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Legal and regulatory challenges to the development of renewable energy communities

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Abstract

The Renewable Energy Directive defines Renewable Energy Communities (REC) as legal entities with open and voluntary participation, controlled by shareholders or members near renewable energy projects. REC aims to provide environmental, economic, or social benefits to shareholders and local areas, focusing on activities like generation, consumption, aggregation, energy supply, and sharing.

The study examines REC practice in Germany and Sweden, focusing on local production and customer engagement. The paper analyzes the legal framework, challenges, and potential improvements. The lack of a legal definition of Renewable Energy Certificates (REC) in Germany and Sweden hinders nationwide development and challenges the Renewable Energy Act of 2021. Germany's lack of a legal framework for self-consumption and energy sharing hinders renewable energy distribution. The government may redesign energy market structures before addressing regulatory frameworks.

Germany's shift towards market systems has negatively impacted the energy market and transition process. The Swedish legal framework lacks legislation for regulating ECs, and proposed law is insufficient. Adopting the Community Energy Plan would benefit national legal frameworks for ECs, but an ambiguous definition makes it difficult to identify ECs for policy measures.

In addition, understanding sociotechnical imaginaries can help formulate more effective energy policies and technologies by considering social values, beliefs, and aspirations influencing energy transitions.

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Abbreviations

CEC	Citizen Energy Community
CEP	Clean energy for all Europeans package
EC	Energy Community
EU	European Union
RE	Renewable Energy
REC	Renewable Energy Community

1 INTRODUCTION

1.1 Background

Climate change and energy-related issues are closely connected to each other. Greenhouse gas emissions largely come from energy production such as oil, coal, and natural gas, and it covers a great number of total emissions which cause global warming. Therefore, the energy transition, for instance, a replacement of energy sources with renewable sources and low-carbon sources, is essential. The renewable energy community (hereafter: REC) is the collective citizens' action of participation in renewable energy production at the local level. An installation of renewable energy can vary in size and sources of energy, but regardless of them, an important point is that the citizens will benefit from it. Recently, the idea of a REC is gathering attention across the globe, as this concept has the potential to increase renewable energy and contribute to a decarbonized society. By introducing the REC, citizens will be able to improve energy security. For instance, by consuming energy produced in the community by generating electricity, they can secure their energy supply and would have less risk to face electricity shortage. Also, a transition of energy sources from fossil fuels to renewable energy will enhance sustainable energy use, which also will contribute to the decarbonization of the energy sector.

However, there are some legal and regulatory challenges to the development of renewable energy communities. Legal challenges of establishing a REC and the absence of incentives for renewable prosumer projects are the main regulatory barriers faced by collective prosumers. Legislative changes can create uncertainty for prosumers, and the legal gaps are particularly notable concerning the RECs. In addition, collective prosumer laws often take a one-size fits all approach that may limit the potential for further innovation.[1]

This paper will introduce a concept called “sociotechnical imaginaries” defined by Jasonoff and Kim.[2] Sociotechnical imaginaries refer to collectively shared visions of desirable futures that involve both technological advancements and social practices.

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[1] Campos et al. 2010, p.8-9.

[2] Tadeusz 2021, p.221.

These imaginaries are influential in shaping public discourse and policy decisions about science, technology, and innovation. In the context of energy, sociotechnical imaginaries can shape attitudes toward energy production and consumption and influence the development and implementation of energy policies and technologies. Understanding the sociotechnical imaginaries related to energy can provide insights into the societal values, beliefs, and aspirations that shape energy transitions and help to create more effective energy policies and technologies.[3]

1.2 Purpose and research questions

The primary objective of this thesis is to know the positive role that the REC can play in society and the difficulties from a legal perspective. This paper will explain the situation of the REC under the current legislation in the EU. Implementing the REC could be a possible solution to tackle the energy crisis and mitigate the impact of climate change in the next decades across the globe.

The main research question of this thesis is what the legal barrier is to establish and developing a REC in the EU. To address this question, several sub-questions will follow:

- Who can participate in the energy community and how can it be developed?

- How the renewable energy communities' guidelines and EU directives are adopted into their national legislation in the EU? How the State is successfully implementing the renewable energy targets into their national legislation?

- What are the mechanisms of sociotechnical imaginaries?

- How can the idea of sociotechnical imaginaries enhance renewable energy, and at which level should it be considered?

- Are current directives working enough to develop and increase the number of energy communities? or the new change needed to be made?

[3] Tadeusz 2021, p.220-222, 224-226.

1.3 Methodology

In this thesis, legal doctrinal research will be used since the goal of doctrinal research is to accurately describe the current status of the laws. Doctrinal research also includes evaluation of the existing laws, which can bring a normative comment on the proposed legislation, after the descriptive work.[4] This thesis will focus on the EU Directives and national legislation of relevant countries. It is necessary to reflect on and evaluate the current legal system in order to discuss the limitation of the legal system on the development of the REC. Then, this research will enable us to classify the components and organize what is important in this issue. An internal perspective will be taken in this thesis as a legal researcher usually take an internal perspective in legal research by justifying and criticizing research in regard to internal legal practice standards.[5] It is also more suitable to take the legislature's perspective than the judge's in this context. It is necessary to think and address the issue from the decision-makers view, then it will be able to examine how much of the consequences can be brought by new legislation in practice.

1.4 Scope

This thesis will focus the research on the REC within the EU. This is because the EU is the leading role in addressing climate change and energy transition, and renewable energy is increasing all over the EU. Under the EU Directive, some Member States have implemented renewable energy communities in their countries and successfully developing. This paper chose Germany and Sweden as case studies and make a comparison between the two countries to analyze the legal framework and how they implement the EU directive into national laws.

1.5 Structure

First, the paper will make an overview of the content of the energy communities, especially, the REC. By looking into some pieces of literature, the EU directives, and legislation, this paper will explain how the REC is socially and legally defined and considered.

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[4] Sanne 2010, p.3.

[5] Ibid. p.7-11.

Second, this thesis is going to study the REC in Germany and Sweden. In particular, the following topics will be explained: The current legal framework and its feature, the participation of self-consumers, the current situation of the energy market, and legal and regulatory challenges with their legislation.

Third, this paper will present a comparative analysis of the legal framework from Germany and Sweden. Also, a discussion on the current challenges that renewable energy communities are facing will follow. Not only legal and regulatory challenges will be discussed, but also other challenges from different aspects will be discussed. Through the discussion of regulatory and legal challenges, this paper is going to point out some potential improvement of the legal framework of REC and will discuss about the relation between sociotechnical imaginaries and energy transition.

2 THE ENERGY COMMUNITY OF THE EU

This chapter will focus on taking an overview based on some works of literature, the Clean energy for all Europeans package[6], the Renewable Energy Directive, and the Electricity Directive.

2.1 Literature review

To achieve a low-carbon and sustainable society, the energy transition should have a key role in this topic. In this paper, when it comes to the energy transition, it is not only about the energy source transition but also the transition of the energy system matters. The transition of the energy system, for instance, from a centralized to a decentralized energy system is necessary for the future of our society. Currently, lots of places in the world have a centralized energy system, in which the energy is generated initially in large power plants located distant from consumers, then it is transmitted with high-voltage wires and distributed to consumers through electrical power grids.[7] On the other hand, in a decentralized energy system, smaller power plants generate the energy and distribute it to neighboring consumers. The author of this paper believes that a decentralized energy system is important in the energy transition because it will secure the energy supply and enhance the efficient use of energy. In the decentralized energy system, energy prosumers can play a significant role and also develop renewable energy. Prosumers can produce a moderate amount of energy and consume it as much as they need. Also, prosumers can be collectively participate in energy market and form an entity. The size of collective prosumers can vary from small group of household or companies to municipalities. This paper use the term: energy communities to refer to this topic. Many pieces of literature have discussed about the collective prosumers with a focus on a variety of different concepts of energy communities such as REC, CEC, and clean energy community.[8][9] REC and CEC will be further discussed in the following paragraphs.

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[6] Hereafer, CEP

[7] Hive Power, 2022

[8] Campos et al. 2010, p.1.

[9] European commission, “Energy Communities”

Clean energy community is the broader concept of REC, which is discussed in a literature by Gui and MacGill. They define clean energy community as "social and organizational structures formed to achieve specific goals of its members primarily in the cleaner energy production, consumption, supply, and distribution, although this may also extend to water, waste, transportation, and other local resources."[10] Referring to their definition, this community isn't confined to a specific location, thus it can range in size from a small group of households to a large group of household, or even to the business groups. Also, the members of this community can have different objectives and interests such as benefits to the economy, society, and environment to the members of the community.[11]

2.2 Clean energy for all Europeans package

In 2019, the EU introduced the idea of energy communities in its legislation through the CEP, specifically as REC and citizen energy communities. The CEP provides provisions designed to help local communities in taking roles in the energy transition through the idea of energy communities in recognition of the key role those local actors, specifically citizens play in the process of the energy transition.[12]

It also aims that the transition to a decentralized energy system where consumers play a greater part in the process will bring more transparency and opportunities for citizens to make their own choices regarding what form of energy they're willing to use would. With this legislation under the CEP, prosumers and energy communities will be enhanced and developed.[13]

The CEP introduced the energy communities in the EU, followed by legally defining and regulating the renewable energy directive and electricity directive.

[10] Emi and Iain 2017, p. 95.

[11] Ibid. p. 96.

[12] European commission, "Energy Communities"

[13] Clean energy for all Europeans package, 2019, pg.13.

