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The Energy Transition in the Hands of the Citizens: a Comparative Study of Energy Communities in Germany and Italy

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Abstract

Energy communities (EC) have gained attention in Europe due to their economic, environmental and social benefits and their potential contribution to a faster and fairer energy transition in the European Union (EU). With the Clean Energy for all Europeans Package in 2019, the EU introduced a legislative framework for ECs to promote them in all EU countries. Among these, Germany is a historically successful example of development of ECs, while Italy counts very few modern ones. To understand what reasons contributed to create this gap, this dissertation answers the following question: **What are the factors that have enabled and/or disabled energy communities in Italy and Germany?**

The study analyses scholarly articles and conducts interviews to investigate in two separate chapters (one each for Germany and Italy) how the local natural and technical resources, the institutional and legislative framework, and the actors involved have influenced the ECs' development in the two countries. The elements and factors analysed are derived from the operationalisation of Ostrom's (2007) Socio-Ecological System framework.

The final section presents a comparison and discussion of the findings, which indicates that the German and Italian ECs' sectors have taken different paths over the decades. The exceptional expansion of German ECs has been led by a successful national legislative framework, municipal support and the citizens´ culture and mentality. The Italian EC sector instead has been enabled primarily by the EU legislation, recent national regulation, and the involvement of municipalities, businesses and non-governmental organisations rather than the local population. From these findings, one can conclude that EU countries are characterised by different sociological, financial, political, environmental and technical factors that altogether determine the development of ECs. Therefore, EU countries must implement specific policies and targeted strategies that address their unique needs to accelerate the ECs' development for a just energy transition.

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List of Abbreviations

ARERA = Authority for the Regulation of Energy Network and Environment

CEC = Citizens Energy Community

CEP = Clean Energy for all Europeans Package

CER = Comunità Energetiche Rinnovabili (Renewable Energy Communities)

CSC = collective self-consumption

DSO = Distribution system operator

e.G. = *Energiegenossenschaften* (energy cooperatives)

EC = Energy community

EEG = *Erneuerbare-Energien-Gesetz* (Renewable Sources Act)

EU = European Union

GSE = Gestore Servizi Energetici (Energy Services Operator)

IEMD = Internal Electricity Market Directive

MS = Member States

NGO = Non-Governmental Organisation

NIMBY = Not In My Backyard

REC = Renewable Energy Community

RED = Renewable Energy Directive

RES = Renewable energy source

SES = Socio-Ecological System

Introduction: What are the factors that have enabled and/or disabled energy communities in Italy and Germany?

To honour the pledge of 2050-carbon-neutrality announced with the publication of the European Green Deal, the European Union (EU) has set the intermediary objective of reducing greenhouse gas emissions by 55-57% by 2030. The achievement of both targets will depend mainly on the EU's capacity to cut down the emissions related to the energy sector, which accounted for 77.01% of all EU greenhouse gas emissions in 2019 (European Parliament, 2023). With the intent of supporting these decarbonization efforts, the EU launched the Clean Energy for all Europeans Package (CEP) in 2019, which represented an important steppingstone in the European energy transition. Indeed, this energy rulebook introduced a set of eight legislative proposals to promote the transition from fossil fuels to renewable energy sources (RES), foster energy efficiency, integrate the EU's electricity markets and make the European energy system more decentralized.

By promoting the decentralization of the energy system, the EU sought to increase its share of cleaner sources of energy and make the European energy sector more flexible, secure and less susceptible to volatile prices. This process was also meant to put the EU citizens at the heart of the energy transition, by recognizing their right to produce, share, store and consume energy by forming energy communities (EC). According to REScoop.eu's (n.d.d) definition, ECs are organisations of citizens who democratically collaborate on an energy project that provides the local community with services and various benefits and, at the same time, proposes a new business philosophy that has not economic profits as the main purpose. ECs have proved to bring economic, social, technical and environmental advantages to the communities involved, making citizens part of a new democratic model where they pass from being passive energy consumers to becoming active energy producers, also known as prosumers. The positive contribution of these realities to the EU energy transition is expected to grow substantially in the upcoming decades, at the point that by 2050, 37% of the EU households producing renewable energy are projected to do so by participating in an EC (Caramizaru & Uihlein, 2020).

Over the past decade, ECs have attracted the interest not only of institutions, companies and individuals but also of scholars. Indeed, on the one hand, many academics have focused their research on the potential contribution of ECs to the European energy transition (Lowitzsch, 2019; Abada et al., 2017; Wierling et al., 2021). On the other hand, other scholars have investigated how national governments are incentivizing community energy and what factors can lead to the successful and/or unsuccessful development of community energy (Bauwens et al., 2016; Romero-

Rubio & de Andrés Díaz, 2015). In this field of research, Germany is among the most, if not the most, researched case studies due to its high number of community energy projects and its leading example in setting a favourable legal framework for these realities. Indeed, the German case represented a European model for promoting the development of ECs, at least until the latest reforms on feed-in tariffs and the auction system were implemented. Nonetheless, still today Germany can be regarded as a successful case for community energy, especially compared to Eastern and Southern European member states (MS), whose growth in community energy initiatives has been slow and limited. Among these countries, the Italian community energy landscape has been under-researched and rarely investigated next to more enabling energy frameworks for ECs, such as the German one. Due to this gap in the literature, it is not clear what factors have contributed to hindering and/or enabling the development of community energy in Italy and Germany, which share some common features with the Italian energy sector and mix. Moreover, most research on ECs has been conducted before the publication of the CEP in 2019, when the European framework on community energy was introduced. To contribute to filling these gaps in the literature, this dissertation intends to answer the following research question: **What are the factors that have enabled and/or disabled energy communities in Italy and Germany?**

This dissertation bears both academic and societal relevance. On the one hand, as introduced above, it intends to address an existing gap in the energy and social sciences literature on community energy in an under-researched comparative study (ECs in Italy and Germany). This research´s findings can also explain to a limited extent the more general Northern-Southern European divide in the field of EC development. Therefore, this dissertation contributes also in advancing the research on the overall EU energy transition and decentralisation, which today appear more urgent than ever. Indeed, as the guide by Sccale203050 (2022) reports, the Covid-19 pandemic, the Russian War in Ukraine and the consequent energy crises have furthermore highlighted the importance of a decentralized energy system that prioritises people and communities. First, the health emergency made it clear how external supplies may prove to be fragile in times of crisis and how the EU should shift from external to domestic supplies, including energy ones. Not only ECs strengthen the local economy and resilience, but they also allow to shorten supply chains and make energy systems more secure and flexible. Second, the Russian War in Ukraine stressed the urgency for Europe to abandon fossil fuels, particularly the ones coming from authoritarian external partners, and shift to cleaner sources of energy without developing another dependence on external parties in terms of critical minerals and rare earth elements.

Thirdly, the effects of the energy crises have been devastating for both European citizens and businesses, and ECs represent an opportunity for them to contribute to the energy transition while saving on energy bills and reinvesting in social projects. Given the pertinency of ECs to this historical period, it is relevant to investigate the successful case of Germany and the less prosperous one of Italy. By doing so one can draw lessons on what enabling and disabling factors can be enhanced or inhibited and how international and regional differences can be taken into account to regulate ECs properly.

To answer the research question reported above, the dissertation is divided into three main chapters and a concluding section for the discussion of the findings. First, the introductory chapter presents the available literature on community energy in Europe, the research's case studies (Germany and Italy), the "Socio-Ecological System" (SES) framework used to structure the dissertation´s analysis and the research methods, namely content analysis and interviewing. Second, the following two chapters delve into the respective analyses of the EC sectors in Germany and Italy, taking into account the natural and technical resources, the governance systems and the actors involved in the development of ECs. Finally, the dissertation concludes with a comparison of the two case studies and it reflects on how Germany and Italy differ in terms of enabling and/or disabling factors for ECs.

Chapter 1: The state of art on energy communities and research methods

1.1 Energy communities in Europe

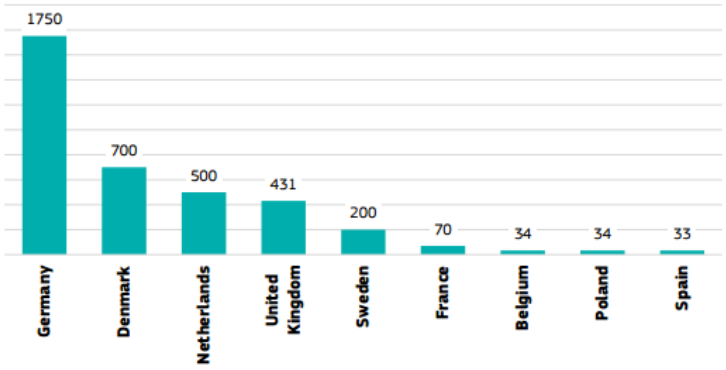
ECs started developing in Europe in the early 20th century in areas where the local population lived in isolated areas difficult to connect to the national grid, such as in South Tyrol (Italy) or Bayern (Germany) (Yildiz et al., 2014; Spinicci, 2011). During the 1960s and 1970s, due to the devastating effects of the oil shocks and the rise in the anti-nuclear movements across Europe, the ECs grew in popularity again (Caramizaru & Uihlein, 2020). Indeed, this concept started being seen as a valid alternative to Europe's traditional centralized energy system, characterized by large-scale power plants dependent on fossil fuels, few monopolies of energy producers and little involvement of the public in decision-making. However, the ECs' numbers started rising at unprecedented levels only during the 1990s and 2000s, especially thanks to the legal and financial support schemes for renewable energies implemented by countries such as Denmark and Germany (Caramizaru & Uihlein, 2020).

The reasons for citizens to unite and start an EC have not only included the opposition to nuclear energy, the resistance to a centralized and top-down energy system, or the difficulties with the connection to the national grid. Indeed, ECs have demonstrated to provide a wide range of benefits for individual citizens, communities, the energy system and the environment. Other benefits that the EU and MS want to promote by investing in ECs are for instance: access to cleaner and more affordable energy and to more information on energy efficiency, creation of new employment opportunities linked to RES, more community cohesion, investments in rural areas and more flexibility and security for the energy system (Directorate-General, 2022).

Since the ECs' sector includes many disparate realities that have developed with different definitions and paces from one EU MS to the other, still today there is no exact data on how many ECs are present in Europe. However, it is estimated that around 9.000 ECs exist nowadays in the EU and the Directorate-General for Energy (2022) reports that 1 million EU citizens participate in these initiatives. The majority of these are located in Germany, Denmark, the Netherlands and the United Kingdom (see Figure 1 below). The most diffused legal forms or organisational models of ECs in Europe are limited partnerships, community trusts and foundations, housing associations, non-profit customer-owned enterprises, public and private partnerships, public utility companies and energy cooperatives (Caramizaru & Uihlein, 2020).

