that support or hinder the growth of energy communities.

2. ENERGY COMMUNITIES

Energy communities are a rapidly emerging concept in the global energy landscape, fostering local, decentralized energy systems and active citizen participation in the energy transition. By bringing together citizens, local businesses, and public entities, energy communities enable the generation, storage, and distribution of locally produced renewable energy.

2.1 Overview of the concept of energy communities

The emergence of energy communities as a model for decentralized and community-led energy production, use, and distribution can be seen as a response to the growing need for more sustainable, inclusive, and locally driven approaches to energy transition. It reflects a shift towards a more democratized and participatory energy system, where communities play an active role in shaping their energy future, and where the benefits of renewable energy are shared more equitably among local stakeholders. In Europe, the concept of energy community gained momentum with the introduction of the "Clean Energy for All Europeans" legislative package (CEP) in 2016 [7]. The package included two key legislative proposals, the Renewable Energy Directive II (REDII) (2018/2001/EU) and the revised Internal Electricity Market Directive (IEMD) (2019/944/EU). The former set the framework of Renewable Energy Communities (REC) by introducing measures to simplify administrative procedures, improve market access, and promote the participation of citizens and communities in renewable energy projects. The IEMD on the other hand, introduces new roles and responsibilities for Citizen Energy Communities (CEC). Different technologies and combinations for different contexts of energy community are possible with RED II, which leave significant room for manoeuvre to the national legislators [2,8]. Several countries worldwide have witnessed the emergence of energy communities, including Germany, the United Kingdom, the Netherlands, and Denmark [9]. Key drivers for the growth of energy communities include technological advancements in renewable energy production, government support, and increasing public awareness of environmental and climate issues [10]. However, it is important first to identify the main actors in energy communities. According to [11], the actors in an energy community can vary from natural persons to public utility companies or municipalities, and the roles that they play within the community depend on the local conditions and community goals. They are categorized into three main categories: consumer, energy service provider, and initiator. Consumers are the beneficiaries of energy services provided by other actors, while energy service providers can generate, distribute, store, supply, and aggregate energy-related commodities and services. Initiators are actors that initiate, organize, and coordinate community projects, which can be public or private, and may or may not be beneficiaries of the community energy service. Consumers can also be initiators, receiving aid from financing institutions, partnering with local companies, and forming associations or legal representatives for implementing energy efficiency measures and investing in renewable heat for self-consumption. Prosumers, who are at the intersection between consumers and energy service providers, can act as energy service providers when they generate more energy than they consume and trade it with other community members through a peer-to-peer trading platform. And this is one of the key features of energy communities, their emphasis on prosumership [8].

2.2 Challenges and barriers

Several barriers have been identified to help the energy community establish themselves on the market. To speed the establishment, it is critical to understand the demands of actors and define what an energy community is as part of a national strategy or within a legal framework [12], while still allowing actors to build energy communities that meet their individual needs [13]. However, as previously mentioned, the CEP provides a lot of room for manoeuvre for member states to regulate and manage energy communities. A lack of uniformity in precisely defining an energy community, causes confusion and uncertainty among stakeholders, hindering the establishment and participation in energy communities [14]. Businesses find it difficult to comply

with rules when they are inconsistently enforced, which hinders investors from funding renewable energy initiatives [12]. Additionally, the various legislative frameworks limit cooperation between European nations in the advancement of renewable energy sources and lead to knowledge gaps. Due to the existing market structure, which benefits huge energy firms and disadvantages small, community-driven projects, discrimination is another problem brought on by these constraints [14].

From a technical standpoint, the intermittent characteristics inherent in RE presents a significant impediment, leading to an unstable and variable electricity generation pattern. This complexity magnifies the challenges associated with seamlessly integrating renewable energy sources into the existing electrical grid infrastructure, necessitating the incorporation of energy storage systems [15] or alternative back-up energy sources [11]. Consequently, substantial investment rates are incurred in order to address these challenges effectively.

Furthermore, the lack of funding remains one of the most significant obstacles in the development of energy communities [14,16,17]. Energy communities require subsidies and other financial support to start and overcome the initial stage [18]. Therefore, state funding, subsidy mechanisms, and dedicated support programs are vital for the development of energy communities. However, it can be challenging to secure funding in the early stages of an energy community, when plans are being implemented. Thus, it is crucial to develop funding mechanisms and provide subsidies to encourage and facilitate the creation of energy communities, while focusing on ensuring equal opportunities for different level of households' incomes [17,19]. In addition, any system put in a place in which the consumer and investor are expected to participate must be able to pay off itself over time [14,18]. An economic and payback point of view is crucial to motivate the consumer to participate in an energy community.