2.3 Renewable Energy Directive

Renewable energy directive[14] defines REC in its provision. Article 2 (16) defines REC as

"a legal entity that, in accordance with the applicable national law, is based on open and voluntary participation, autonomous, effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities."[15]
It is important that participation in REC is open and voluntary, but only participants with some conditions can be a member of REC. Also, the REC has a narrow scope on a local community that owns and develops the RE project in their community, thus it has a restricted vicinity.

The primary purpose of REC is "to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits."[16] This ensures the local community will directly benefit from the energy system. REC can exercise activities related to RE sources, for example; generation, consumption, aggregation, energy supply, and sharing.[17]

The renewable energy directive also introduces another concept of energy prosumers called jointly acting renewable self-consumers. According to the directive, it is "a group of at least two jointly acting renewables self-consumers…who are located in the same building or multi-apartment block."[18] This concept has a much narrower geographical scope for instance in a single household who lives in the specific location.

[14] Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources

[15] Renewable energy directive art.2.16(a)(b)

[16] Ibid. art2.16(c)

[17] Ibid art22.2, 4

[18] Ibid art2.15

2.4 Electricity Directive

The citizen energy community[19] is the concept that is introduced in the Electricity Directive.[20] According to the directive, a CEC is "a legal entity that is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises."[21] This concept is similar to the REC, however, it has different scope when it comes to the activities that the communities can engage in. The activities of the CEC are only limited to the electricity sector, while REC can engage in any form of activity related to RE.

The CEC aims at providing "environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits"[22], which shares a similar primary purpose with REC. On the other hand, there are some differences between these two energy communities. The CEC does not have a geographical limitation, which implies that the size of the community can be very large and not restricted by location. Also, wider participation can be involved in this community since there's no limitation of location.

These different concepts of EC are established under the CEP, and the ideas are widely shared with the EU member states. However, at a national level, the implementation of these energy communities would face some challenges regarding the existing energy system and energy market within their own territories. In the following chapter, this paper will continue with a discussion and research on REC in two EU states, Germany and Sweden.

[19] Hereafter, CEC

[20] Directive (EU) 2019/944 on common rules for the internal market for electricity

[21] Ibid. art2.11(a)

[22] Electricity directive, art2.11(b)

3 RENEWABLE ENERGY COMMUNITIES PRACTICE IN GERMANY

This chapter will illustrate the analysis of REC practice in Germany. It aims to provide an overview of the development of community renewable energy in Germany as of lately, to analyze the status of the RE directive implementation and transposition, and to figure out the extent to which the government accomplishing in establishing favorable conditions for the development of REC in the country.

3.1 Current legal framework and its feature

Community energy development in Germany has been greatly enhanced by the national legislative and regulatory framework. In Germany, REC, in which community citizens and local businesses jointly own and operate renewable energy projects, is especially growing rapidly. These community projects are accomplished through a variety of renewable energy technologies, including wind and solar power.

The German government has taken policy measures to support the development of REC, mainly with feed-in tariffs and premiums. Long-term feed-in tariffs and premiums have established safe investment conditions, while purchase assurances and priority renewable energy feed-in have provided investors with planning stability. Small-scale, locally-based renewable energy producers are benefiting the most from these initiatives. Low-interest loans from public banks have made it easier for energy communities to develop, while amendments in the Cooperative Law passed in 2006 made the regulations for creating energy cooperatives easier. Community wind farms have also benefited from subnational policies in a number of federal states in the form of financial assistance, networking opportunities, capacity building, and advice. The growth of community energy in Germany has been successfully promoted by the integration of national and sectoral strategies across several governmental levels.[23]

[23] Krug et al. 2022, pg.6

However, Germany falls behind other states in regard to implementing REC-relevant provisions into its national laws. Germany's recent amendments to the Renewable Energy Sources Act[24] have not fully incorporated REC provisions, resulting in gaps in transition. German law does not officially establish RECs, thus there is no regulatory framework for members of REC to share energy.

Renewable Energy Sources Act (EEG 2017) introduces the term, citizen energy company called Bürgerenergie in German. Bürgerenergie is a citizen's community that "consists of at least ten natural persons, …in which at least 51% of voting rights are held by natural persons, from the district in which a wind farm is installed, and in which no member holds more than 10 percent of the voting rights."[25] [26] This concept is similar to RECs, but there are no comparable terms for other RE sources.

3.2 Participation of self-consumers

In Germany, citizen-led renewable energy projects are common, notably in relation to wind and solar energy, as a consequence of attractive regulatory environments like feed-in tariffs. In Germany, the initiative for renewable energy can be seen as a drive-by-profit movement rather than a strictly voluntary one. Financially advantageous investments have a great interest to citizens.

[24] 2017 revision of the Renewable Energy Sources Act (Renewable Energy Sources Act (EEG 2017))

[25] 2017 revision of the Renewable Energy Sources Act, section3.15

[26] Campos et al. 2010, p.6.

According to the Rural Energy Community Advisory Hub, the number of energy cooperatives in Germany is increasing in the last few years, especially RE cooperatives illustrate a rapid growth. Below are the statistics related to RE energy collectives:[27]

- 914 renewable energy collectives
- 220,000 members are involved
- €3.3 billion invested so far in RE
- 3 million tons of CO2 emissions prevented in 2021
- 8 Twh community-owned electricity generation in 2021
- 3.5 % share of the total renewable electricity generation in Germany
- 95% of members are individuals, 4% are companies and banks and 1% are farmers (In Germany, the main participants in community energy are "citizens' energy companies (Bürgerenenergiegesellschaften), individual owners, and energy suppliers."[28])

This paper will introduce some good practices of REC in Germany.

The Lower Saxony community of Jühnde, where around 800 people live is the country's first village to generate heat and energy from biomass resources while maintaining a CO2-neutral balance. To adapt to changing demand for heat and electricity, biomass can be utilized flexibly. The Jühnde model intends to shift the whole village to renewable biomass derived from nearby agriculture and forests in place of fossil fuel-based energy sources. Over 70% of the local population joined the cooperative after paying a membership fee and making an investment to connect their residences to the district heating system in order to organize and obtain investment subsidies for the project.

[27] Rural Energy Community Advisory Hub

[28] Mergner and Rutz 2014, pg.5

Three primary components make up the energy plant: a biogas plant that co-ferments liquid manure and silage from different energy crops, a wood chip boiler that burns local wood chips, and a district heating system that serves 145 homes. With a combined heat and power plant with an electrical output of 700 kW and thermal power of 750 kW, the biogas turns into electricity and heat. The wood chip boiler, which has a heating capacity of 550 kW, is able to keep up with the homes' constant need for heat during the winter thanks to two 50 m3 hot water storage tanks. In addition, a backup conventional oil boiler with a 1,700-kW peak load is used in the event that the biogas or wood chip boilers fail.[29]

The entire project was implemented in the community over a total of roughly five years. Having qualified local specialists prepared to share transparent information about the project, including its obstacles and issues, was essential to this project. To encourage the local community to participate in the project, multiple advertising campaigns were carried out through village meetings and newsletters. Due to the municipality and the actively involved local community, the bioenergy village was successfully developed.[30]

Figure 1: The bioenergy plant in Jühnde (source: Hannoverschen Allgemeine)

[29] IEA Bioenergy Task 37

[30] Mergner and Rutz 2014, pg.10

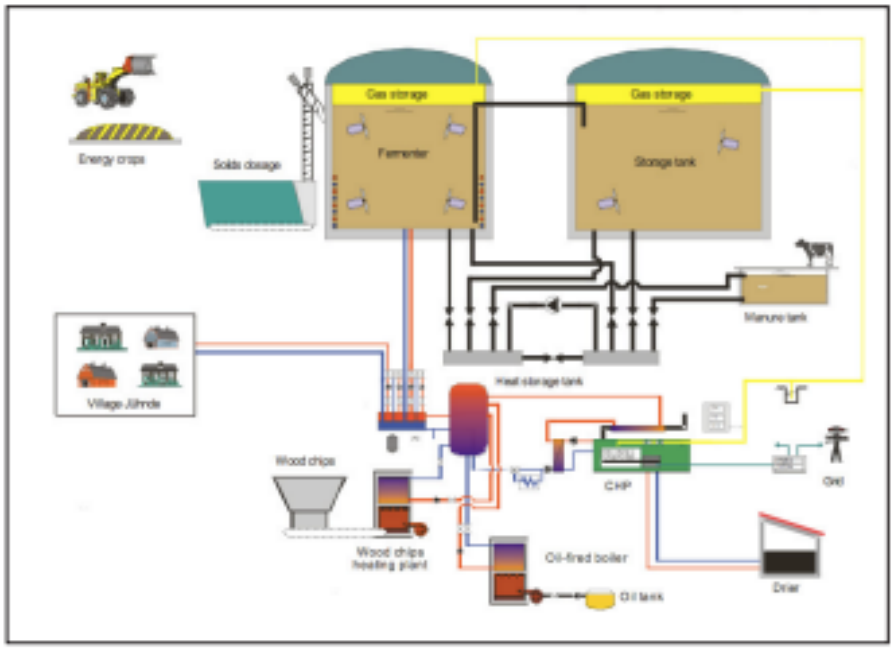

Figure 2: The Jühnde bioenergy plant's graphic image (Source: IEA Bioenergy Task 37)

The Jühnde project illustrated that an engaged village community and a strong social network are necessary to achieve a significant percentage of involvement of individuals connected to the local community. Citizens' investment and contribution to energy generation, and also through organizing community energy projects will be able to aim to strengthen the democratic structures of the community. Individuals could only have a limited amount of resources, yet by collecting money, knowledge, and effort, larger-scale biomass, wind, and solar power projects can be established at a local level.[31]

Another example of REC in Germany is an EC in Heilbronn, a town in southwestern Germany, a local REC is highly active and visible throughout the town. The cooperative, established by anti-nuclear energy activists in 2010, now has 1,150 members and owns two wind turbines and 48 solar farms. These solar panels can be found in various buildings such as homes, kindergartens, schools, municipal buildings, and factories throughout the town. The cooperative's clean energy, combined with other collectively owned renewable sources, provides electricity for around one-third of Heilbronn's households.[32] It is also a successful practice of collective prosumers.