According to Caramizaru and Uihlein (2020), the cooperative model is by far the most popular one in Europe, especially in countries like Germany and Sweden with deep-rooted community cultures. The cooperative framework is known for its democratic type of governance based on the "one member – one vote" principle, with which the most important decisions for the community project are taken. The profit generated through these initiatives is reinvested in activities that benefit the whole community or it is directly allocated to its members, depending on what the cooperative's statutes stipulate. Energy cooperatives can also join forces in broader associations or networks, within the country or at the European level, such as REScoop.eu (REScoop.eu, n.d.a).

Figure 1:
Approximate number of ECs in Europe



Source: Caramizaru & Uihlein, 2020, p. 5.

The number of community energy initiatives is expected to increase significantly in the next decades, especially after the EU published the CEP, which introduced the term of ECs in EU law and encouraged Member States to incentivize these realities. To understand how the CEP revolutionized the community energy sector in Europe and what it entails for the MS, the next sub-section explains what role the decentralization of the energy system plays in the EU's decarbonization and what the EU´s definition of ECs is.

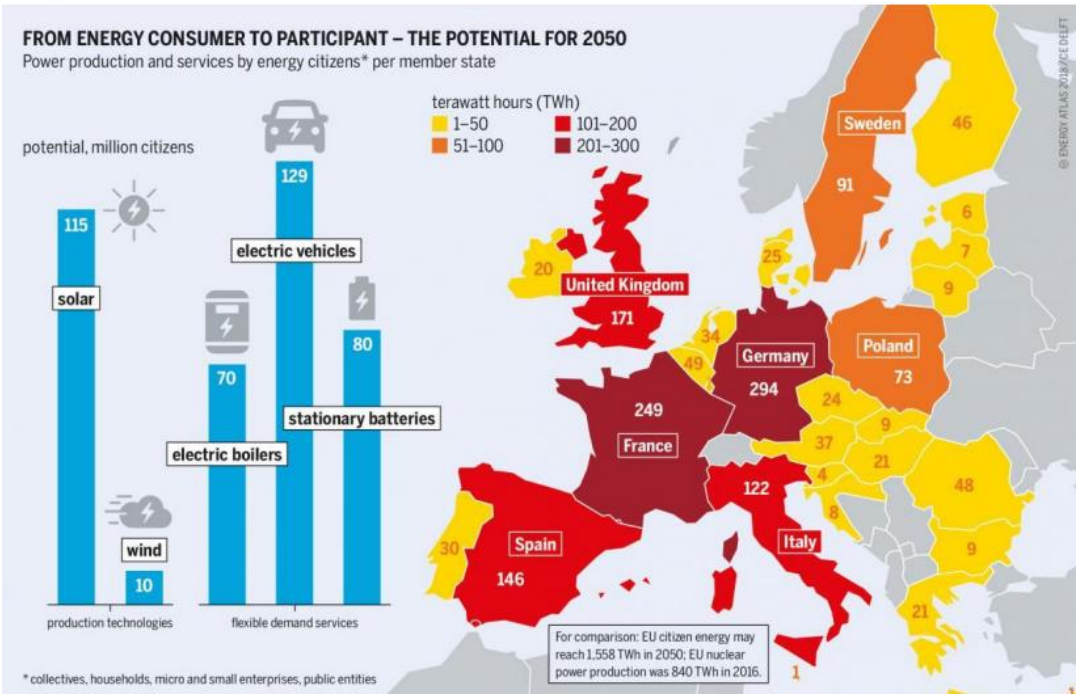
1.2 The Clean Energy for all Europeans Package and the definitions of energy communities

Although ECs started developing in Europe at the beginning of the last century, it was not until 2019 with the introduction of the CEP that the EU started investing in this sector. Indeed, this new energy rulebook marked a significant step in the EU's promotion of a more secure, affordable, decentralized energy system that enables citizens to play an active role in the energy transition while protecting their rights and environment.

The CEP was built on the previous EU third energy package of 2009, which was intended to further liberalise the EU energy market, enhance its internal collaboration and make it more competitive (Heidecke et al., 2022). After these measures were successfully implemented, the EU decided to publish the CEP's legislative proposals to enable the EU achievement of the decarbonization commitments taken with the signing of the Paris Agreement. Indeed, to maintain global warming within +2 degrees Celsius warming compared to pre-industrial levels, the EU announced the recast or introduction of eight legislations that touched upon the following five areas: energy efficiency, EU climate global leadership, a rulebook on national energy and climate strategies, secure and smarter energy systems and consumers' energy rights.

ECs and the decentralization of the EU energy system were envisaged to play an important part in the achievement of the CEP's five policy priorities. Indeed, when the CEP was published, the Directorate-General for Energy (2019) reported that by 2030 community energy would contribute to around 20% of wind and solar installed capacity in the EU. As shown in Figure 2 in the next page, the potential of ECs in Europe was very promising even before the publication of the CEP, since the power production of community energy was expected to surpass the total EU nuclear power production of 2016 by 2050 (Arybilia et al., 2018).

Figure 2:
Citizens' power production and energy services expected by 2050 per MS



Source: Arybilia et al., 2018, p. 16

The decentralisation of energy production through the development of ECs would have also helped the EU to increase energy efficiency by minimising transmission and distribution losses, diversifying energy resources, enhancing the security of supply and lower energy dependency, and empower EU citizens in the energy transition. As regards the last objective, the EU aimed indeed at making citizens able to take decisions over their own energy production, storage and sales and to reduce energy poverty by benefitting from national incentives schemes for renewable energy production.

ECs were specifically addressed in two legislative proposals, namely the recasts of the Internal Electricity Market Directive (IEMD II) and the Renewable Energy Directive (RED II). On the one hand, the IEMD II ensured a market-based price competition among energy suppliers and it promoted active citizen participation in the energy transition by introducing various consumers' rights, such as access to smart meters and producing their electricity under non-discriminatory requirements (European Parliament, 2022). On the other hand, the RED II increased to 32% the share of renewable sources foreseen in the EU energy mix by 2030 and it introduced rules on the transition to cleaner energy sources for the transport, heating and cooling sectors, incentive

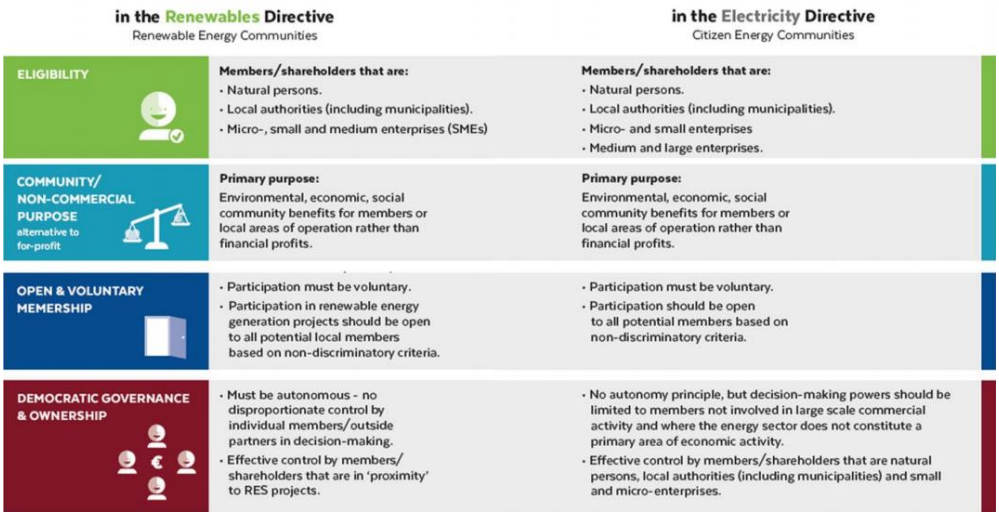
measures for renewables and the removal of barriers for their development (European Commission, n.d.b). Regarding community energy, these two legislative pieces simplified the administrative procedure for setting up ECs (RED II), improved the conditions of the market to pave their way (IEMD II) and, most importantly, introduced the first official EU-wide definitions of different types of community energy. The adoption of official ECs´ definitions in the CEP was a significant step in the EU promotion of community energy in Europe as it helped to identify these new realities as new market actors, it allowed existing and new initiatives to thrive, and it promoted incentives and a more favourable legal and financial environment for investments in the field (Tounquet et al., 2020).

These definitions do not concern only ECs but also another form of community energy, namely collective self-consumption (CSC) schemes, defined as "jointly acting renewables self consumers" under Article 21 of RED II. CSCs and ECs are two different concepts with distinct focuses: the former refer to a group of people living in the same structure who generate renewable energy for their use and can store and sell the power in excess. ECs instead, concern energy activities owned by a group of people usually located in the same area with, on the contrary to CSCs, a specific focus on the organisational structure and market factors of the project. In the EU legislative framework ECs are defined as "citizens energy communities" (CEC) and "renewable energy communities" (REC) respectively in the IEMD II (Article 2) and in the RED II (Article 22). These two legislative pieces describe two categories of ECs that share commonalities but also differ in some regards, especially concerning the governance approach at the national level and within the community projects (for the visual schematization of the RECs and CECs´ characteristics, see Figure 3 in the next page).

CECs and RECs are both legal entities that refer to community energy projects that are managed through a democratic system of governance and are intended to bring economic, environmental and social benefits to the citizens involved. These initiatives must be openly accessible and voluntary, and they must be under the "effective control" of certain participants. However, while CECs can include all types of actors with no geographic limitation, RECs exclude large companies and must be autonomous and involve only members that are located in proximity to the energy project. For RECs the project is limited to renewable ones operating in any energy sector, while CECs can use any kind of energy source but only for activities in the electricity sector (Frieden et al., 2020). Moreover, the EMD II and RED II's approaches differ substantially in terms of incentives for ECs since the former aims only at providing an enabling environment for the

experimentation of innovative energy market solutions, and the latter at specifically providing incentive tools to promote renewable ECs. Since the purpose of this dissertation is to investigate the factors enabling and/or disabling ECs in Italy and Germany, the definition of "energy community" adopted in the dissertation refers to the typology of EC most diffused in the two countries, namely the one corresponding to the RECs' one contained in the RED II (Tounquet et al.., 2020).