In terms of membership, the lack of technical knowledge has been seen as a major barrier for participation in energy communities, especially that the future can bring an increased complexity of the system and thus a need for more professional competence [12]. On the other hand, the lack of understanding and belief among residents in the technological and financial advantages [12,20], worries about control and decision-making within the community [14], and the need for voluntary involvement are social barriers that impede the implementation of energy communities [12,14,20]. Consequently, education and awareness are often emphasized since they correlate with the willingness to participate in an EC. However, existing policy programs aimed at educating citizens about energy efficiency or RE have been ineffective, overlooking broader social contexts and relying too heavily on the rational actor concept [12].

2.3 Energy Communities in Sweden

Several challenges need to be addressed for the successful implementation of energy communities in Sweden. Despite being a pioneer in renewable energy, Sweden faces challenges in fostering the growth of energy communities due to the lack of supportive policies compared to other European countries. The country's electricity market is centralized, dominated by a few utilities [5], and lacks direct engagement between utilities and end-users [12]. Policies promoting community-led energy initiatives are currently lacking. The Swedish government has not introduced specific regulations for energy communities and has deemed the existing legal framework sufficient to support their development. Furthermore, there is a lack of regulatory systems to facilitate a market for energy sharing among neighbors. In fact, sharing electricity without an internal grid is currently illegal, and the construction of such a grid is subject to regulatory requirements. However, the Internal network regulation grants certain exceptions from the concession requirement for electricity networks, providing an incentive for flexible energy systems and enabling energy sharing within limited areas like buildings or specific regions [21]. Moreover, the country's electricity grid is not designed for storage, so any electricity generated must be consumed. This is hindering one key aspect of energy communities, which is increased citizen engagement in energy production, as these communities emphasize the importance of individual and local involvement in ensuring energy security, combating climate change, and reducing costs for consumers. In addition, limited incentives, and support measures, including financial support and technical and administrative assistance, have been a challenge for the financing and development of energy community projects [22,23]. Lastly, the willingness to participate in energy communities is affected by a lack of technical knowledge, coordination among umbrella organizations, and the need to navigate bureaucracy, grant applications, and technical standards. A centralized umbrella organization for energy communities could help to coordinate communication, provide resources,

advocate for policy changes, and support the perseverance of members [12,24,25].

3. MATERIALS AND METHODS

3.1 Case Study: Sätra, Sweden

Sätra is an upcoming sustainable residential neighborhood in Västerås, Sweden, designed as a mix of modern and traditional district that promotes diversity, by establishing nursing homes, sports facilities, schools, kindergartens, and single and multi-housing for residents. Emphasizing energy efficiency and resource optimization, the neighborhood aims to become a plus-energy district by implementing energy-efficient buildings, solar panels for local electricity production, and connection to the city's district heating system.

3.2 Interviews and Documentation review

The methodology employed a mixed approach, including document analysis, literature review, and semi-structured interviews to comprehensively investigate the collaborations and practices of Sätra's energy community. Qualitative content analysis was utilized to understand the conceptualization of energy communities, their goals, and actors' involvement. Close contact was established with the project leader of the Sätra project, providing access to planning documents and valuable insights into the organizational circumstances. An interview was also conducted with the Vice CEO of Mälarenergi Elnät (the electricity provider in Västerås), who provided technical insights. A literature review was carried out to identify barriers, incentives, and mitigation tactics for energy communities, focusing on smart grids and the local electricity market. Semi-structured interviews were conducted with various experts, including researchers, analysts, and CEOs with knowledge in energy communities, smart grids, or electricity markets. The list of interviewees is provided in Table 1. The interviews were conducted over the phone or through virtual platforms, ranging from 20 to 60 minutes in length. Participants gave their consent for recording, and anonymity was offered upon request. The selection of interviewees involved four steps [26]: identifying relevant professions, searching for suitable candidates in various sectors, narrowing down the pool based on criteria and interest, and notifying and inviting selected candidates for interviews. Thematic analysis was employed to analyze interview transcripts, identifying patterns and themes in the qualitative data. The analysis followed four steps, ensuring accuracy and alignment with respondents' perspectives. Ethical considerations were also addressed, following guidelines for consent, confidentiality, and information usage.