[31] Mergner and Rutz 2014, pg.5

[32] Hockenos 2021, Yale environment 360

3.3 Situation of the energy market

Under the CEP, the EU encourages communities and individuals to actively engage as participants in the European energy market and facilitate citizens by giving them a stake in the energy transition because they are believed to play an important role in the clean energy transition.

In 2022, Germany has approximately 45 % of RE sources in energy production. Within the share of RE, wind offshore, solar, and biomass are the primary energy sources. This data shows Germany is gradually developing the RE in its energy production, but the share of RE sources can expand more if Germany could implement the REC into their legislation.

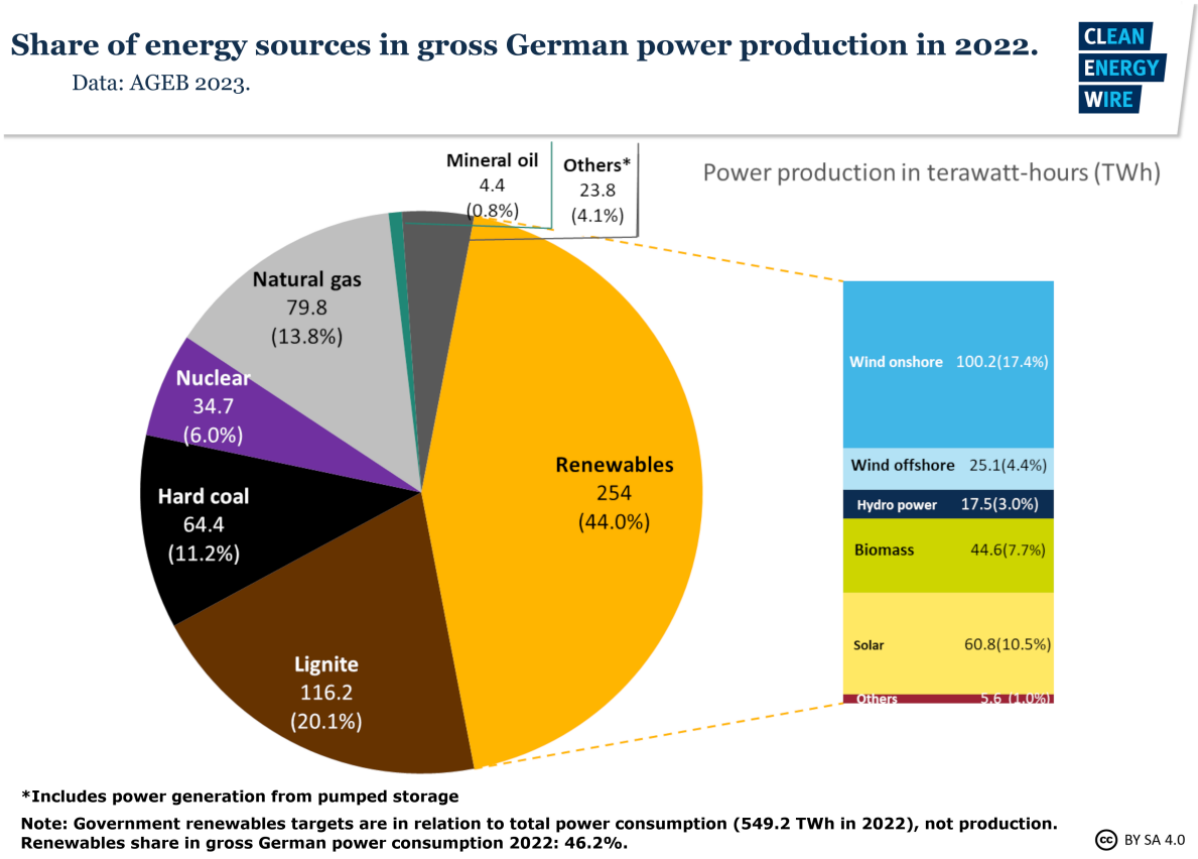

Figure 3: Share of energy sources in production in Germany (source: Appunn,Haas, and Wettengel 2023)

According to the RE directive, the REC has a right to "access all suitable energy markets both directly or through aggregation in a non-discriminatory manner. "[33] Self-consumers of any kind can engage in the energy market directly and by aggregators. However, in order to directly participate in the energy market, they must register as an energy supplier and be issued a supplier permit. The literature points out that this process has burdensome rules and regulations and may be exceedingly costly for citizens.[34]

Also, Germany discontinued feed-in-tariffs, and price subsidies given to smaller producers of RE, which significantly encouraged the grassroots energy movement. This is because financing the development of RE has eventually increased the price of electricity. Additionally, Germany began hosting auctions in 2017 to create huge renewable energy projects, which has made bottom-up EC initiatives more difficult to implement. Given that, larger solar power plants, biomass, onshore and offshore wind, and other projects have been able to participate in auctions where only the lowest-priced offers are chosen to be compensated contracts. The "price only" selection approach is part of the auction design; in other words, the required support level for the electricity serves as the only criteria for the award. [35] The withdrawal of the feed-in-tariff/premium system and the shift to auctions was an idea that benefits larger businesses and on the other hand, smaller participants were likely to be placed in a disadvantageous circumstance in the energy market, which resulted in a decline in number of EC in the market.[36]

[33] Renewable energy directive art.22.2(c)

[34] Campos et al. 2010, p.6.

[35] Krug et al. 2022, pg.6,7

[36] Hockenos 2021, Yale environment 360

3.4 Legal and regulatory challenges

A significant barrier to the REC in Germany is that a legal definition of REC and the regulatory framework to develop REC in the country is still missing from national laws and legislation. The criteria for RECs as specified in the RE directive may already be informally met by many existing energy communities in Germany. However, there is no legal definition of REC in German law that accords entirely with the RE directive, though are some similarities between the concept of REC in the RE directive and the legal term citizen energy company; Bürgerenergie which was created in Renewable Energy Sources Act (EEG 2017). However, German law does not explicitly provide a substitute for the purpose of REC as stated in Art 2.16 of the Renewable Energy Sources Act. [37]

Moreover, there is no counterpart for the other RE, and the definition of a citizen energy company in German laws only applies to wind energy in a very narrow context. The group of potential participants for a citizen energy company is broader than what the RE directive had intended for REC in its provision. The authorities and activities of the REC described in RE directive Art. 22.2 are not specifically defined under German law. Entities that meet the requirements of a REC are able to produce, consume, store, and sell RE from their community, even though they don't have the formal legal authority to do so. Nevertheless, there is no legal framework that would let REC members share generated RE by the community as a whole.[38]

Another obstacle in Germany is the economic factor. Due to high investment costs compared to a few subsidies, individuals and small groups of households are less interested in remodeling their community to REC. This results in less participation in the establishment of the EC and hinders the growth of it in the country.

The author of this paper thinks that the establishment of a legal definition and supportive regulatory system is essential in Germany in the first place to enhance and develop the REC to achieve a clean energy transition and sustainable energy system.

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[37] Krug et al. 2022, pg.7

[38] Krug et al. 2022, pg.7

4 RENEWABLE ENERGY COMMUNITIES PRACTICE IN SWEDEN

In Sweden, not only REC, but the EC itself is not a common concept, unlike Germany. This paper will argue that Sweden is behind the other countries in developing energy communities, mainly because there are no regulations on any kind of EC existing in Swedish legislation.

4.1 Current legal framework and its features

As it is mentioned previously, the concept of energy communities has not yet been properly integrated into legislation by the Swedish government, and it is the process of adopting relevant directives into national law is currently in progress. Nevertheless, the Swedish Energy Regulator (hereafter: Ei) has proposed how to implement the national legislation in 2020.[39]

In the following paragraphs, this paper will introduce the proposed legislation by Ei, based on the literature by Palm.

The five chapters form the framework for Ei's draft law on the EC. Chapters 1, 4, and 5 focus on energy communities in general, whereas Chapters 2 and 3 respectively address CEC and REC. According to general regulations, an EC is required to be created by three or more natural or legal people. As an economic association, an EC needs to be registered and according to the Ei, the economic association is the most ideal organizational form since it is practical, has an easier administrative transition demand, and is not restricted by regulations, for instance, limited business. This is in line with the CEP’s goal of minimizing red tape in energy system.[40]

Also, the EC must provide economic, social, and environmental benefits to its members in the legislation. The EC aims to support its members through energy-related services, including generation, transmission, distribution, consumption, aggregation, storage, EV charging, and energy efficiency services EC members are able to join at any time and withdraw from the EC at any time.

[39] Energimarknadsinspektionen. Ren Energi Inom EU; Ei: Eskilstuna, Sweden, 2020

[40] Palm 2021, pg.7

The law on economic associations, which is the basis for governance, is referenced in the law on the EC. The concept distinguishes between non-funded and funded members, imposing stricter regulations on the latter.[41]

A concept of the EC is proposed by the Ei with two applicable definitions: citizen energy communities and REC. It is expected to establish one concept that will function as a basis for both the citizen EC and REC and should encourage the development of the concept at a national level. The primary purpose of energy communities is clear and shared with the RE directive, which is to "provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates"[42] However, Ei added that an objective is also to distribute power among its members, which requires no grid ownership.