Figure 3:
Comparison of RECs and CECs in the CEP



Source: REScoop.eu, n.d.d

After the RED II and the EMD II came into force, MS had the legal obligation to transpose them into national law by 30th June 2021, to provide ECs with official definitions, rights and obligations, and allow them to develop at a faster peace in the legal form allowed by each MS (REScoop.eu, n.d.d). After the publication of the CEP, ECs were not mentioned specifically in any other major EU legislative piece, but they were rather promoted indirectly through the increased RES targets presented with the third recast of the RED and the REPower EU, namely the EU package of measures to end the European dependence on Russian gas. Despite the EU did not promote ECs in any other legislative piece, the European Commission launched two projects aimed at fostering the expansion of community energy: the Energy Communities Repository and the Rural Energy Community Advisory Hub. The former supports urban actors to develop EC projects through the collection of data and technical assistance, while the latter aims at helping rural zones to do the same by promoting networking between the various actors from rural areas, sharing best

practices and assisting with technical and financial support (European Commission, n.d.a; European Commission, n.d.c)

1.3 Enabling and disabling factors for energy communities in Europe

After their introduction to the EU legal framework 4 years ago and despite the clear economic, environmental and social benefits offered, ECs have not increased at an exponential rate like one would have expected. Indeed, the development of ECs is not only influenced by the legal and political contexts but it is rather impacted by a range of factors that differ from country to country. These factors include societal, cultural, political, legislative, technological and environmental aspects that influence the will of the local population, authority or businesses to form an EC or whether this will develop successfully or unsuccessfully. These elements have been investigated by several scholars in the field of ECs under the names of "incentives and barriers", "benefits and barriers", "drivers and barriers" "challenges", and "contextual factors" (Walker, 2008; Bauwens et al., 2016; Brummer, 2018; Busch et al., 2021; Ruggiero et al., 2021). To better reflect the complexity of the factors impacting the ECs' development, this dissertation will use the terms "enabling" and "disabling" factors instead of the conventional "drivers and barriers". These terms better convey and reflect the complexity and nuance of factors that contribute as a whole to shape the development of community energy, eventually helping achieve a deeper comprehension of the intricate processes at play. Indeed, by referring to the factors contributing to the ECs' development as "enabling" and "disabling" ones, this dissertation stresses that these elements can evolve and be dynamic over time, passing from having a positive impact to having a negative one on community energy. Moreover, this wording also better conveys that these factors do not contribute alone to the ECs' growth but rather add up to each other and shape the ECs´ development altogether.

According to an assessment of the barriers and drivers for ECs found in the academic literature by REScoop.eu and ECOLOG (Holstenkamp & Kriel, 2022), the development of community energy depends on elements summarised in the following categories: the business case and legal framework, market access, the informal institutions and conflicts, and the resources. First, from a business and legal perspective, national and municipal legislation (climate, incentives and planning), financial rules and investment attitudes, natural resources (e.g. wind and solar conditions) and energy prices have been identified as factors that can influence the development of ECs. Second, the success or failure of ECs is also influenced by the legal and technical rules for

ECs to access the energy market, the definition and legal format of ECs in different contexts, the licensing procedures and the presence of hostile and/or favourable market actors. Third, also factors related to civil society have a fundamental role in determining what turn the ECs' development takes. For instance, the presence of energy activism or deep-rooted environmental movements, to what extent people trust institutions and the market, what the societal vision on the energy system, renewables and the climate crisis is, and whether the population is engaged at the community and political level. Finally, ECs need resources to develop successfully, including members' time and know-how, funds, committed members, societal support, technical assistance and equity capital.

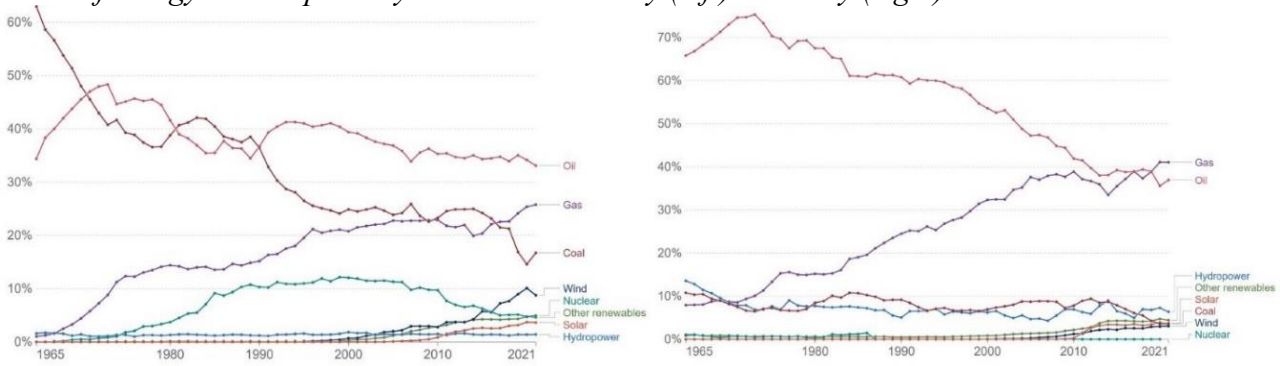
The European countries that have been investigated the most in terms of community energy are Germany, Denmark, the Netherlands and the United Kingdom. The reason for this is that these countries are the ones where ECs are the most diffused and successful, and where national governments have used specific and varied incentives and governance approaches to promote ECs (Caramizaru & Uihlein, 2020). Most of the literature focuses on investigating the reasons for the success of the countries with the most thriving examples of community energy rather than also analysing the reasons for the absence or poor development of such initiatives in other countries. In Europe, community energy is less developed in Eastern and Southern Europe. The latter region has experienced an increase in the numbers of ECs in recent years, but the community energy landscapes of countries such as Spain and Italy have not attracted much academic research. Moreover, the little literature available does not focus on the reasons for the slow development of ECs in these countries but rather on more general characteristics of the sector in those regions, mostly before the CEP was even transposed in the EU MS (Wierling et al., 2021; Romero-Rubio & de Andrés Díaz, 2015; Biresselioglu et al. 2021). To contribute to filling these gaps in the literature, this dissertation conducts an original comparative research study to analyse the enabling and disabling factors that have contributed to the development of ECs in two countries, one from Northern Europe, Germany, and one from Southern Europe, Italy. The next section of this chapter explains in further detail why these two specific countries were chosen for this dissertation's exploratory multiple case study and how their energy systems and ECs' sector share some commonalities and differences.

1.4 Case selection: multiple-case study on Germany and Italy

This subsection presents the two case studies chosen for this dissertation, namely Germany and Italy. In social sciences, multiple-case studies are used to explore various examples and experiences of one phenomenon from which it is possible to identify patterns, recognise similarities and differences, and get practical insights on specific samples. Moreover, by analysing the same subject in different contexts, researchers can evaluate how the various identified factors can lead to different outcomes in different socio-political contexts, thus drawing relevant conclusions for further theory building and development. These characteristics make the explanatory multiple-case studies a suitable methodology for this dissertation since it aims at exploring the community energy landscape of Italy and Germany and identifying existing patterns of enabling and/or disabling factors for ECs and how they affect the overall development of this sector.

Looking more specifically at the German and Italian energy systems and policies, the two countries show various divergences but also significant similarities, especially regarding the community energy sector. As one can observe from Figure 4 below, their energy consumption differs in terms of sources, for instance as regards nuclear power and the renewables share, but they resemble in other aspects related to the energy field, such as the historical significance of anti-nuclear movements, the high dependence on natural gas, renewable energy policies and characteristics of ECs.

Figure 4:
Share of energy consumption by source in Germany (left) and Italy (right)



Sources: Ritchie et al., 2022a; Ritchie et al., 2022b.

Even though Germany has relied for many years on the production of nuclear energy, it shares a history of strong anti-nuclear sentiment with Italy. Indeed, on the one hand, Italian citizens expressed their opposition to nuclear power with two different referendums (1987 and 2011), the

first of which led the Italian government to end all nuclear energy production after the Chernobyl disaster in 1986. On the other hand, a strong anti-nuclear movement has been active in Germany since the early 1970s and especially after the Fukushima incident in 2011. These anti-nuclear campaigns have had strong repercussions in Germany, including the citizens' will to end their energy dependence on nuclear energy and to push the federal government to end all nuclear power production by 2022. This plan was delayed by one year due to energy security and supply issues caused by the Russian-Ukrainian conflict.

As regards energy dependency, Germany and Italy were the largest net importers of energy in the EU in 2020 (Eurostat, 2022a). This is especially true for natural gas, which constitutes a big part of these two countries' energy mixes and imports (Bundesnetzagentur, 2023; International Trade Administration, 2022). Since most of the gas was provided by Russia before the Russian invasion of Ukraine, Germany and Italy have joined the rest of the EU Member States in diversifying their natural gas suppliers, but also in upscaling investments in renewable energies. Over the past decades, the renewables sector has grown exponentially in both countries, especially in Germany which has become famous for its *Energiewende* ("energy turnover" intended as "energy transition" in English). While the German transition to cleaner sources of energy has been sustained by the federal government and the citizens' will, in Italy the energy transition has been mainly steered by European regulations. Both countries have incentivized the use of renewables with feed-in tariffs and other similar financial tools, contributing to accelerating the growth of especially wind power in Germany and solar energy in Italy. With the EU provisional agreement to achieve 42,5% (and possibly 45%) of renewables-powered electricity by 2030 (European Commission, n.d.b), ECs are expected to contribute substantially to the achievement of this target.

Interestingly, even though European community energy was born in the first 1900s in Spain, Germany and Italy (Capellan-Perez et al., 2018; Yildiz et al., 2014; Spinicci, 2011), the development of ECs that followed in the latter two countries has been both quite different and similar from certain points of view. On the one hand, Berlin has developed a more advanced legal and financial framework for community energy and these realities are more present on the German territory, especially in the form of energy cooperatives. In Italy, the community energy sector is relatively new except for the province of Bolzano in the Northern part of the country, where some of the first European ECs were born out of the necessity to overcome the difficulties with connecting to the national grid. As regards the similarities between ECs in the two countries, these realities have shown favouritism for solar power and the introduction of feed-in tariffs and the

decreasing costs for photovoltaic panels have contributed significantly to increasing the number of ECs in both Italy and Germany (Wierling et al., 2021). According to Wierling et al. (2021), a decline in governmental incentives has caused a decrease in the creation of new ECs in the two countries. These realities have also been demonstrated to be particularly present in rural areas and in zones in-between rural and urban, generally where the local population had a higher source of income.

Despite sharing an anti-nuclear sentiment, high dependence on energy imports (especially of gas), similar incentives for renewables and trends for ECs, Italy and Germany show significant differences regarding the development of the community energy sector, which is far more developed in the latter. However, an interesting phenomenon started taking place some years ago: on the one hand, in Germany, the EU leader in community energy, the number of newly established energy communities and cooperatives have started declining due to unfavourable legislative and political conditions. On the other hand, in Italy the sector has attracted the interest of many and registered a sudden increase in numbers after the transposition of the CEP (Wierling et al., 2018; Wettengel, 2018; Ministero dell'Ambiente e della Sicurezza Energetica, 2022; GSE, 2022) These contrasting realities make the two countries a suitable choice to conduct an exploratory multiple-case study to understand what specific factors enabled and/ or disabled the expansion of community energy and, to a certain extent, why the trends in the two countries are inverting and why a divide between Northern and Southern Europe exists in the sector. The next sections of the chapter present how the analytical framework and research method structure the dissertation's analysis to answer the research question and discuss these other side issues.