Table 1: Interviewees' Details and Affiliations in the Study on energy communities in Sweden

#	Name	Organization	Occupation
1	Henrik Jalalian	Cogito	General manager
2	Markus Lindgren	Västerås stad	Municipal council
3	Jeanette Greene	Multiply	Project leader
4	Anna Werner	Svensk Solenergi	CEO
5	Anne-Charlotte Boldrup	Västerås Stad	Project leader
6	David Larsson	Solisten	CEO
7	Robert Lagerström	E. ON	Senior specialist
8	Caroline Carlstrand	Energimyndigheten	Analytics
9	Alejandro Eguez	Energimarknadsinspektionen	Analytics
10	Martin Warneryd	RISE	Researcher
11	Jenny Palm	Lund Universitet	Researcher
12	Helena Olssén	Mälarenergi	Vice CEO
13	Jennie Nyberg	Energimarknadsinspektionen	Analytics
14	Magnus Linden	Svenska Kraftnät	Consultant
15	Magnus Westman	Ellevio	Project leader
16	Anonymous	-	Research Assistant

4. RESULTS AND DISCUSSION

4.1 Regulatory aspect

The lack of a legal definition and dedicated regulatory framework for energy communities in Sweden poses challenges for their development and support. To address this issue, efforts are being made to establish proper legislation for energy communities, but it may take time due to the complexity of the task. Currently, energy communities and individual renewable energy installations both benefit from the same broad renewable energy regulations, that incentivize installing solar panels, managing the electricity production, and selling surplus electricity. However, this may not be sustainable for growing energy communities and may affect the motivation of energy community participants. To overcome regulatory barriers, the idea of creating an umbrella organization is proposed, which would unify the voices of various actors involved in renewable energy initiatives and help coordinate their efforts more effectively, with the government providing initial funding and support for its establishment. Despite these challenges, Sätra's project team has sought clarity through exchanges of information and workshop participation. While this approach lacks the policy impact of an umbrella organization, it has not stopped their efforts to inspire legal change. If a suitable framework is found, Swedish energy market inspectors will present it to the government.

4.2 Technological aspect

In order to overcome the intermittent nature of RE and the consequential issues, it was proposed that the emphasis for energy communities should be on advancing dependable energy storage systems, like batteries, capable of conserving surplus energy for subsequent utilization in order to foster a steadier energy system. Respondent 1 further advised that these communities establish partnerships with local grid operators or energy providers to develop a more adaptable and cohesive energy system. Through such cooperative efforts, energy communities can enhance their energy resource management and fine-tune their energy generation and usage. Respondent 5 confirmed that Sätra's infrastructure is compatible with photovoltaic installations and smart grid implementation, with the presence of underground empty pipes that could be used as a part of a microgrid infrastructure. While energy storage has not been fully resolved by the Sätra team, they acknowledge its importance and have partnered with Mälarenergi for this. Running an independent electricity network calls for specialized knowledge and proficiency and Mälarenergi possesses the necessary expertise in this field. The Sätra team appears to be on the right track, indicating that implementing and operating an energy community is feasible under their approach. Respondent 3 highlighted that government grants and other funding are vital for kick-starting renewable energy projects in energy communities. In the case of Sätra, funding was obtained through the Swedish Energy Agency's E2B2 funding initiative. However, Respondents 10, 11 and 16 noted that based on experiences from UK, local funding could promote energy community project integration within society but could be limiting as decisions may be investor-driven. They, along with Respondent 1, also emphasized the benefits of community membership, including affordability and accessibility of photovoltaic systems, efficient energy usage, and fostering a sense of ownership and sustainability. As technology advances and costs decrease, they foresee community-owned energy systems becoming mainstream.

4.3 Economical aspect

A potential barrier, as Respondent 16 cited, is the Swedish Tax Agency's rulings on profits for wind cooperatives, which could also be applied for solar cooperatives. With shrinking profit margins and shifting government policies, investors are hesitant to invest in solar and wind power initiatives. Another aspect pointed out by Respondent 7, is that the attraction of energy communities could lead to over-urbanization, counteracting Sweden's rural development goals. Areas with sparse population face challenges with electricity access, maintenance costs, and potentially older infrastructure, impacting electricity tariffs. In addition, with energy community potential projects, other challenges would be added such as long distances between power lines and energy sources, which increase the costs. He suggested considering the entire value chain to understand the influencing factors.