Ei proposed a new comment on the geographical limitation and the participant. Ei stated that only citizens who live or work in the energy communities' geographic region or who have some kind of continuing grid connection to the area are eligible to become a member of REC. Moreover, according to the Ei proposal, cross-border participation in REC is not permitted, even though the RE directive doesn't mention about it.

The Ei's proposal seems to include the essential criteria of EC, as transparency of participation and membership of energy communities' rejection are discussed. Also, a member's ability to discontinue their membership covers the voluntarism aspect of the concept. Limitations on membership eligibility which are based on location enable RECs to be managed effectively.[43]

[41] Palm 2021, pg.7

[42] Renewable energy directive art.2.16(c)

[43] REScoop.eu. 2023

4.2 Participation of self-consumers

There are several types of joint ownership of energy in Sweden, including solar plant ownership and wind power associations. Aside from providing individual flats, some tenant-owner associations also hold solar cells together and use them for shared consumption. All of these current cooperatives have the option to eventually become ECs, but they are also entitled to carry on operating in the same manner as they do now. Nothing in the draft law requires current cooperatives to transform into ECs.[44]

This paper is going to discuss the REC in the village of Simris in Sweden. With around 200 residents, a small Swedish village is now a community that uses only renewable energy sources. Simris can be found in one of Sweden's windiest and sunniest regions. In this community, by integrating solar panels, wind turbines, battery energy storage, efficient energy management, and a completely dedicated citizen EC, uses a creative strategy to deliver locally generated power.[45]

Figure 4: Visual image of Simris (source: Housing Europe)

[44] Palm 2021, pg.8,9

[45] Housing Europe

The project gave the citizens of Simris the capacity to generate and store their own energy from renewable sources, promoting the development of an active and resilient community. The battery energy storage devices were offered to ensure that locally produced power could be stored for occasions in which there were times of excess and so that locals could have access to renewable energy whenever it became necessary but could not be produced, particularly at night. Furthermore, the grid, which serves as the basis of the community, remains balanced due to the battery storage. The unique electricity system in Simris is supplied with power by the smart control system. Also, it monitors the voltage 50 times per second and makes sure that the local electricity generation meets consumer demand and usage.[46] The electricity can be stored in a big battery when there is wind, sun, and little demand for energy. The energy system links to the main grid and transmits surplus production after it is completely charged.

The objective of the project was to establish a prosumer community of active citizen energy consumers or individuals who generate and use local RE simultaneously. Simris's EC is considered as an iconic example of the best practice of REC. The Simris residents were aware of the significance of using renewable energy in the transition to a sustainable energy source. Moreover, each of them played a role in their adaptation, whether they were prosumers, producers, or consumers of locally produced RE.[47]

4.3 Situation of the energy market

Regardless of the good practice in Simris, Sweden has fewer energy communities and lacks the practice compared to other member states in the EU. An article point out that the

[46] E.ON Energidistribution (elnät). 2022

[47] Ibid

centralized energy market structure of Sweden is the main factor of it. The centralized market structure of the Swedish energy industry, where hydro and nuclear power are the primary sources of power and held by a small number of national or international businesses. The significant role of communities as producers of gas, electricity, and district heating is another notable characteristic of Sweden that can help to clarify the relatively small number of citizen engagement.[48]

4.4 Legal and regulatory challenges

A significant lacking factor of REC in Sweden is that there's no legislation related to energy communities in national law. Although there are some collective self-energy consumers, the concept of energy communities is not yet implemented into Swedish legislation. Through the proposal by Ei, the term EC is introduced, but some argue that this term can be seen as a strange word in the Swedish language. In Swedish, the citizen EC is translated to Medborgargemenskap and REC is translated to Gemenskap för förnybar energi.[49] The concepts are simply translated here into Swedish, but the words seem difficult to adapt to the Swedish language. Some energy agencies commented that the EC is a complicated and inconvenient concept, and the Swedish word "kooperativ" means cooperative, which is deeply rooted in Swedish culture, so they argued that the use of the word "cooperative" is more appropriate to refer to the EC.[50]

Also, the ambiguity of the proposed law is claimed by some authorities in Sweden. They argued what obligations and rights an EC would be given as well as how ECs distinct from current actors in the traditional energy sector are too vague to be implemented into national law.

[48] Palm 2021, pg.6,7

[49] Ibid, pg.9

[50] Palm 2021, pg.9

According to the Swedish Energy Agency, further research is necessary to determine the function of energy communities because they appear to be ambiguous terms adaptable to several interpretations. The Energy Agency stated that the Ei had a narrow interpretation of the CEP's objective regarding energy communities. The Energy Agency added that to what extent energy communities would be entitled to withdraw from particular elements of the current or proposed legislation is unclear in the context. The directive's implementation and adoption of the new law could have a direct impact on the existence of multiple projects currently being conducted in Sweden.[51]

[51] Ibid

5 COMPARATIVE IDENTIFICATION AND DISCUSSION OF THE LEGAL AND REGULATORY CHALLENGES IN THE DEVELOPMENT OF THE RENEWABLE ENERGY COMMUNITY

This chapter will discuss the comparative analysis of the legal framework related to REC in Germany and Sweden, as explained in the previous chapters. Also, this paper will discuss some challenges besides the legal and regulatory challenges of the REC.

5.1 Comparative assessment of the legal framework

Based on the previous chapters of this paper, we will analyze the current legal framework of Germany and Sweden.

Under the German legal framework, there is no legal definition of REC and it is considered to be a significant problem in developing REC nationwide. Without a legal framework, it is complicated and challenging for the government and municipalities to practice. Failures in the transposition resulted from the RE directive's provisions not being fully and promptly included in the most recent revisions to the Renewable Energy Act of 2021. There is no official legal definition of REC in German legislation that is in line with the RE directive, even though several existing energy communities may meet the conditions of the REC stated in the directive. There are some similarities between the concept of REC and the term citizen energy company; Bürgerenergie in German laws, yet there are also differences in extent, and the absence of a comparable term and concept for other RE sources is a big concern of the German legal framework.

Also, the right to produce, consume, store, and sell RE is unhindered in Germany for entities that meet the criteria for a REC, notwithstanding the lack of specific legal definitions for the rights and activities stated in Article 22.2 of the RE directive. Article 22.2 of the RE directive states that:

Member States shall ensure that renewable energy communities are entitled to:

(a) produce, consume, store and sell renewable energy, including through renewables power purchase agreements;

(b) share, within the renewable energy community, renewable energy that is produced by the production units owned by that renewable energy community, subject to the other requirements laid down in this Article and to maintaining the rights and obligations of the renewable energy community members as customers;

(c) access all suitable energy markets both directly or through aggregation in a non-discriminatory manner. [52]

However, REC members are incapable of distributing the RE generated in the community as a result of the absence of a legal framework for self-consumption and energy sharing. Some suggest the government intends to significantly redesign the structure of the energy market, including the complicated network of surcharges, fees, and taxes, prior to proceeding to deal with the regulatory framework.[53]

The growth of the EC in Germany for the past decades was significantly supported by the beneficial legal and regulatory environment. Especially, feed-in tariffs had greatly developed the EC in Germany.

In Germany, where the public's participation has historically been essential to the growth of RE, there is a shift toward a greater reliance on market systems.

[52] Renewable energy directive art.22.2

[53] Krug et al. 2022, pg 8

For instance, the implementation of a required market-premium system in 2014, the lowering of feed-in tariffs for solar power plants in 2012, and the final transition from feed-in tariffs to a tender-based system in 2017. It is predicted that this will benefit major energy providers at the expense of smaller businesses.[54] This transition also led to a decrease in the number of energy communities in the national energy market. It can be said that this circumstance is not preferable for the energy market as a whole, but also it will affect the process of energy transition in Germany after all.

Thus, it is difficult to study gaps between the implementation of EU directives in Germany and the directive itself as the legislative amendments enacted so far do not contain specific requirements on energy communities. [55]

In the Swedish legal framework, currently, the legislation that regulates the EC in own country doesn't exist, and the proposed law by Ei is not solid enough as the legal framework. A favorable legal framework is necessary for the development of ECs, based on earlier studies. The absence of national regulations and legal definitions of ECs was a primary factor in assessing the development of ECs in a country. The national legal frameworks for ECs will benefit from the adoption of the CEP. At the same time, it's critical to recognize the necessity of national adaptation and to create localized ECs. An excessively limited definition poses a risk of excluding previously established options because the ways in which existing ECs and community energy systems are developing vary across the EU. A broad definition would let the development of new types of businesses and enhance the growth of ECs.

[54] Bauwensa and Devine-Wright. 2018, pg 623

[55] Biresselioglu et al. 2021, pg14

However, an ambiguous definition creates it harder to identify ECs for particular policy measures and provide assistance. Consequently, there are advantages and disadvantages to Sweden's new EC legislation.[56]

Through comparative analyzing the legal framework of Germany and Sweden, the author of this paper noticed the common factor of both frameworks

German framework and Swedish framework are not very similar but are different in the status of the legislations of ECs, participation of citizens, and national energy market. However, they seem to have a lack of incentive for EC and REC in general.

As the German energy market changed its system from feed-in tariffs to auction pricing design, large businesses and companies benefited from it due to their economic capacity, however, small-scale participants such as individuals and local communities tend to be placed in a disadvantageous position in the energy market. If the larger entities will likely win the auction and then the small-scale participants' group is at a competitive disadvantage, there’s no incentive for them to engage in EC. Also, under this energy system, it is reasonable that the citizens' participation would decrease since they are not willing to pay high costs for installation if they’re not getting subsidies from the government.

Likewise in Sweden, The advisory groups emphasized the absence of incentives for EC development and uncertainty around the benefits of participation for citizens. Some of them intended an exemption from taxes for ECs. They were additionally concerned that the fact that ECs will not benefit is troublesome to encouraging ECs and for EC cost-effectiveness. Thus, energy generated for an EC's own consumption shouldn't be liable to an energy tax.