1.5 Analytical framework: the Social-Ecological System

Several analytical frameworks related to energy and ecological transitions have been used by academics to analyse the field of community energy and develop policy recommendations to overcome existing barriers in the sector. The main theoretical frameworks include the Strategic Niche Management framework by Kemp et al. (1998), the Multi-Level Perspective framework by Geels (2002) and the SES framework by Ostrom (2007).

The first one was introduced as a strategy for institutional actors to encourage and foster research on new "niche" technologies to study their applicability and, eventually, promote their development and expansion in society. Kemp et al.'s (1998) do not propose a simple strategy of "technology-push" for new sustainable innovations, but they rather aim at helping authorities create

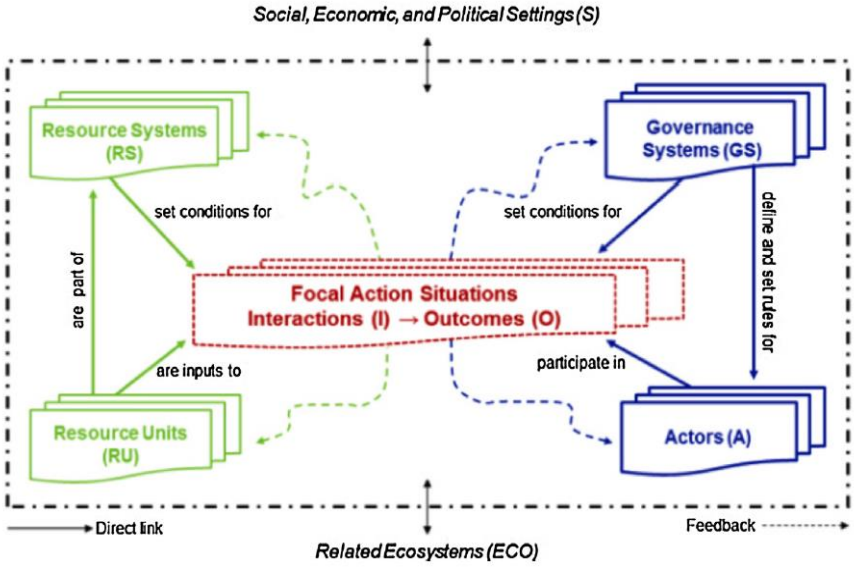
a suitable environment for niche technologies to develop successfully through a 5-steps strategy. The proposed plan articulates as follows: identifying the niche technology, choosing the experiment, conducting the experiment, scaling up the experiment and, finally, implementing policies to help the successful innovative technologies affirm in society (e.g. subsidies or demand-side incentives).

The second framework instead, was elaborated by Geels (2002) on the traces of frameworks of other scholars, including Kemp et al. (1998), to explain more in detail the process of how sustainability transitions take place starting with niche innovations and interacting with different layers of factors. The first level is the niches itself, namely where innovative technological projects are developed and utilised by a restricted number of actors (e.g. digital computers in the army sector). The second layer - the socio-technical regimes – is where niche inventions interact with the set of social and technological rules that govern society. The third level of factors - the "socio-technological landscape" – encompasses elements such as macro-economic, cultural and political factors that interact with the development of both niche innovations and socio-technical regimes (Geels, 2011). Depending on how the three levels of factors interact and co-evolve, sustainability innovations can, on the one hand, encounter a "window of opportunity" and establish in society or, on the other hand, not find a suitable environment for wide-spread use and remain a niche technology or gradually be abandoned.

Lastly, the SES framework was developed by Ostrom (2007) to identify the specific roles of actors and variables of a given socio-ecological system, how they interact and to what extent each of them is influential in determining certain outcomes and the progression of energy and environmental transitions. The SES framework has not only been applied to investigate the relations between ecosystems and society but it has also been used to analyse the interactions between humans, their surrounding environment and their technological systems, including energy infrastructure and its governance. According to the SES theory, the four contextual variables that influence socio-ecological systems are Resource Systems, Resource Units, Governance Systems and Actors. Resource Systems concern the biophysical/technical systems from which the Resource Units are extracted. The Governance systems instead, refer to "the prevailing sets of processes or institutions through which the rules shaping the behaviour of the actors are set and revised" (McGinnis, 2011, p. 181). Lastly, the Actors are those individuals or collective entities who participate in the socio-ecological system (i.e. civil society and businesses) and are characterized by shared norms and traits (technological access, financial capital, traditions, etc..).

Given that the dissertation aims at understanding the enabling and disabling factors that have contributed to the development of community energy in Italy and Germany, the third framework seems the most suitable for this research study. Indeed, while the first two analytical frameworks focus more on how sustainability transitions take place overall, the SES framework allows the researcher to conduct an agency analysis and understand what is the role of each individual factor in the socio-ecological system and how they impact developments in sustainability transitions. In other words, Kemp et al. (1998) and Geels' (2002) frameworks focus on *how* socio-technological transitions take place, while Ostrom's (2007) aims at categorizing the factors and variables involved and *what* their individual role and impact are. To understand how the Ostrom's (2007) framework operates, the Figure 5 below illustrates how the four variables contribute and interact to define the SES.

Figure 5:
Visualization of the SES framework



Source: McGinnis & Ostrom, 2014, p. 4

Applying this analytical framework to the energy sector, and the ECs' one in particular, Resource Systems can refer to biophysical ones (e.g. the presence of natural resources like wind and sun, the location of resources, etc.) or technical ones (referring to the type and size of the technology, the distance from the grid, etc.). The Resource Units are those elements extracted from the Resource Systems and they are consumed as inputs in a production process or exchanged for other goods and services. The Governance systems instead, correspond to the system's political

and legal institutions and energy policies, both at the national or local level in the case of community energy. Lastly, the Actors influencing the development of community energy include civil society, businesses, energy companies and more, and their impact on ECs is determined by, for instance, the people's attitude towards the cooperative model, cultures of local energy activism, collaborative approach by the private sector, etc. In order to apply Ostrom's (2007) SES framework to this dissertation's research, the author has operationalised the scholar's categories of variables into concrete factors to be later investigated in the analysis (see Table 1 below).

Table 1:

Author's elaboration of the factors affecting the SES framework

SES framework categories	**Factors of agency obtained through the operationalization of the SES framework**	**Related factors of agency to investigate**

Resource Systems & Units	• Biophysical resource system variables:
	  ○ Local natural resources
	  ○ Geographical position
	• Technical resource system variables:
	  ○ Energy infrastructure
	  ○ Energy storage infrastructure
		• Presence of natural resources:
		  ○ Sun
		  ○ Water
		  ○ Wind
		• Grid connection and state
		• Smart technologies

Governance Systems	• European Union
	• Member States' national governments
	• Local authorities (e.g. municipalities)
		• EU regulatory framework
		• National regulatory framework:
		  ○ Legislations
		  ○ Incentives scheme
		  ○ Experimental programmes
		  ○ Climate and energy strategies and targets
		• Municipal regulatory framework and involvement:
		  ○ Legislations
		  ○ Incentives scheme
		  ○ Permitting and planning procedures
		  ○ Promotion of initiatives on community energy

Actors	• Citizens and civil society
	• Non-governmental organisations (NGO)
	• Private business:
	  ○ Energy companies
	  ○ DSOs and TSOs
		• Local population's attitudes towards the cooperative model
		• Culture of local energy activism
		  • Anti-nuclear movements
		  • Civil society organisations
		• Citizens' trust in the institutions and in the community around
		• Financial capabilities of the local population and authority
		• The attitude of energy companies and DSOs and TSOs toward community energy

It is crucial to stress that this operationalisation and the selection of factors investigated in the research present some limitations. First, since community energy is a concept that unites sociological, political, technical, environmental and economic elements, its development can be influenced by an almost unlimited number of factors. Due to constraints of length and time, only a few of these factors have been analysed in this dissertation. These elements have been selected after a review of the literature covering the SES framework's application to the community energy sector, e.g. Partelow (2015) and Bauwens et al. (2016), and with the help of insightful information provided by the experts interviewed for the research. Second, given the intention of this dissertation to give a comprehensive vision of the main enabling and disabling factors influencing the ECs' development in Germany and Italy, the factors reported in the table below are still quite numerous and, therefore, the focus on each of them in the analysis is limited. Even though Table 1 encompasses all the selected factors pertinent to the analysis, not all of them proved to be relevant for both Germany and Italy. Therefore, their respective significance and value for the analysis vary based on the findings.

1.6 Research design:

The dissertation conducts a qualitative mixed methods analysis, also known as triangulation, to enhance the validity and credibility of this research. In order to answer the research question through different sources of data and information, the analysis presented in the next two analytical chapters employed the methods of content analysis and interviewing.

First, content analysis is a commonly employed method in the social sciences for deriving reliable and accurate insights from texts or other relevant materials concerning their usage contexts. This approach involves analysing both explicit and implicit meanings within the texts to allow for

a critical examination and narrative revaluation of the investigated material, as described by Drisko and Maschi (2016). In the next chapters, a content analysis of documents regarding the Italian and German ECs' landscapes is conducted according to the order of the categorisation of factors reported in Table 1 (see above). As regards the analysed documents, the dissertation uses both primary and secondary sources: on the one hand, official governmental documents, legislative rules and reports were selected from the websites of the Italian and German governments and national energy agencies. On the other hand, this dissertation also looks into academic articles on how community energy has developed in the two countries and how different actors have affected the expansion process of this sector. This content analysis provides background and complementary information to the interviews. However, the content analysis of academic papers has been limited by two factors: the author's background in social and political sciences and the limited dimension of the Italian community energy landscape and the relative small-scale research conducted on this case study. The two limitations were addressed by giving a socio-political focus to the research and by using the interviews' findings to guide the analysis of the Italian case.

Second, semi-structured interviews were conducted by the author in order to collect insights on what factors are enabling or not the development of ECs in Italy and Germany. Semi-structured interviews were chosen as the main data collection method in this dissertation as they present many benefits for this dissertation's scope. By being semi-structured, the interviews bring more flexibility to the conversation between the researcher and the interviewee, who can feel able to follow up on interesting responses and more open to describe genuinely his/her/their perspective of the issue in question. Moreover, semi-structured interviews allow the interviewee to jump freely from one topic to the other according to what he/she/they find the most relevant to the study, offering guiding help to the researcher and possibly introducing new emergent themes and aspects to the knowledge of people external to the environment of study.