4.4 Social aspect

Residents in Sweden may be skeptical about energy communities due to a lack of understanding of the concept and its benefits, as suggested by Respondent 3 and researchers like Brummer [14], Ghiani et al. [20], and Palm [12]. This skepticism could lead to a lack of support as participation in such communities must be voluntary, as outlined by the European Commission. Additionally, the predominance of economically well-off middle-aged men in energy communities, as highlighted by Respondent 11 and 13, can contradict the non-discriminatory principle of the European Union's directive. The establishment of energy communities can

have social benefits, such as fostering neighborly bonds and promoting renewable energy behavior, in addition to providing education and skill training opportunities. However, Respondent 3 posits that these advantages are not well-understood by the local population. To overcome these barriers, transparent communication and educational initiatives tailored to the public are proposed as effective mitigation strategies. In Sätra, a town with a population of 4000, face-to-face communication could be an effective way of educating residents about energy communities [27]. While there is no record of conducting surveys or workshops so far, an increase in solar installations among Mälarenergi Elnät's customers might signal potential local support for the energy community in Sätra once residents move in. As it stands, Sätra's project team has not implemented any social mitigation strategies yet, indicating potential difficulties in establishing their energy community if local support is lacking post-move. The team's active information exchange with other organizations suggests the possibility of changes being implemented before any issues arise. If the team engages with residents in the future, the social feasibility of the energy community in Sätra could be viable. If not, the project could face the risk of failure.

5. CONCLUSIONS

In conclusion, the development of energy communities in Sweden, such as in Sätra, is currently challenged by several factors, encompassing regulatory, technological, economic, and social dimensions. From a regulatory perspective, the absence of a specific legal definition and a dedicated regulatory framework for energy communities hinders their development. While there are ongoing efforts to create legislation tailored for energy communities, the process is complex and time-consuming. In the meanwhile, energy communities continue to operate under broad renewable energy regulations. One potential solution for overcoming regulatory hurdles is the formation of an umbrella organization that can unify various renewable energy actors and enhance coordination of their efforts. In terms of technology, tackling the intermittency of renewable energy and developing reliable energy storage solutions are seen as vital for the successful operation of energy communities. Cooperation with local grid operators or energy providers is also proposed as a means of achieving a more flexible and integrated energy system. The Sätra project team is making strides in this area, with infrastructural compatibility and partnerships with experts like Mälarenergi Elnät. The economic aspect reveals a few barriers such as the Swedish Tax Agency's rules on wind cooperative profits, investor hesitation due to shrinking profit margins and changing policies, and the risk of neglecting rural areas. Careful consideration of the entire value chain is recommended to fully comprehend these influencing factors. Lastly, from a social standpoint, skepticism and lack of understanding among Swedish residents present challenges. However, with proper education and transparent communication, these barriers could be overcome, paving the way for socially feasible energy communities. The case of Sätra illustrates a path towards a successful energy community despite the existing challenges. Through active information exchange, the team shows potential for managing these hurdles effectively. However, a major determinant of success will be the team's ability to engage with residents, build local support and ensure social feasibility once residents move in. If not well managed, these projects risk failure. As such, the road to energy communities in Sweden may be complex, but it is certainly achievable with strategic and coordinated effort.

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DECLARATION OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. All authors read and approved the final manuscript.

REFERENCE

[1] European Commission. Energy communities n.d. https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en (accessed December 18 2023).

[2] Frieden D, Roberts J, Gubina AF. Collective self-consumption and energy communities: Overview of emerging regulatory approaches in Europe. COMPILE Project 2019.

[3] Mutani G, Santantonio S, Brunetta G, Caldarice O, Demichela M. An energy community for territorial