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[56] Palm 2021, pg.11

The Swedish Solar Commission recommended it too because they believe that a self-produced RE tax exemption would encourage people to join an EC.[57]

[57] Palm 2021, pg.10

5.2 Current challenges

In this section, the paper will further discuss the major challenges of the development of REC.

5.2.1 Lack of awareness

An obstacle to the development of REC is the absence of a clear and well-accepted legal definition of communal energy. Excessively broad definitions have occasionally led to financial benefits for projects which, in reality, are contrary to the definition of community energy offered in the EU directive. Initiatives like these could arise a risk of weakening the impact of the EC concept on society, blurring its positive message, as the important role in energy transition which can contribute to the clean energy system. Moreover, an incorrect way of using the term EC in different energy projects can influence citizens in a bad manner, resulting in harming its reputation. If this happens, fewer citizens and communities will likely participate in REC or even the energy market.

When the citizens and society obtain the correct knowledge about the REC and a solid and widely accepted definition is established by a legal framework, more and more citizens would participate in REC, then the REC can develop in the nation.

5.2.2 NIMBY

Social acceptance of RE technologies by the local community is also essential in the development of REC. The local population's objections to new energy infrastructure especially to RE could be a barrier to clean energy transition. This social movement is called NIMBY (Not in my backyard).

Even if the citizens understand the benefit of the installation of REC in their community, there’s always opposition to building large infrastructures such as solar power plants, wind farms, and hydropower plants in a location close to their house or community. A group of citizens known as NIMBYs oppose development initiatives that are introduced by their governments when they are adjacent to their area of residence.

The primary challenge is that NIMBY people will oppose these projects, which will be conducted in a location close to their homes because they believe that the large infrastructure can often impact the community's appearance and landscape, and ruin the nature of the community, or influence the number of new residents to the community. As a result, even though the installation of such RE power plants adjacent to their neighborhoods is beneficial to the sustainable growth of the community itself and establishing a clean energy system, there are citizens protesting against this installation. However, NIMBY people will more likely support such energy projects when they were placed anywhere else, for instance, a lot further from their houses.[58]

The installation of these RE power plants is an extremely large land-use footprint, thus it is clearly one of its disadvantages. It takes a lot of lands to install many of these wind turbines and solar panels, as well as the transmission lines required to transport the energy from place to place so that citizens can access the electricity. This leads to many conflicts over land use. Thus the government has to consider the approach that they will going to handle all those conflicts if they are going to install this energy system. It is a complex problem, as citizens want projects for the common good to be established, such as affordable housing, rail, roads, and renewable energy sources, yet they are against getting anywhere near those projects.

On the contrary, the Please in My Backyard (PIMBY) phenomenon arises with farmers in the American Midwest welcoming wind turbine installation. This is completely the opposite idea of NIMBY.

[58] Reis, the Atlas report, 2023.

In light of concerns about noise, its impact on animals, and the industrialization of the natural environment, wind turbines have encountered criticism in numerous places across the world. However, in the Midwest of the US rural areas, citizens are welcoming wind farms and have a PIMBY attitude toward power plant installation.[59]

Along with the financial benefits, wind turbines are well received in these towns due to a cultural attraction to link prosperity and technology with machinery employed for constructive reasons. Farmers in the Midwest experienced a two-step process and a change in argumentation to be recognized as modern. In response to urban disputes and prejudices, farmers first formed an ideology of rural capitalistic modernity, which grew stronger throughout the Cold War. Eventually, this gave rise to an ultramodern discourse in which farmers considered themselves technologically advanced as well as significant on a worldwide scale. [60] This acceptance of energy plants installation which is PIMBY has its roots in a historical process when farmers developed an ultramodern identity and used technology to preserve their rural values and deny prejudices enforced by other urban communities.

Farmers' optimistic opinion of themselves as sophisticated technology users and compatibility with their long history of defining rural identity on machinery can be seen in their positive attitude toward wind turbines. The study highlights the importance of the value of cultural attitudes and technological ideologies in communities in order to understand their acceptance of wind turbines.

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[59] Brinkman and Hirsh, 2017, pg.335-339

[60] Brinkman and Hirsh, 2017,pg339-353

The article written by Brinkman and Hirsh emphasized Anthony Giddens' notion of modernity as a mental condition and emphasizes the idea of rural capitalistic modernity, which saw mechanization as a representation of American cultural standards and strengthened farmers' identities as contemporary, independent business owners.[61]

However, PIMBY is not a common attitude of the citizens toward the installation of RE power plants in the community. Thus NIMBY hinders the development of REC in many places across the world.

5.2.3 Financial challenge

Financial challenges are related to the incapacity of communities to raise capital and their absence of access to funding from outside of the country. Particular attention is given to this issue in developing countries. Energy communities could possibly be able to pay off loans on time with the revenue generated from their energy projects, but supplying the capital necessary for ownership and management of the RE projects is a major challenge in the context. Not many existing business models have been able to convert land rights yet, expected to recurring payments, and financial gains into equity.[62]

Communities and the government struggle to raise money to support and complete initiatives. Billions of euros are expected to be needed to finance local renewable energy projects with shared regional interest. State-owned incumbent utilities are hindered by public finances and unable to fund such projects on their own financial sheets, creating possibilities for energy producers in the private sector to make up the gap in funding.

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[61] Ibid

[62] IRENA, 2018, pg5

The national energy markets do not yet offer secure, transparent regulatory frameworks or a competitive environment for such investments, thus attracting investors appears to be fairly challenging. Furthermore, the national markets are regarded to be small-scale, which reduces the opportunity for economic scaling.[63]

The main obstacle to the development of RE and REC has been investors' unwillingness to finance these projects since they evaluate those energy projects as extremely risky and offering a low rate of return on their invested capital. It is both achievable as well as necessary to address the financial challenges to remove the obstacle to the development of REC.[64]

5.2.4 Cultural and geographical challenges

Aspects of culture may also prevent the growth of REC. In some nations, democratic decision-making and shared ownership are traditions. Due to historical events and social characteristics in others, these actions are problematic.

Furthermore, even the most well-intended community energy initiatives cannot ensure that the advantages will be shared fairly among the communities that are hosting them. As a result, community energy projects may not have the beneficial effects and widespread support they might have gotten.

The attitudes of citizens and the energy community regarding RE may be influenced by, several factors including fundamental beliefs, and values connected to consumerism, prosperity, faith, management, and freedom. Therefore, individuals who oppose wind farms and solar panels as well as other renewable power sources might be reasoned by they do not understand the need for such technologies.[65]

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[63] Jovičić, 2015

[64] ADBI Working Paper Series, 2018

[65] Sovacool 2009

In respect of cultural challenges, culture is not only about sharing language, values, traditions, norms, customs, or beliefs among people in the community. A culture can also be developed within the place where citizens live. For example, the successful practice of REC in Germany and Sweden which were previously discussed, both communities have a small population.

In a small-scale community, citizens are more likely to be connected to each other and share similar lifestyles. Also, in a small community, citizens tend to have more interest in what is happening in their community because anything that happens within their community can affect others' lifestyles. For instance, if a village of 300 people plans to install solar power plants, the solar panels can be installed in individual houses and the building in a public area. In this case, citizens may think of cooperatively engaging in this project with each other to produce and consume the energy, since it directly affects their energy supply and demand situation. In the small village, citizens are more likely to feel involved in the project and contribute to it.

On the other hand, in cities with large populations, there is often little human interaction. Even in cities of tens of thousands of people, they do not interfere with each other's lifestyles; rather, each has his or her own lifestyle that is not particularly influenced by the environment in which he or she lives. In such cities, people are less likely to feel involved in the community. In larger cities, it is not always easy to know everything that is happening in the city, and because of the different environments within a city, it is sometimes difficult to say that a one-size-fits-all approach is effective.

Moreover, there could be geographical challenges in development of REC. As mentioned earlier, a large area is occupied in setting up RE power plants. Wind power plants, in particular, require open land, which makes them difficult to set up in small or populated cities. Furthermore, it is important that wind farms be located in environments where the wind blows frequently, such as near mountains or the ocean. Even in open land, there are places where the wind does not blow enough to efficiently generate electricity on the plains.

Similarly in solar power generation, energy can be efficiently produced by installing power plants on land where sunlight is continuously available. However, in northern Europe, where winters are long and sunlight hours are low, it is difficult to generate electricity efficiently, and it is difficult to say that even if you have the equipment in place, it will produce effective results.

In Nordic countries, renewable energy power plants are often built in the north, where the land is larger. However, since the most populated cities are relatively concentrated in the south, it is essential to have transmission lines to send energy generated from the north to the south. As more transmission lines are built, energy distribution will become more complex and more expensive to set up.

While these geographical conditions would make it more cost-effective to implement RECs, geographical conditions cannot be altered and may hinder the development of RECs.

5.3 Potential improvement of the legal framework

Based on the discussion of the various difficulties and obstacles in the development of RECs as described above, this chapter will discuss possible improvements in the legal framework in regard to RECs.