The interviews were structured following the factors of agency obtained with the operationalization of the SES framework's variables (see Annex 1 for an example of the interviews' questions). The interviewees conducted were thirteen: six from the sector of German community energy, six from the Italian EC's landscape and one from the European one. These experts encompass workers from the community energy sector, representatives of local authorities working on ECs' matters and people working on initiatives of community energy within larger energy companies. By selecting these categories of professionals, the author tried to cover the perspectives and the regional differences of the most important actors involved in the field of ECs. In Table 2

below, the interviewees are reported together with the category of actors to which they belong, the national or supranational context they work in, their assigned anonymous pseudonym (e.g. interviewee 1G/1I/1E) and their occupation.

Table 2:

Interviewees, their country of origin and their job position

Category of interviewees	**Supranational/ national context**	**Interviewees' pseudonym**	**Occupation**
Workers from the energy community sector	Germany	Interviewee 1G	Worker in an energy cooperative in Northern Germany near Hamburg
		Interviewee 2G	Member of the Board of Directors of one of the first energy cooperatives in Germany (Western-Central Germany)
	Italy	Interviewee 1I	Founder of a start-up that helps people develop an EC
		Interviewee 2I	Employee at an energy cooperative based in Lombardy
European/ national/ regional/ municipal representatives working on energy matters	Europe	Interviewee 1E	Employee at a European federation of ECs
	Germany	Interviewee 3G	Mayor of a village in Eastern Germany which is currently starting an EC
		Interviewee 4G	Employee at an energy agency working with the German government on projects such as ECs
	Italy	Interviewee 3I	Mayor of a town in Sardinia which developed an EC to fight locals' energy poverty
		Interviewee 4I	Employee at the Department of Energy and Climate of the municipal government in a large city in Northern Italy
Private businesses working on energy community projects	Germany	Interviewee 5G	Expert in ECs from one of the German cooperatives federations, working also in cooperation with other energy businesses
		Interviewee 6G	Employee at a company providing individuals and ECs with renewable energy in Germany

(Distribution System Operators (DSO) and energy companies)	Italy	Interviewee 5I	Employee specialized in ECs from one of the top 5 energy companies in Italy
		Interviewee 6I	Employee specialised in ECs from one of the major energy companies in Italy

The interviews conducted lasted between 30 and 45 minutes on average and they were conducted in English (for the German and European categories) and in Italian (for the Italian category). In the analysis, the interviewees' responses are reported by citing their statements but, mostly, by paraphrasing and grouping their contributions and opinions. This reporting approach is applied to stress the number of interviewees agreeing on a certain topic, thus enhancing the validity of their statements and their contribution to support and enrich the arguments found in the literature and vice versa. In case the reader is interested in consulting one or more interviews´ transcriptions, the author can provide him/her/them with the transcripts upon request.

It is important to recognise that how the interviewing method has been carried out presents some limitations. The first one regards the biases that the methodology itself has, such as the subjectivity of the participants, the possible influence of the interviewer on the interviewee and the social desirability bias. Indeed, all interview participants are influenced by their own experiences and personal interpretations, but they can also be influenced by how certain questions are posed, by what they think would put them in a positive light or by what they believe the interviewer expects. This limitation has been addressed by posing as neutral questions as possible and by using a mixed-methods research methodology, namely by conducting a triangulation of data and information to enhance the credibility of the answers obtained during the interviews.

Second, conducting interviews in Italian and English (also as a replacement for German for the German-speaker interviewees), and then using only the latter for the writing process can lead to a loss in nuance and, thus, to potential misrepresentations or misinterpretations. Moreover, using a non-native language can create a communication barrier for interviewees, who can therefore have difficulties in formulating complex ideas, enriching the messages they want to convey or even properly understanding the question posed. These limitations have been addressed by taking into account the researcher's bilingual proficiency in the two languages used, by interviewing only Italian and English proficient speakers and by using advanced translating tools such as the website application *DeepL*. Various scholars consider this website as reliable and continuously enhancing

its translation methods, particularly in terms of capturing language nuances (DeMattee et al., 2022, p. 3; Zulfiqar et al., 2018, p. 2222).

Third, the sample of interviewees does not represent fully the diversity of the actors in the community energy sector. This could have been addressed by also interviewing NGOs from the energy and climate fields or by involving ordinary citizens and members of ECs with survey research. Unfortunately, due to a lack of time and resources and because of the dissertation's words limit, it has not been possible to include these participants in the interview process, or to conduct a survey research.

Chapter 2: Energy communities in Germany

In the previous chapter, the dissertation presented the state of the art on the European ECs' landscape and framework, and what theoretical framework and research methods the study applies. This chapter and the next one instead delve into the analysis of the enabling and disabling factors for the development of ECs in Germany and then Italy. As previously mentioned, these two analytical chapters are structured according to the SES framework's categories and, thus, divided into three sections each: the Resource Systems and Units, the Governance Systems and the Actors.

2.1 The German energy communities and the Resource Systems and Units

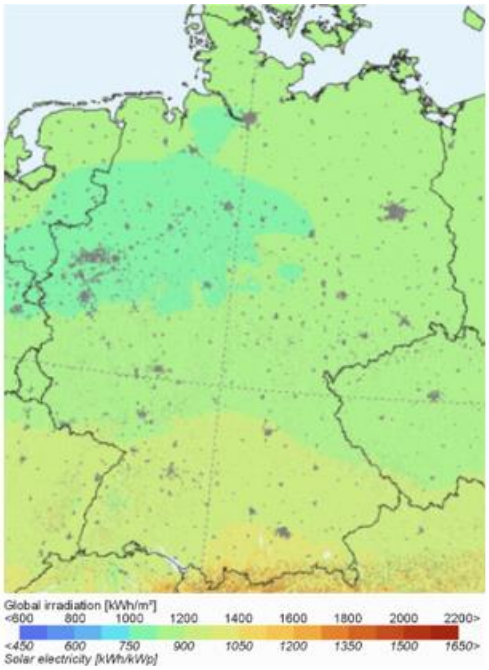
As above-mentioned, Germany is the EU country with the highest number of ECs, c.a. 1750 (Caramizaru & Uihlein, 2020). The most common legal forms of ECs are the limited partnership model (GmbH & Co. KG), especially for wind-based community energy, and the cooperative form. Nowadays, almost half of all German ECs are cooperatives (847), and they count 220.000 members, 1.200 employees and 3.3 billion euros overall invested in renewable energies since 2006 (DGRV, n.d., DGRV, 2022). Energy cooperatives, called *Energiegenossenschaften* (*e.G.*[1]) in German, contributed to the electrification of rural areas around the beginning of the 20th century, but only a few of them survived over the decades until the mid-2000s when they started rising in numbers again (Krug et al., 2022). Most of nowadays' *e.G.*s have been founded after the nuclear incident of Fukushima, which revived the German anti-nuclear movement and the will of citizens to foster the energy transition to RES (Wierling et al., 2018). *E.G.s* experienced a peak in new registrations in 2011, but then they started declining after 2013 corresponding with legislative changes.

According to the literature and the interviews carried out, solar, wind and hydro power have been the most relevant in the ECs´ development in Europe, considering that the first ECs of the 20th century mainly produced hydro power, while modern community energy revolves around solar and wind power. When comparing the German ECs' numbers with the ones of other MS, one could argue that the development of the German community energy sector might have been enabled by the abundance of these natural resources, namely sunlight, wind or water. However, when looking at the photovoltaic, wind and hydro power potentials in Germany (see Figures 6, 7 and 8 in the

[1] The abbreviation "*e.G.*" in German stands both for "Energiegenossenschaft" ("energy cooperative" in English) and "eingetragene Genossenschaft" (legal term for "registered cooperative"). For the purpose of this dissertation, the term *e.G.* will refer to energy cooperatives.

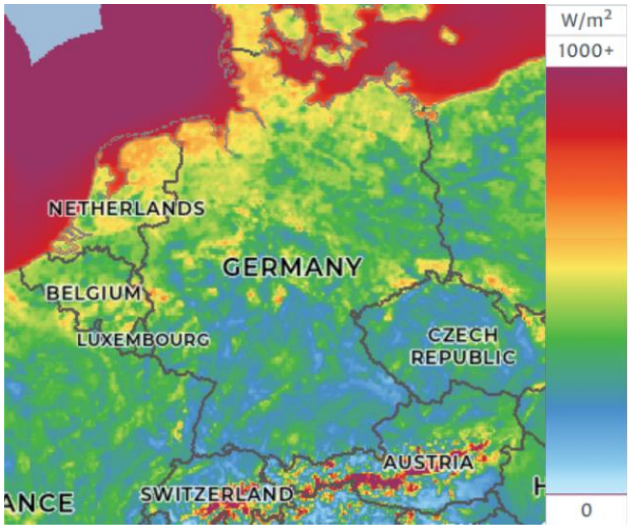
next pages), it becomes evident that other factors have played a more important role in enabling this development. Indeed, the highly windy Northern regions of Germany have not registered a significantly high number of ECs, while the relatively sunnier and water-rich Southern regions of Germany have developed numerous ECs, especially in Bavaria, Baden-Württemberg and Lower Saxon (Yildiz et al., 2014). Moreover, Germany seems to have a lower hydropower potential than other European countries, despite being among the first countries to develop a high number of ECs based on this source of energy. This uneven distribution is justified by scholars and some of the interviewees by the spillover and imitators' effects, and by the difference in investments needed for the different RES (Yildiz et al., 2014; Bauwens et al., 2016; Interviewees 1G and 5G). For instance, Interviewee 1G argued that the existing gap in ECs' development between Baden-Württemberg (South of Germany) and Northern Germany is due to the difference in the affordability of photovoltaic and wind power projects. In this sense, interviewees 1G and 5G highlighted how the presence of natural resources can be both an enabling or a disabling factor for the development of ECs as it constrains the choice of projects feasible in a region. Indeed, according to Bauwens et al. (2016), not only photovoltaic infrastructure is very cheap, but it also brings higher returns to the community compared to other RES projects, which need higher initial investments. These elements might explain why most German ECs are active in the photovoltaic sector (60%), only 20% in the wind power one and 4% in the hydro power field (Wierling et al., 2018). Overall, apart from influencing

Figure 6:
Yearly sum of irradiation incident on optimally inclined south-oriented photovoltaic modules



Source: Joint Research Centre, 2006.