resilience: Measurement of the risk of an energy supply blackout. Energy Build 2021;240:110906. https://doi.org/10.1016/J.ENBUILD.2021.110906.
[4] Hatziargyriou N. Differences and synergies between local energy communities and microgrids. Oxford Open Energy 2023;2:oiac013. https://doi.org/10.1093/ooenergy/oiac013.
[5] Magnusson D, Palm J. Come Together—The Development of Swedish Energy Communities. Sustainability 2019;11. https://doi.org/10.3390/su11041056.
[6] Ministry of Climate and Enterprise. Sweden's draft integrated national energy and climate plan. 2019.
[7] Bauwens T, Schraven D, Drewing E, Radtke J, Holstenkamp L, Gotchev B, et al. Conceptualizing community in energy systems: A systematic review of 183 definitions. Renewable and Sustainable Energy Reviews 2022;156. https://doi.org/10.1016/j.rser.2021.111999.
[8] Lowitzsch J, Hoicka CE, van Tulder FJ. Renewable energy communities under the 2019 European Clean Energy Package – Governance model for the energy clusters of the future? Renewable and Sustainable Energy Reviews 2020;122:109489. https://doi.org/10.1016/j.rser.2019.109489.
[9] Morris C, Jungjohann A. Energy democracy: Germany's energiewende to renewables. 2016. https://doi.org/10.1007/978-3-319-31891-2.
[10] Seyfang G, Park JJ, Smith A. A thousand flowers blooming? An examination of community energy in the UK. Energy Policy 2013;61. https://doi.org/10.1016/j.enpol.2013.06.030.
[11] Gjorgievski VZ, Cundeva S, Georghiou GE. Social arrangements, technical designs and impacts of energy communities: A review. Renew Energy 2021;169:1138–56. https://doi.org/10.1016/J.RENENE.2021.01.078.
[12] Palm J. New Clean Energy Communities in a Changing European Energy System (NEWCOMERS). 2020.
[13] Busch H, Ruggiero S, Isakovic A, Hansen T. Policy challenges to community energy in the EU: A systematic review of the scientific literature. Renewable and Sustainable Energy Reviews 2021;151. https://doi.org/10.1016/j.rser.2021.111535.
[14] Brummer V. Community energy – benefits and barriers: A comparative literature review of Community Energy in the UK, Germany and the USA, the benefits it provides for society and the barriers it faces. Renewable and Sustainable Energy Reviews 2018;94:187–96. https://doi.org/10.1016/J.RSER.2018.06.013.
[15] Rae C, Kerr S, Maroto-Valer MM. Upscaling smart local energy systems: A review of technical barriers. Renewable and Sustainable Energy Reviews 2020;131:110020. https://doi.org/10.1016/J.RSER.2020.110020.
[16] Creamer E, Taylor Aiken G, van Veelen B, Walker G, Devine-Wright P. Community renewable energy: What does it do? Walker and Devine-Wright (2008) ten years on. Energy Res Soc Sci 2019;57:101223. https://doi.org/10.1016/J.ERSS.2019.101223.
[17] Botsaris PN, Giourka P, Papatsounis A, Dimitriadou P, Goitia-Zabaleta N, Patsonakis C. Developing a Business Case for a Renewable Energy Community in a Public Housing Settlement in Greece—The Case of a Student Housing and Its Challenges, Prospects and Barriers. Sustainability 2021;13. https://doi.org/10.3390/su13073792.
[18] Lazdins R, Mutule A, Zalostiba D. PV Energy Communities—Challenges and Barriers from a Consumer Perspective: A Literature Review. Energies (Basel) 2021;14. https://doi.org/10.3390/en14164873.
[19] Tuerk A, Frieden D, Neumann C, Latanis K, Tsitsanis A, Kousouris S, et al. Integrating Plus Energy Buildings and Districts with the EU Energy Community Framework: Regulatory Opportunities, Barriers and Technological Solutions. Buildings 2021;11. https://doi.org/10.3390/buildings11100468.
[20] Ghiani E, Giordano A, Nieddu A, Rosetti L, Pilo F. Planning of a Smart Local Energy Community: The Case of Berchidda Municipality (Italy). Energies (Basel) 2019;12. https://doi.org/10.3390/en12244629.
[21] Bäckman C, Husblad R, Morén G, Nordström J, Nylander C V., Sidén J, et al. Slutna distributionssystem och interna nät 2022.
[22] Husblad R, Morén G, Nordström J, Vendel Nylander C, Tedebrand L, Whalberg S. Ren energi inom EU, Ett genomförande av fem rättsakter 2020.
[23] Palm J, Sandin J. Energigemenskaper i Sverige. Internationella Miljöinstitutet, Lunds universitet; 2021.
[24] Kooij HJ, Oteman M, Veenman S, Sperling K, Magnusson D, Palm J, et al. Between grassroots and treetops: Community power and institutional dependence in the renewable energy sector in Denmark, Sweden and the Netherlands. Energy Res Soc Sci 2018;37:52–64. https://doi.org/10.1016/J.ERSS.2017.09.019.
[25] Rahmani S, Murayama T, Nishikizawa S. Review of community renewable energy projects: the driving factors and their continuation in the upscaling process. IOP Conf Ser Earth Environ Sci 2020;592:12033. https://doi.org/10.1088/1755-1315/592/1/012033.

[26] Tegan Georges. Semi-Structured Interview | Definition, Guide & Examples 2022.
[27] Capaccioli A. Participatory Design for Community Energy Designing the Renewable Energy Commons. University of Trento, 2018.