The RE directive provides an extensive list of the essential components of RE that a supporting legal framework must include. Article 22.4 of the RE directive lists the criteria of REC legislation such as:

(a) unjustified regulatory and administrative barriers to renewable energy communities are removed;

(b) renewable energy communities that supply energy or provide aggregation or other commercial energy services are subject to the provisions relevant for such activities;

(c) the relevant distribution system operator cooperates with renewable energy communities to facilitate energy transfers within renewable energy communities;

(d) renewable energy communities are subject to fair, proportionate and transparent procedures, including registration and licensing procedures, and cost-reflective network charges, as well as relevant charges, levies and taxes, ensuring that they contribute, in an adequate, fair and balanced way, to the overall cost sharing of the system in line with a transparent cost-benefit analysis of distributed energy sources developed by the national competent authorities;

(e) renewable energy communities are not subject to discriminatory treatment with regard to their activities, rights and obligations as final customers, producers, suppliers, distribution system operators, or as other market participants;

(f) the participation in the renewable energy communities is accessible to all consumers, including those in low-income or vulnerable households;

(g) tools to facilitate access to finance and information are available;

(h) regulatory and capacity-building support is provided to public authorities in enabling and setting up renewable energy communities, and in helping authorities to participate directly;

(i) rules to secure the equal and non-discriminatory treatment of consumers that participate in the renewable energy community are in place.[66]

Member States are obliged to evaluate the obstacles presently in place and the potential for REC development. Furthermore, while developing support schemes for RES, they will need to take into account the unique characteristics of RECs so that these can enhance the support under the same terms as other market participants. [67]

Several exemplary measures are provided in Recital 26 of the RED II. Those are the provision of providing information, technical and financial support, reducing administrative requirements, the inclusion of community-focused bidding criteria targeted at RECs, tailored bidding windows for RECs, remuneration through direct support if RECs comply with the "de minimis" criteria for small installations."[68]

[66] Renewable energy directive art.22.4

[67] Krug et al. 2022, pg.6

[68] Renewable energy directive Recital26

Another solution is to clarify the legal terms in the directives. The EU directives contain some unclear terms in definitions of legal terms or the scope and conditions to which they can be applied. For example, in some countries where they have not fully implemented the provision of REC into national legislation, the existing energy self-consumers are referred to in different words, such as community energy, energy cooperatives, citizen energy companies, etc.

Due to the vagueness of the legal terms, the Member States can exercise flexibility in establishing a legislative and regulatory framework that will be favorable to the development of RECs. This is particularly relevant for corporate governance criteria involving proximity or autonomy as well as effective management.

Above are the potential improvement of the legal framework of REC to enhance the development of REC in the EU. In addition, this paper is going to introduce the concept of sociotechnical imaginaries and discuss how this concept can be linked to the development of RECs.

Sociotechnical imaginaries is defined as "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects."[69] The idea of sociotechnical imaginaries is based partly on the increasing awareness that the ability to anticipate the future is a fundamental component of social and political practice. The ability to imagine and set goals for success are crucial cultural resources that facilitate the development of new life forms.

[69] Jasanoff and Kim, 2009, pg. 120

Instead, imagination aids in the creation of systems of significance that allow for collective opinions of social reality; it establishes a sense of community and connection to a political group; and it directs the standardization and simplification of human subjects in order to more effectively govern them.

In essence, sociotechnical imagination, which is seen as an organized field of social practices is a crucial component in the development of social structure.[70]

Sociotechnical imaginaries are important social instruments that impact how society responds to innovation, even though they are never entirely determinative of policy results. However, concerns about how to enhance modern society are continuously linked to political imaginations about the advantages and disadvantages of technological transition. In particular, the way various national energy imaginaries manage risk in different ways gives insight into potential future global cooperation. Sociotechnical imaginaries may influence the development and implementation of energy policies and technology, as well as attitudes toward the production and consumption of energy. Considering the sociotechnical imaginaries of energy can assist develop more efficient energy policies and technology by highlighting the social values, precepts, and aspirations that influence energy transitions.

In the energy context, the sociotechnical imagination can shape attitudes toward energy production and consumption and influence the development and implementation of energy policies and technologies. Understanding the sociotechnical imagination as it relates to energy can provide insight into the values, beliefs, and aspirations of societies that shape energy transitions and help create more effective energy policies and technologies.

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[70] Jasanoff and Kim, 2009, pg. 122

The Pacific Northwest and the Desert Southwest of the United States, together with Portland, Oregon, and Phoenix, Arizona, are the two urban areas where the growth of energy innovations such as smart grids and distributed generation is examined in the article by Anthony M. Levenda, Jennifer Richter, Thaddeus Millerb, and Erik Fisher.[71] Their findings illustrate how imaginations at both the national and regional levels influence the multi-level governance of innovation in energy systems. The case studies of Portland and Phoenix demonstrate how various socio-cultural and political-economic contexts engage with and produce different national sociotechnical energy imaginaries, as well as how these consequently form sociotechnical arrangements of energy innovations, usually to be alternatives to national imaginaries. Public expectations and values corresponding to energy technologies have been influenced by national sociotechnical imaginaries of modernization and security in both the Northwest and Southwest of the US. Major organizations in the regions promoted these imaginaries through policy discourses and actions.

Portland is part of the Pacific Northwest in the US, which has a diverse energy infrastructure made up of natural gas, hydropower, coal, wind, solar, and biomass plants. A new Renewable Portfolio Standard was adopted in Oregon in 2016, requiring large utilities to get 50% of their energy from renewable sources by the year 2040.[72] Portland aims to make the transition to urban sustainability, yet the city's choices are limited because existing organizations generally dominate the governance of the city's current energy systems. Grid upgrading is prioritized by the Power and Conservation Council of this region, which is in charge of regional energy planning, in order to support demand response and energy efficiency. Demand response initiatives work to move and modify energy demand in order to increase its responsiveness

[71] Levenda et al, 2019

[72] Ibid, pg184-185

and flexibility. This is compatible with the region's dedication to conservation and "least-cost" planning, as energy efficiency is considered the key activity. Smart grid technologies are thought of as a method to modernize the system while enhancing dependability, stability, and efficiency. Portland's sustainability objectives include an emphasis on energy efficiency and community energy solutions to lower greenhouse gas emissions and combat climate change. Nevertheless, Portland's infrastructure, which continues to rely on coal and natural gas, places more of an emphasis on preserving stability and dependability through attempts at efficiency and modernization. Even when scattered and erratic renewable energy sources are integrated, they place a higher priority on maintaining control over energy futures and the grid's dependability. This demonstrates the conflict between the city's goals for clean energy and the utilities' focus on consistency and long-term investments in conventional power production.[73]

Phoenix, a desert city with little rainfall, grew quickly in the 1990s because it was affordable and had facilities like swimming pools and air conditioning. Comprehensive planning and infrastructure investments were essential for the city's energy and water systems, which were mostly supported by federal programs. The dam constructed with federal assistance was one of the major infrastructure projects. In Arizona, solar energy represents both an opportunity and a challenge to a region. The implementation of a renewable portfolio standard required a specific portion of power to be produced from renewable resources, serving as the impetus for the state's foray into solar energy production. The solar energy output was further boosted by the federal Solar Investment Tax Credit and other incentives from government agencies. The role of distributed generation and its effects on security, dependability, independence, and democracy, however, has drawn controversy. Customers thought distributed generation systems were smart long-term investments that helped reduce carbon emissions, while

[73] Levenda et al, 2019, pg.185

operators prioritized certainty, control, and grid reliability. Regulations intended to incorporate solar energy into established systems have been abandoned as a result of these conflicting points of view. Studying such discussions enables the reader to highlight the conflicting sociotechnical imaginaries and energy values at issue in the complicated debates and controversies within solar energy in Arizona.[74]

The article emphasized on two primary categories of subjects in our research of Portland and Phoenix: reliability and stability and democracy and independence. In Portland, stability and dependability are promoted as objectives that serve the general public. Utilities are seen as public servants who provide essential services to the area, particularly to vast and expanding urban regions. Discourses of continuity, which are prominent in talks of gradual transitions to renewable energy, are another way that stability is conveyed. Local politicians and activists, who call for quick transitions away from fossil fuels, vehemently disagree with this practicality and regulatory discourse. Stability is questioned in contexts when reliability is perceived as a more appealing discourse.[75]

Similarly, utilities and regulators in Phoenix share the thought that energy technologies should be promoted for increased dependability and stability. The challenge of solar distributed generation is much more prevalent in Phoenix, leading to disagreement and legislative changes at the local level over who should be able to make decisions about the implementation and pricing of distributed generation as well as how it should be valued.

[74] Levenda et al, 2019, pg.186-187

[75] Ibid, pg184-186

While the subtext of stability as a keyword for stasis in the industry is also expressed. In Phoenix, stability is aimed at the centralized management of technical development by utilities and regulators, and individual action is perceived as a risk and challenge to the current systems of power provision, minimizing stability and reliability.[76]

Additionally, the article also highlighted democracy and independence as major principles shaping regional energy imaginaries. Distributed solar is encountering resistance from traditional energy suppliers in Phoenix as a result of the debates surrounding the concept of net metering as well as how consumers produce and connect to the grid, which is challenging the current utility business in the city. In contrast, similar conflicts can be observed in Portland, although there are fewer residential distributed generation adoptions and more cooperative community projects that manage to get beyond utility pressure. Distributed generation and smart technology advancements have made it possible to produce energy at the individual and community levels, but the current social and political organization of the energy systems has placed "consumers" in restricted roles. These functions are constrained in both urban environments, for instance, by involvement in experiments for pricing and specified utility plans. While citizen action organizations contribute to challenging the status quo in both Phoenix and Portland, the influence and acceptance of these groups by the government and regulators vary. Conflicts over net metering laws have arisen in Phoenix as a consequence of prosumers' adoption of distributed generation, while legislative changes have promoted more centralized and utility-controlled solar power. On the contrary, Portland's city administration favors climate action and sustainability while promoting a community-driven method of transitioning toward alternatives to fossil fuels.[77]

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[76] Levenda et al, 2019, pg.186-188

[77] Ibid,pg.189

This study examined the manner in which national imaginaries still have an impact on local and regional sociotechnical imaginaries as well as varying from them. Portland and Phoenix case studies show how energy innovations reflect and refract the larger national imaginaries of modernization and security. Efficiency, least-cost planning, and demand response are prioritized in Portland, supported by smart grid technologies that are compatible with the region's principles of independence, stability, and democracy. In Phoenix, disputes over solar technology are representations of the democratic and independent energy principles of the region. Advocates want more say in decision-making, while utilities favor centralized solutions for dependability and stability. The various ways in which each area expresses reliability, stability, and energy values highlight how those values reflect national imaginations. Solar energy production in Portland is shaped by local ideas of democracy and independence, whereas in Phoenix, conservatism and environmental justice are significant factors. These findings show how different conceptions of modernization and security have distinct effects on how values related to energy are shaped.