Figure 7:
Mean Power Density at 100m - Germany

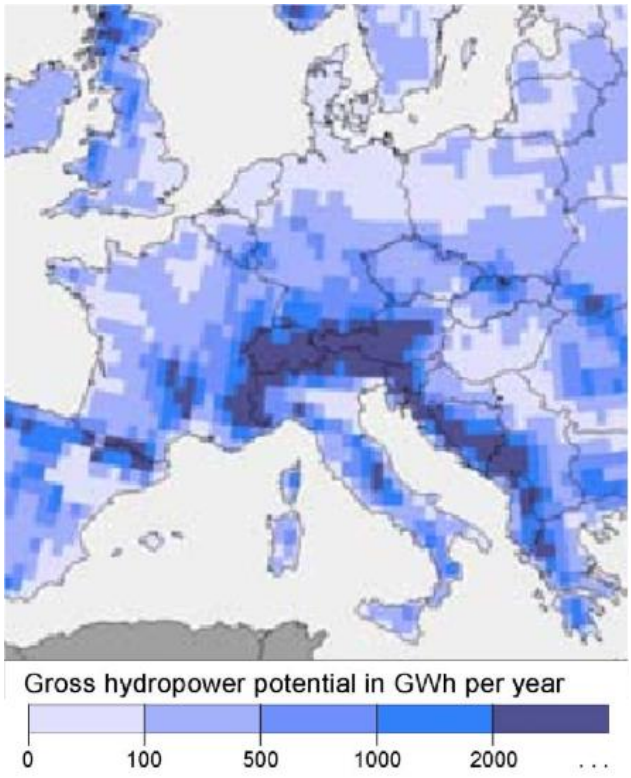


Source: Global Wind Atlas, n.d.

the choice of the resource chosen to form an EC, most interviewees agreed that the presence of natural resources is not a significant enabling factor for the development of community energy.

German ECs are located mostly in rural areas for several factors (Wierling et al., 2021). Firstly, rural areas offer advantages that urban zones do not, such as the abundance of space and a lower population density. According to the German mayor interviewed (3G), the latter factor makes it easier to install, for instance, windmills as their potential negative effects would impact fewer individuals. Secondly, the historical ECs were created in rural isolated areas and still more than half of those created during the 1920s exist today (Wierling et al., 2018; Yildiz et al., 2014). However, the need to electrify isolated areas and to find alternatives to the national grid are not enabling factors anymore for the development of German ECs, as also reported by all the interviewees. Indeed, nowadays Germany is fully electrified even in remote areas and the German grid is among the most reliable worldwide (Appunn & Russell, 2021).

Figure 8:
Gross hydropower potential in GWh per year calculated by applying average (1961-90) runoff and discharge values of WaterGAP



Source: Lehner et al., 2001.

However, certain German ECs are already facing (or will face soon) technical issues linked to the obsolescence of the grid system and the limited expansion of smart technologies for better management of bi-directional energy flows and power exchanges. These challenges hinder the ECs' capabilities to expand both in terms of numbers and new RES projects. For instance, the mayor from Eastern Germany (Interviewee 3G) reported that the several windmills installed in his region often have to stand still since the transmission lines cannot afford to conduct all the produced power to where industries are located, hampering local investments in new RES. To address these issues, the German government is investing in the expansion of the grids, such as the transmission lines that will link the Northern regions, where most wind power is generated, to the South-West, where most industries are located (Appunn & Russell, 2021). However, given that 95% of all RES are

connected to the DSOs' network, also distribution grids need investments in, for instance, the installation of more local distribution substations and smart meters in German households (Appunn & Russell, 2021). Regarding these latter, Interviewee 5G asserted that the development of community energy in the country will depend also on the pace of adoption of smart meters, which in his opinion are still not spread enough. Indeed, despite the adoption of a federal law in 2015 to foster the adoption of smart meters, they have not been installed at the desired pace due to data privacy issues and setbacks in technological advancements (Appunn & Russell, 2021). Therefore, the federal government has recently passed legislation to speed up the installation of smart technologies (Kurmayer, 2023).

2.2 The German energy communities and the Governance System

From a legal and political perspective, the success of the German community energy sector has been mainly enabled by the national legislative framework rather than the European one. As introduced above, German ECs started developing in the early 20th century and towards the end of the 1980s, the German government implemented several measures to increase RES production. Thanks to measures such as feed-in tariffs, enabled by the *Stromeinspeisungsgesetz* in 1991, the production of renewable energy grew significantly and ECs with it (Lauber & Mez, 2004). With the EU First Energy Package (1996) for the liberalization of the European electricity markets, MS went through an unbundling process that would promote competition among energy actors and facilitate grid access (Meister et al., 2020). This EU measure impacted heavily the development of ECs: on the one hand, it allowed new community energy initiatives to access the grid and the market. On the other hand, already-existing German ECs feared being displaced by larger energy companies as a result of the liberalization process. This was the case for Interviewee 2G's energy community, which responded to these developments by adopting a cooperative model to increase the number of members more easily, collect more investments and evolve into a German-wide green electricity provider.

The main German legislative piece that enabled the first exponential growth rate in the number of ECs was introduced in 2000 under the name of the *Erneuerbare-Energien-Gesetz* (*EEG*), namely the Renewable Sources Act. The *EEG* supported the growth in RES production and the development of community energy by granting 20-year-long feed-in tariffs and ensuring priority access to the distribution and transmission grids for all RES producers (Wainer et al., 2022.;

Bauwens et al., 2016). All the German interviewees agreed that the *EEG* initially played a significant role in enabling the development of ECs, as it allowed citizens to come up with an "easy business plan" (Interviewee 5G) thanks to a low-risk and financially attractive framework for investing in clean energy. The spread of community energy was also enabled by the recast of the Cooperative Act in 2006, which eased the procedures and regulations to form cooperatives (Krug et al., 2022; Meister et al., 2020). According to Interviewees 2G and 6G, the cooperative model became the easiest one for ECs to collect money and integrate new members, explaining the reason why *e.G.*s became the most common legal form of EC in Germany.

Thereafter, the *EEG* has been amended on average every 3 years and over a decade it gradually passed from being the main enabling factor for the development of ECs to being a rather disabling one for the community energy sector after 2012. Indeed, the amendments of 2012, 2014 and 2016 coincided with decreases in the numbers of newly registered ECs, as the recasts of the *EEG* made regulations for ECs and RES producers more complicated, heavily bureaucratic and poorer in financial incentives (Wettengel, 2018; Wierling et al., 2018; Wierling et al., 2021; Krug et al., 2022). As regards the latter, the feed-in tariffs were maintained only for small RES installations, while the remuneration for larger RES projects was established via a tendering process. At first, the auctions regarded only large solar and offshore wind power projects, but later they included also onshore wind energy, granting financial support only to the most economic-competitive RES projects. Due to concerns over the disadvantaged position that energy communities would have faced in competing with larger energy companies due to lack of funds and expertise, the *EEG* granted ECs special privileges in the tendering process. However, these benefits and legislative loopholes led to episodes of corporate capture and made it possible for larger energy actors to fall into the category of ECs. This allowed initiatives by energy companies to be considered as ECs and made community energy projects result as the main beneficiaries in the first rounds of bids (98% of all selected projects) (Wehrmann, 2017; Krug et al., 2022). In 2018, part of these benefits were revoked and, since then, ECs have struggled to compete with other energy actors in the tendering process and the number of newly established *e.G.*s per year has shrunk.

Commentators attribute this negative development to the tendering process, but also to other disabling factors such as the cut in financial incentives, the decreasing investments in photovoltaic installations coupled with increasing ones in wind power by GmbH & Co. KGs, the complex bureaucratic process, a general lack of know-how and low scale efficiencies of projects (Krug et

al., 2022; Keating, 2021; Wehrmann, 2017). Most of the interviewees agreed on the fact that the *EEG* had been a significant enabling factor for the development of ECs at the beginning. However, they argue that the recasts have made it more difficult for ECs to thrive and expand in new RES projects (Wehrmann, 2019; DGRV, 2021). According to Interviewee 6G, the constant re-amendment of the *EEG* has also made it hard for the workers of the sector to react to new requirements every few years, causing an uncertain regulatory framework that discouraged new *e.G.*s to enter the market. Interviewee 1E also stressed that the majority of people working in ECs are volunteers with other full-time jobs and, therefore, constant amendments of the *EEG* make it hard for them to keep up with the legislative changes.

Unfortunately, the EU's CEP did not help in reviving the German community energy sector. Indeed, to this date, the IEDM II and the RED II have still not been transposed completely into national law. As regards the former, no official definition has been adopted for CECs. On the contrary, the RECs' definition has been introduced by amending the existing term for *Bürgerenergiegesellschaften* - citizen energy corporations – first in the *EEG* 2021 and later also in the *EEG* 2023. According to German law, ECs must consist of at least 50 natural persons, they can include micro, small or medium enterprises and local authorities or associations, and their members must be located in proximity and hold effective control, as long as no member holds more than 10% of the voting rights. The definition does not refer to the ECs' scopes or their open and voluntary character, even though the latter is mentioned in the Cooperative Act (REScoop.eu, n.d.b). Moreover, according to REScoop.eu (n.d.b) Germany still needs to conduct an assessment of the obstacles and potential for ECs, introduce the right of energy-sharing and address issues such as the accessibility for vulnerable households or the non-discrimination of ECs as market participants (REScoop.eu, n.d.b). The experts interviewed agreed that the CEP has still not had an impact on the development of ECs in Germany due to the delays of the federal government in transposing the directives. According to Interviewees 4G and 1G, such setbacks could be attributed to different factors, such as the lobby activities of energy companies and the lack of urgency to transpose EU legislation due to pre-existing regulations on energy cooperatives.

Looking at the subnational levels, scholars have argued that states (*Länder*) and municipalities' policies have been an enabling factor in developing ECs, especially given the German federal structure and the significant powers that these authorities wield (Schönberger & Reiche, 2016; Meister et al., 2020). On the one hand, *Länder* can legislate over energy supplies issues, which has allowed them to implement regional climate and energy plans, financially

promote RES and carry out energy-efficiency initiatives (Schönberger & Reiche, 2016). On the other hand, also municipal authorities have much legal and political autonomy regarding energy and planning and permit issues (Meister et al., 2020). As explained by Interviewees 3G and 1G, municipal governments are widely supportive of ECs as they can invest in RES, thus fulfilling the decarbonization obligations, while also investing locally for the benefit of the community rather than big energy companies.

According to a survey study conducted by Meister et al. (2020), the participation of local governments in German ECs is an overall enabling factor, as it contributes to increasing social acceptance of RES projects and it provides different forms of support. The most diffused types of municipal assistance are the concession of land or roofs (50% of *e.G.*s) and help with planning and permitting processes. As regards expertise and financial assistance by the municipality, the former is very rarely passed to the EC and the latter is often provided through membership, thus by granting equity. However, ECs do not struggle to find alternative financial support from other institutions such as the cooperative banks *Genossenschaftsbanken* (Wettengel, 2018; Meister et al., 2020).

In the interviews conducted for this dissertation, most interviewees agreed that municipalities influence the development of ECs, but this can be both an enabling or a disabling factor. As Interviewee 2G reported, when the ECs' sector was less developed, community energy initiatives were perceived as risky. However, since nowadays ECs are spread and acknowledged in Germany, local authorities are more supportive of them (Interviewees 1G, 3G, 5G, 6G). However, Interviewee 6G stressed that the involvement of municipalities can be a disabling factor for the development of the EC sometimes, as they can try to impose their decision over the citizens' will.