Sociotechnical imaginaries are a popular subject among energy system studies, and it is illustrated in Rudek's study on the social sciences related to energy is consistent with the collection of research papers about the concept published in it. [78]

[78] Tadeusz Jozef Rudek, 2021

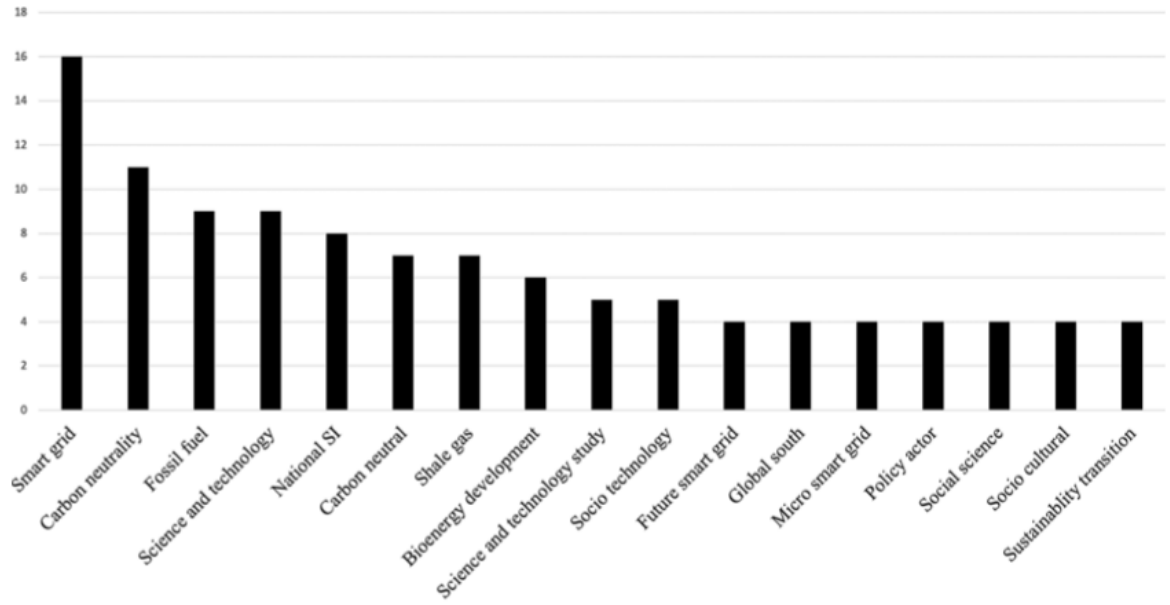

Figure 4: Distribution of phrases in sociotechnical imaginaries articles related to energy studies (Source: Tadeusz Jozef Rudek, 2021)

The significant technological and policy focuses of sociotechnical imaginaries are illustrated in Figure 4. The smart grid was the keyword being examined the most often. This is important for the technical advancement that optimizes energy utilization. The two following are clearly related to the decarbonization strategy at the same time. It is justified to claim that sociotechnical imaginaries are closely related to the following keywords: technology, policy, future, and vision. Thus, the studies according to consideration are consistent with the original definition of the term provided by Jasanoff and Kim. Sociotechnical imaginaries in studies on energy tend to be futuristic, and when it comes to energy transition, they become an important instrument to comprehend, manage, and carry out. Sociotechnical imaginaries are an effective instrument for addressing the issues related to energy issues, including how the energy transition is seen, regulated, and exercised[79]

[79] Rudek, 2021, pg.224

Distinguishment of an analytical concept from other ideas of similar characteristics, or by making straightforward both what it is as well as what it is not, an analytical concept can be made clearer. Imaginaries are different from policy goals. They belong to a collection of norms and discourses, metaphors, and cultural meanings from which actors construct their policy preferences. They're less explicit, less issue-specific, less focused on objectives, less politically liable, and less intellectual. Imaginaries are also more than just elaborate stories used to support investments in research and technology, such as the widely accepted modern myth that links science to advancement. Imaginaries are practical and futuristic in contrast to master narratives, which frequently draw from past events and provide explanatory or justification objectives. They projected perspectives on what is desirable, beneficial, and worth achieving for a political community and articulate workable futures. On the other hand, imaginaries also forewarn of dangers or problems that could come with innovation if it is forced too hard or too quickly. Imaginaries assist develop the political will or public commitment to achieve goals by igniting collective consciousness.[80]

Sociotechnical imaginaries shouldn't be considered strictly constrained belief systems that are static in nature. To believe that there are particular imaginaries directing the creation of knowledge or knowledge-based technologies in the competitive arena of democratic policymaking would also be too simple. Nevertheless, among the various competing sociotechnical imaginations at work in any society, some have a tendency to be more resilient at the national level because potent tools for meaning-making and goal-selection frequently fall under the jurisdiction of nation-states, like political campaigns, media outlets under state control, and official policy reports and instruments. Moreover, since past comparative studies have demonstrated, nation-building is strongly linked to the framing and boundary-setting of

[80] Jasanoff and Kim, 2009. pg.123-124

Sociotechnical initiatives and related policies, despite the increasing worldwide movement of finance, media, knowledge, and skills. Even the designs and procedures used in scientific research and technological progress might be penetrated by national imaginations. And the politics of science and technology that emerges may influence not only the specific difficulties surrounding those businesses as well as broader social and political perceptions of a country's history, present, and future.[81]

Sociotechnical imaginaries is closely connected to public participation and policy decisions making of related topics of science, technology, and innovation. In the energy field, Sociotechnical imaginaries can impact the development and implementation of energy policies and technology as well as attitudes toward energy production and consumption. Energy-related sociotechnical imaginaries can provide light on the social values, precepts, and goals that influence energy transitions and aid in the development of more efficient energy policy. By understanding this concept, the REC can be developed in a more effective and reasonable manner with closely linked to not only energy systems but also the social science and even the technology sector.

[81] Jasanoff and Kim, 2009. pg.123-124

6 CONCLUSIONS

This paper discussed the REC development in the EU from a legal perspective. The Renewable Energy Directive provides a definition for Renewable Energy Communities (REC). According to Article 2 (16), REC is a legal entity that operates based on open and voluntary participation and is effectively controlled by shareholders or members who are located near the renewable energy projects owned and developed by the entity. The shareholders or members can be individuals, small and medium-sized enterprises (SMEs), or local authorities, including municipalities. Participation in REC is open and voluntary, but there are specific conditions for becoming a member. REC has a limited scope, focusing on local communities that own and develop renewable energy projects within their vicinity. The primary objective of REC is to provide environmental, economic, or social benefits to its shareholders or members and the local areas where it operates, rather than pursuing financial profits. This ensures that the community directly benefits from the energy system. REC can engage in various activities related to renewable energy sources, such as generation, consumption, aggregation, energy supply, and sharing. Additionally, the Renewable Energy Directive introduces the concept of jointly acting renewable self-consumers. This refers to a group of at least two self-consumers of renewable energy who are located in the same building or multi-apartment block. This concept has a narrower geographical scope, typically within a single household or a specific location.

In the study of REC practice in Germany and Sweden, the national laws were examined first whether they implement REC properly. Also, this paper looked into good examples of RECs in both countries and analyzed the project. From the findings of the case study in both countries, it is clearly concluded that the RE power should be locally produced and centered around engaged customers so that the citizen can be fully committed to the energy

community. this will develop a prosumer, passionate, and actively engaging energy community

Through these case studies, the paper made a comparative analysis of the legal framework of Germany and Sweden. Also, this paper raised the challenges of the development of REC. There are many challenges and obstacles from different aspects, including social acceptance, NIMBY and PIMBY phenomenon, financial barriers, and cultural and geographical challenges.

Lastly, this paper discussed possible improvements in the legal framework. The current legal framework in Germany and Sweden lacks a legal definition of Renewable Energy Certificates (REC), which poses a significant challenge in developing REC nationwide. This lack of a legal framework has led to difficulties in transposition and failures in the recent revisions to the Renewable Energy Act of 2021. Although several existing energy communities meet the REC conditions, there are similarities between REC and Bürgerenergie in German laws, but differences in extent. The absence of a comparable term for other renewable energy sources is a significant concern in the German legal framework. Additionally, the right to produce, consume, store, and sell RE remains unhindered for entities meeting the criteria for a REC, despite the lack of specific legal definitions in Article 22.2 of the RE directive.

The lack of a legal framework for self-consumption and energy sharing in Germany hinders the distribution of renewable energy (REC) generated by community members. The government may redesign the energy market structure, including surcharges, fees, and taxes, before addressing the regulatory framework. Germany's growth in renewable energy (REC) has been largely supported by the favorable legal and regulatory environment, particularly feed-in tariffs. However, Germany's shift towards market systems, such as market-premium systems, solar power plant lowerings, and tender-based systems, has led to a decrease in

energy communities and a negative impact on the energy market and energy transition process. Studying gaps between EU directives in Germany and the directive itself is challenging due to the lack of specific requirements on energy communities.