2.3 The German energy communities and the Actors

This subsection presents the main actors involved in the development of ECs and related elements: private individuals involved in ECs (as they constitute more than 90% of *e.G.*s' members), the public opinion on ECs and RES (as they affect the willingness of citizens to participate in community energy projects), and DSOs (whose relations with ECs can affect the development of these initiatives).

According to Radtke and Ohlhorst (2021), most of the German ECs' members are over 45 years-old and males (80%), mostly highly educated, with a wage of more than 3.500 euros per month and quite socially and politically engaged (80% are involved in social or political

associations). Moreover, more than 90% of the surveyed members affirm that their involvement in an EC is mainly due to environmental motivations, while financial reasons are second in line. This data confirms what Interviewee 4G stressed as one of the main issues of ECs: even if they are supposed to assist the most vulnerable societal groups, they are still a niche reality in Germany, overrepresented by middle-aged, well-educated and wealthy men.

Looking at the successful development of ECs in Germany and, in particular, of the cooperative model, it seems to have been partly enabled by the favourable public attitude towards cooperatives in general. Indeed, Germans have a deep-rooted culture of cooperatives, which was revived through the amendment of the Cooperative Act in 2006 (Bauwens et al., 2016). This tradition is particularly felt in the areas of Baden-Württemberg, Weser-Ems and Northern Bavaria, while they are less successful in Eastern Germany. Some scholars argue that this is due to the Soviet past of Eastern Germany and the relative collectivisation heritage and trauma (Bauwens et al., 2016; Yildiz et al., 2014).

Another important enabling factor in the development of German ECs has been the presence of local energy activism, most notably the presence of a strong anti-nuclear movement. After ECs developed at the beginning of the 20th century, they experienced a renewed interest after the nuclear accident of Chernobyl in 1986 (Wierling et al., 2018; Bauwens et al., 2016). This episode had a dramatic impact on Germans: Chernobyl changed the peoples' attitude of believing unconditionally in what the government would say about nuclear power and the percentage of citizens opposed to this source of energy grew to 70% (Interviewee 2G; Lauber & Mez, 2004). Since then, a significant part of the broader German environmental movement became strongly anti-nuclear, advocating against polluting and unsafe sources of energy and in favour of the transition to RES (Lauber & Mez, 2004; Bauwens et al., 2016). Even if still nowadays the anti-nuclear and the climate movement in Germany "work in synergy" to a certain extent (Interviewee 4G), climate action seems to have gained more significance as enabling factor for the development of EC than anti-nuclear sentiments (Interviewees 2G and 5G). This shift can be attributed to the announcement made over 10 years ago by the German government to phase-out nuclear (Interviewee 5G), but also to the change in public opinion about nuclear power after the recent energy crises (Bateson, 2021; Staudenmaier, 2022). It is important to stress though, that the presence of anti-nuclear movements in a region does not necessarily mean that the area presents more ECs than other ones. This can be demonstrated by Eastern Germany, which also experienced anti-nuclear movements but did not see a significant development of ECs. Therefore, Eastern Germany demonstrates that energy activism,

despite being an important cultural factor for the development of ECs, cannot be considered alone as an absolute enabler of community energy.

According to Interviewee 3G, Eastern Germans are also generally less accepting of RES because of the historical links between these regions and coal production, which has introduced high-paying wages for locals. However, the problem of social acceptance is not restricted to these regions. On the one hand, social acceptance for RES in Germany is increasing and it is higher than the EU average: 69% of Germans "totally agree" with encouraging investments in clean energy, compared to 60% of EU citizens (European Commission, 2019). However, there is a growing "loud minority" part of the Not In My Backyard (NIMBY) movement, which is opposed to renewable energy projects at the local level (Wettengel, 2023). An example of how these movements have affected local regulation for RES is the Bavarian "10H rule", a legislation introduced by the Christian Social Union party to impose a minimum distance of ten times the height of wind turbines between them and human settlements. This rule has been accused to have hampered the development of wind power in the region and, thus, one can argue also of ECs (Kyllmann, 2022). However, scholars observed that ECs are part of the solution to increase social acceptance of RES at the local level, thanks to the inclusion of citizens in the decision-making and in the sharing of economic, social and environmental benefits that community energy brings (Caramizaru & Uihlein, 2020; Bauwens et al., 2016).

As regards citizens' trust, it has been claimed both by scholars (Yildiz et al., 2014; Kalkbrenner & Roosen, 2016) and Interviewee 4G that this factor is essential in establishing stable and cooperative relations among the members of a community and, thus, enabling or disabling the development of ECs. According to Our World in Data (2020), 90,6% of German citizens trust very much the people living in their neighbourhood, showing a very high level of trust in the people of their local community compared to the rest of EU countries and the world in general. Based on these results and the scholars´ arguments, one can claim that Germans might show an exceptional openness to initiate or participate in community projects such as ECs.

The development of community energy has also been associated with peoples' income and financial capabilities (Kalkbrenner & Roosen, 2016). Overall, Germany has an above-average GDP per capita compared to the EU average (Eurostat, 2022b), but still, most interviewees stated that ECs are often not affordable enough. On the one hand, Interviewees 2G and 5G argued that, in their experience, the financial resources of the local population do not impact the development of ECs, but rather that the German middle class is ready "to put money into crazy ideas and argue with the

Powerful" (Interviewee 2G). On the other hand, interviewees 1G, 3G, 4G and 6G agreed on the fact that the lack of enough financial resources is an important disabling factor for the ECs' development in less wealthy regions, as it is demonstrated by the concentration of more ECs in the richest areas (Western-Southern Germany). Indeed, the usual average contribution of *e.G.*s' members is quite high, namely €5.200 (DGRV, n.d.). Participation in ECs for low-income citizens is sometimes hindered even in cases where the minimum financial contribution for members is €50 (Hanke & Guyet, 2023; DGRV, n.d.).

Finally, looking at another category of actors – the DSOs –, these have passed from being a disabling force for the development of German ECs to being simply competitors of community energy initiatives. Indeed, Interviewee 2G reported that before the 2000s DSOs would actively hamper the development of ECs at the local level by, for instance, denying access to the grid or threatening the communities' initiatives with legal trials in case of business damage. However, according to Wainer et al. (2022), nowadays German ECs seem to not have controversies with DSOs over the connection to the grid, related prices or relation with the local *Stadtwerke* (the public utilities). Indeed, past issues experienced by older ECs do not arise any more thanks to the *EEG*'s obligation for DSOs to give RES priority of connection to the grid.

Thanks to the analysis of the German ECs´ Resource Systems and Units, Governance Systems and Actors, it has been possible to identify the main factors that have enabled and/or disabled the development of community energy in Germany. Firstly, natural resources have impacted the choice of RES project, thus being an enabling or disabling factor depending on the investments needed, but they have not enabled the willingness of citizens to form ECs. Technical problems have not been influential in the development of ECs either, but issues such as the grids´ state and the rollout of smart technologies could become a serious disabling factor for ECs if not addressed. Secondly, the EU legislative framework has not impacted the German community energy sector due to the delays in the transposition into national law. Instead, ECs have been enabled mainly by the *EEG* through financial incentives, until its amendments transformed it into a disabling factor for the development of community energy. At the subnational levels, *Länder* and especially municipalities have supported ECs by providing communities with public space for RES installations and help with planning and permit issues. Thirdly, the German culture has been a main enabling factor for the development of community energy, especially as regards environmental consciousness, the cooperative culture, the history of energy activism and the exceptionally-high community trust. The financial capacities have, instead, proved to be a disabling factor for ECs in

the poorer regions of the country. As regards DSOs, they do not represent a disabling force for ECs thanks to the *EEG´*s obligation for them to provide community energy initiatives with the priority of connection to the grid.

Chapter 3: Energy communities in Italy

3.1 The Italian energy communities and the Resource Systems and Units

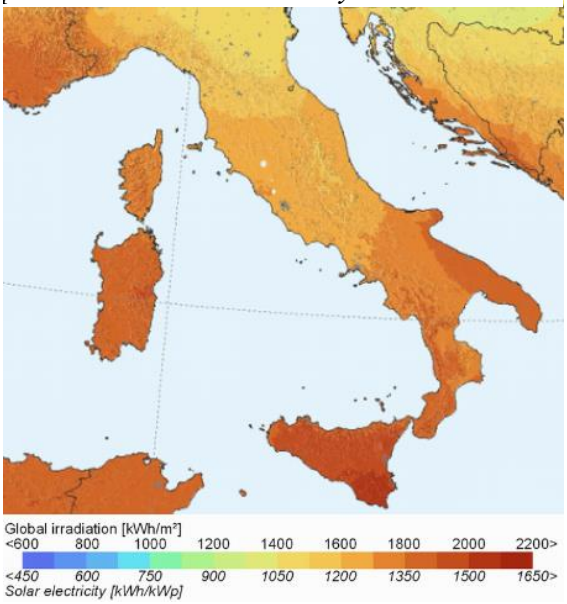
Given the limited expansion of ECs in Italy and the recent regulation of these realities at the national level, the data and numbers on how many community energy projects exist and which ones correspond to the newly-introduced definition are incoherent and sparse. For instance, looking at REScoop.eu's (n.d.c) database, Italy counts 43 community energy projects. Confcooperative Consumo e Utenza (n.d.) reports instead that 73 energy cooperatives are associated with its federation, including the ancient mountainous ones born more than a century ago. Lastly, according to the Italian energy authority in charge of the ECs' official registration procedures, namely the Operator of Energy Services (GSE) (GSE, 2023), the official number of ECs, known as *Comunità Energetiche Rinnovabili* (*CER*), is 21 and they provide 160 final clients with a total power of 1,4 MW.

Despite the absence of official data, the cooperative model characterizes a large part of the Italian ECs' landscape, especially the most ancient initiatives of community energy in the mountainous areas of Northern Italy (Spinicci, 2011; Barroco et al., 2020; Candelise & Ruggieri, 2021). However, also other legal forms of ECs are diffused, such as non-profit associations and limited companies. As introduced above, the first community energy initiatives in Italy date back to the early 1900s. Thereafter, ECs have not experienced any significant development until 2010, when RES incentives especially for solar power were introduced under the form of feed-in tariffs (Candelise & Ruggieri, 2021). After cuts in supporting measures after 2013, the growth of the Italian RES sector has stopped and likewise the one of ECs (Candelise & Ruggieri, 2020).