The Swedish legal framework lacks legislation regulating ECs in its own country, and the proposed law by Ei is not solid enough. A favorable legal framework is necessary for EC development, and national regulations and legal definitions are crucial factors. Adopting the Community Energy Plan (CEP) will benefit national legal frameworks for ECs. A broad definition would enable new types of businesses and enhance EC growth. However, an ambiguous definition makes it difficult to identify ECs for policy measures and provide assistance.

Comparing the legal frameworks of Germany and Sweden, the author found common factors, but differed in legislation, citizen participation, and national energy markets. The German energy market's shift from feed-in tariffs to auction pricing design has led to a lack of incentive for EC and REC development. Large businesses benefit from this change, while small-scale participants, such as individuals and local communities, face disadvantages. This may lead to a decrease in citizens' participation, as they are unwilling to pay high installation costs without government subsidies. In Sweden, advisory groups have emphasized the absence of incentives for EC development and uncertainty about the benefits for citizens. They propose exemptions from taxes for ECs and argue that energy generated for EC consumption should not be liable to energy taxes.

This paper also examines sociotechnical imaginaries, which are collectively imagined social orders in nation-specific scientific and technological projects. These imaginaries shape societal responses to innovation and energy transitions, influencing energy policies, technology development, and attitudes toward energy production and consumption.

Understanding sociotechnical imaginaries can help formulate more effective energy policies and technologies by considering social values, beliefs, and aspirations that influence energy transitions.

The studied article focuses on reliability and stability, democracy and independence, and the challenges faced by traditional energy suppliers in various cities. Understanding these imaginaries can help identify societal values and aspirations that shape energy transitions and lead to more effective strategies for sustainable energy development.

Sociotechnical imaginaries are a popular subject in energy system studies, with a focus on technology, policy, future, and vision. They are futuristic and crucial for understanding, managing, and executing energy transitions. Unlike policy goals, imaginaries are less explicit, issue-specific, and politically liable. They are practical and futuristic, unlike master narratives that draw from past events and provide explanatory objectives. Imaginaries project perspectives on desirable, beneficial, and worth-achieving futures, while also forewarning potential dangers or problems associated with innovation. They help develop the political will and public commitment to achieve goals by igniting collective consciousness.

Sociotechnical imaginaries are not static belief systems, but rather resilient at the national level, as they often fall under the jurisdiction of nation-states. These imaginaries influence the framing and boundary-setting of sociotechnical initiatives and policies, despite the increasing global movement of finance, media, knowledge, and skills. National imaginations can influence scientific research and technological progress, and the politics of science and technology can influence broader social and political perceptions of a country's history, present, and future.

Sociotechnical imaginaries are closely connected to public participation and policy decisions in related topics, such as science, technology, and innovation. In the energy field, sociotechnical imaginaries can impact the development and implementation of energy policies and technology, as well as attitudes towards energy production and consumption. Understanding this concept can help develop more efficient energy policies, which are closely linked to social science and technology sectors.

7 BIBLIOGRAPHY

Literature

Rudek, Tadeusz Józef, “Capturing the invisible. Sociotechnical imaginaries of energy. The critical overview”(2021) Science and Public Policy, 2022, 49, 219–245

Campos Inês, Pontes Luz Guilherme, Marín-González Esther, Gährs Swantje, Hall Stephen, Holstenkamp Lars, “Regulatory challenges and opportunities for collective renewable energy prosumers in the EU”(2020) Volume 138 *Energy Policy*

Anthony M. Levenda, Jennifer Richter, Thaddeus Miller, Erik Fisher, “Regional sociotechnical imaginaries and the governance of energy innovations (2019) Volume 109

Futures 181-191.

Taekema, Sanne, “Relative Autonomy, A Characterisation of the Discipline of Law” (2010)

Emi Minghui Gui, Iain MacGill,”Typology of future clean energy communities: An exploratory structure, opportunities, and challenges” (2018) Volume 35 *Energy Research & Social Science* 94-107

Michael Krug, Maria Rosaria Di Nucci, Matteo Caldera and Elena De Luca “Mainstreaming Community Energy: Is the Renewable Energy Directive a Driver for Renewable Energy Communities in Germany and Italy?” (2022) *Sustainability* 14, 7181

Mehmet Efe Biresselioglu, Siyami Alp Limoncuoglu, Muhittin Hakan Demir, Johannes Reichl, Katrin Burgstaller, Alessandro Sciullo and Edoardo Ferrero “Legal Provisions and Market Conditions for Energy Communities in Austria, Germany, Greece, Italy, Spain, and Turkey: A Comparative Assessment” (2021)*Sustainability* 13, 11212.

Palm, J. “The Transposition of Energy Communities into Swedish Regulations: Overview and Critique of Emerging Regulations” (2021) *Energies*, 14(16),

Valeriya Azarova, Jed Cohen, Christina Friedl, Johannes Reichl “Designing local renewable energy communities to increase social acceptance: Evidence from a choice experiment in Austria, Germany, Italy, and Switzerland”(2021) *Energies*

Joshua T. Brinkman, Richard F. Hirsh “Welcoming Wind Turbines and the PIMBY ("Please in My Backyard") Phenomenon: The Culture of the Machine in the Rural American Midwest” (2017) Volume 58 *Technology and Culture* 335-367

Benjamin Sovacool “The cultural barriers to renewable energy and energy efficiency in the United States” (2009) Technology in Society 31(4):365-373

Sheila Jasanoff and Sang-Hyun Kim Sociotechnical Imaginaries and National Energy Policies(2013) Science as Culture, 22:2, 189-196,

Jasanoff, S and Sang-Hyun Kim. “Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea” (2009) *Minerva* 47, 119–146

Legislations

Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU OJ L 158

Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources OJ L 328

The IRENA Coalition for Action (Coalition) Coalition for Action_Community Energy_2018

Internet sources [Authority of the website], [“Name of the page where the information is found”] [(date of publication or latest update)]. [<URL of the page>] [(last accessed date)].

European Commsion, “Energy Communities” <https://energy-communities-repository.ec.europa.eu/energy-communities_en#overview>

European Commsion, “What is an energy community?” <https://rural-energy-community-hub.ec.europa.eu/energy-communities/what-energy-community_en#the-differences-between-the-two-communities>

Hive power, “Decentralized Energy Systems, a Necessity in Europe” (04 April 2022)

<https://www.hivepower.tech/blog/decentralized-energy-systems-a-necessity-in-europe>

European commsion, “The landscape of Energy Cooperatives in Germany” <https://rural-energy-community-hub.ec.europa.eu/landscape-energy-cooperatives-germany_en>

Federal Ministry for Economic affairs and climate Action “Renewable energy”<https://www.bmwk.de/Redaktion/EN/Dossier/renewable-energy.html>

Community Energy Cooperative: Schönau, Germany. (n.d.). Centre for Public Impact (CPI). <https://www.centreforpublicimpact.org/case-study/community-energy-cooperative-schoenau-germany>

As Big Energy Gains, Can Europe’s Community Renewables Compete? (n.d.). Yale E360. <https://e360.yale.edu/features/can-europes-community-renewables-compete-with-big-wind-and-solar>

Energy in Minds! Site Neckarsulm | Smart Cities Marketplace. (n.d.). <https://smart-cities-marketplace.ec.europa.eu/projects-and-sites/projects/energy-minds/energy-minds-site-neckarsulm#lessons_learnt>

Germany’s energy consumption and power mix in charts. (2023, April 18). Clean Energy Wire. <https://www.cleanenergywire.org/factsheets/germanys-energy-consumption-and-power-mix-charts>

Sweden - REC/CEC definitions - REScoop. (n.d.). <https://www.rescoop.eu/policy/sweden-rec-cec-definitions>

Simris - a 100% renewable energy community village - Housing Evolutions Hub. (2021, June 8). Housing Evolutions Hub. <https://www.housingevolutions.eu/project/simris-a-100-renewable-energy-community-village/>

e.on - We’re renewing Simris <https://www.eon.se/en_US/om-e-on/local-energy-systems/we-are-renewing-simris#how>

Reis, L. (2023). How NIMBYs Hinder the Scaling Up of Renewable/Emissions Energy Projects Damaging the Quest for Sustainability. *The Atlas Report*. https://atlas-

report.com/how-nimbys-hinder-the-scaling-up-of-renewable-emissions-energy-projects-damaging-the-quest-for-sustainability/

Marketplace. (2023, April 19). *The clean energy economy has a NIMBY problem - Marketplace*. https://www.marketplace.org/shows/make-me-smart/clean-energy-economy-nimby-problem/

Jovičić, B. (2016, October 19). *Challenges to financing renewable energy projects in the Balkans - Balkan Green Energy News*. Balkan Green Energy News. https://balkangreenenergynews.com/challenges-to-financing-renewables-projects-in-the-balkans/

Peimani, H. 2018. Financial Barriers to Development of Renewable and Green Energy Projects in Asia. ADBI Working Paper 862. Tokyo: Asian Development Bank Institute: <https://www.adb.org/publications/financial-barriers-development-renewable-greenenergy-projects-asia>

Official sources

Clean energy for all Europeans package

2017 revision of the Renewable Energy Sources Act Federal Ministry For Economic Affairs And Climate Action (Germany) https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/Renewable%20Energy%20Sources%20Act%20%28EEG%202017%29.pdf

Community energy in Germany: existing models, public-private funding and good practice examples, CO-POWER 2014 https://www.rescoop.eu/uploads/rescoop/downloads/Community-energy-in-Germany-report-2014.pdf

Information from IEA BIOENERGY TASK 37 Energy from biogas and landfill gas https://www.ieabioenergy.com/wp-content/uploads/2018/01/biogas_village.pd