Italian ECs are mainly involved in the production of solar power and they are expanding homogeneously both in the North and South of the country, but less so in the Center. However, given that Italian ECs started developing in the North more than a century ago, *CER* numbers are higher in the Northern part of the country (Musolino et al., 2023; Barroco et al., 2020; Legambiente, 2022). As for the German community energy sector, the Italian Northern-Southern gap in the development of ECs cannot be explained by the distribution of natural resources. Indeed, looking at Figures 8, 9 and 10 reported in the previous chapter and in the next page, there seems to be no

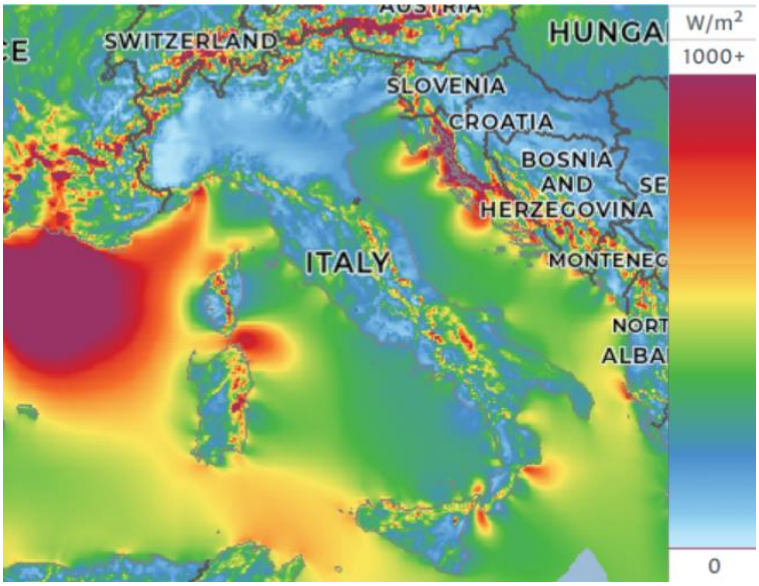
correlation between the presence of ECs (higher in the Northern regions) and the RES potential of the country, except for hydropower potential. Indeed, the abundance of water resources in the North can have enabled the birth of ancient ECs in the early 20th century. However, both solar and wind power potentials are higher in the South, where most of the country's renewable power is produced but not where most ECs are located (Terna, 2023; Caporale & De Lucia, 2015). On the one hand, as confirmed by part of the interviewees (1I, 2I, 3I, 6I), it appears that natural resources have not driven the ECs' development in Italy and that other enabling factors have contributed more significantly to their expansion. The Italian mayor interviewed (Interviewee 3I) argued that the presence of natural resources does not influence the popular willingness to form an EC, but rather attracts energy companies' investments in RES infrastructure. However, on the other hand, some interviewees (4I and 5I) stressed that natural resources can influence the choice of energy resource used since ECs are also born to "enhance the territorial characteristics and natural resources (…) of the territory" (Interviewee 5I).

Figure 9:
Yearly sum of global irradiation incident on optimally-inclined south-oriented photovoltaic modules- Italy



Source: Joint Research Centre, 2006.

Figure 10:
Mean Power Density at 100m - Italy



Source: Global Wind Atlas n.d.

As regards their distribution on the territory, most Italian ECs have developed in rural areas with a low density of population since the early days of the electrification of isolated zones (Wierling et al., 2021). However, as for the German case, all Italian cities, towns and villages are electrified, and all the experts interviewed agree that the fact that the technical issue of connection to the national grid cannot be considered an enabling factor for the development of *CER* anymore. This is not only because Italian grids are very reliable but also because, according to Italian legislation, ECs need to be connected to the national distribution grid and, thus, ECs are not created anymore to replace the national power lines but rather to provide a service connected to them. As regards other technical issues affecting the ECs' development, three main ones have been identified in the literature and the interviews: the state of the Italian grids, the deployment of smart technologies and the access to information on the medium voltage sub-grid stations.

First of all, according to Bertel et al. (2022), the Italian grid operators - Terna for the transmission lines and about 120 DSOs for the distribution grids - have neglected the upscaling of the power network, hampering the introduction of new prosumers in the energy market. Therefore, to comply with the need to connect at least 7 GW of additional renewable energy to the transmission grid every year, the Italian government is investing more than 21 billion euros in the next 10 years to upscale the grids, including the special project "Hypergrid" (Rinnovabili.it, 2022; Terna, 2023). By building 5 transmission lines, this initiative will better connect the South of Italy and the islands with the continental land and the Northern part of the country where most energy is demanded (Terna, 2023). These new transmission grids will enable the development of more RES and ECs in the Southern regions, but, as Interviewee 3I reported, this RES deployment must bring benefits to the local population and avoid transforming areas such as Sardinia into the RES playground of energy companies. Moreover, the Italian government has recently announced the intention to spend more than 3 billion euros of the recovery funds in DSOs' grids, aiming at enabling the connection of a further 4 GW of renewable power to the distribution lines (Ministero dell'Ambiente e della Sicurezza Energetica, n.d.; La Repubblica, 2022).

Second, as regards the deployment of smart technologies, Italy experienced an efficient deployment of smart meters in the early 2000s, thanks to the installation of these technologies led by the main DSO (E-distribuzione) (Stagnaro, 2019). Later, due to the EU-mandated requirements for smart metering, Italy has started a second round of installations of smart meters of second generation. The rollout of these technologies is impacting the current and future ECs´development

since incentives for community energy are calculated based on how much power is consumed by the members at the moment of its generation (Candelise & Ruggieri, 2021). Third, the geographical limitation of *CER* is dictated by the medium voltage distribution sub-grids, and this presents another disabling factor since the information on these sub-grids assets and maps is owned and managed by private DSOs. Many delays in the ECs' development have been registered due to a lack of access to this information (Candelise & Ruggieri, 2021). This was also confirmed by Interviewee 2I, whose energy cooperative had to wait a long time to receive information on the assets and maps of the medium voltage sub-grids and start with the formation of a new EC.

3.2 The Italian energy communities and the Governance systems

To have a clearer picture of the evolution of the development of *CER* in Italy, one has to go back, once again, to the beginning of the 20th century. As previously mentioned, Italian ECs were first born in rural mountainous areas, where the national grids did not reach due to a lack of investments in isolated zones with low population density. With the nationalization of the electricity system in 1962, some of these ECs were integrated with the national utility and the remaining ones were granted a special legal status to own their distribution grids (Candelise & Ruggieri, 2021). The community energy sector in Italy remained limited to the few historical mountain energy cooperatives left until the start of the new millennium (Candelise & Ruggieri, 2021). In the 2000s, the Italian community energy sectors started developing again, especially thanks to national policies incentivizing RES. Some examples are the project for the installation of roof solar panels in 2001 and the periodical feed-in tariff schemes from 2005 to 2013. After national funds for subsidizing the feed-in tariffs were terminated in 2013, RES incentives were substantially cut and they were re-introduced at intermittent intervals. This discontinuity in financial support acted as a disabling factor for the development of community energy, and few *CER* were created, while at the same time the existing ones stopped investing in new RES plants.

In this context, the European RED II revolutionized the ECs' landscape in Italy by introducing the legal obligation for MS to adopt a national definition for community energy projects and to promote these initiatives with financial incentives. According to all interviewees, the EU legislative framework was fundamental in reviving the sector of ECs in Italy and giving it a new life, being actively promoted at all institutional levels. The transposition of the EU directive into Italian national legislation started with the approval of the Decree *Milleproroghe* (more specifically Article 42-bis) in December 2019. This measure initiated a period of experimentation

of *CER* pilot projects scattered across the country, to collect information and data to prepare the integral transposition of the EU legislation. Between August and December 2020, different technical and incentives rules were implemented by different competent authorities, namely the Authority for the Regulation of Energy Network and Environment (ARERA), the Ministry of Economic Development (now called "Ministry of Enterprises and of Made in Italy") and the GSE. In December 2021, the Italian government officially transposed the European directives regulating ECs contained in the CEP.

Italy translated the CECs' definition into national law under the legislative decree 210/08.2021 and the one for RECs under the legislative decrees 199/08.11.2021. Focusing on the latter, according to REScoop.eu (n.d.c), the Italian transposition of RECs is almost fully compliant with the EU guidelines and it has enabled an overall satisfactory enabling framework for ECs. The Italian law says that *CER* must be open, voluntary, autonomous and under the effective control of its members. The membership should be inclusive of vulnerable subjects and it can include all natural persons, local authorities, associations and entities of various types (e.g. religious or environmental), small and medium enterprises and the third sector, as long as being an EC member does not coincide with the company's main commercial activity. Moreover, the Italian ECs can produce up to 1 MW per RES plant and, as introduced in the section above, it imposes that all citizens part of the REC should be located under the same medium voltage station. Looking at the enabling framework for ECs, REScoop.eu (n.d.c) argues that there remain still some disabling factors for ECs such as the lack of ARERA's assessment of the opportunities and disabling factors for ECs and the long waiting times for the GSE's approval for community energy projects to be officially recognised as such and receive incentives. For instance, Interviewee 3I reported that his municipal EC had to wait almost three years to get the GSE´s approval. Lastly, incentives such as feed-in tariffs have been proposed for *CER*s and the energy they produce and consume simultaneously, but the incentivizing measures and the ARERA's implementing decrees are still on their way to being issued.

All interviewees agreed that even if the EU helped the community energy sector to be recognized and promoted in Italy, the national government is causing delays for ECs, businesses and local authorities to get started with new projects. Indeed, the implementing procedures (including the experimental phase) and the measures adopted by the Italian government have been judged as overall satisfactory by the experts interviewed but there remain many disabling factors. The main legislative obstacles according to the interviewees include the complexity, fragmentation

and slowness of the legislative process (which is still undergoing), and the delays both at the national and local levels due to the lacking implementing decrees, the GSE's authorization process and the access to data provided by local DSOs.

Looking at the regional and municipal level, also Italian subnational levels of governance have acquired significant powers in the energy field, having been also described as a "quasi-federal" energy system (Breton & Fraschini, 2016). After the constitutional reform of 2001, energy became a policy area of competitive legislation between the central and regional authorities, which started implementing Regional Energy and Environmental Plans and have obtained powers over the environmental assessment, authorization and strategic planning processes of RES (Di Nucci & Prontera, 2021). Before the transposition of the CEP, the regions of Piedmont and Apulia already emanated legislative measures concerning ECs and, after the *Milleproroghe* decree, several others implemented an EC regional framework (REScoop.eu, n.d.c).

Apart from the regional support, also municipalities have been very much involved in the development of community energy at the local level (Candelise & Ruggieri, 2020). As Interviewee 1E reported, municipalities are a "break it or make it" actor for the development of European ECs, and from what encountered in the analysis this is especially valid for the Italian community energy sector. Indeed, as reported by several scholars such as Candelise and Ruggieri (2020) and Musolino et al. (2023), a majority of the ECs founded after the *Milleproroghe* decree have been initiated by municipal authorities or utilities. After having looked into these initiatives, examined the EC projects presented by Legambiente (2022) and confronted with the literature, it appears that in Italy municipalities have a strong enabling power on the development of ECs, not only as initiators but also as facilitators by providing ECs with the suitable legal and financial conditions or with public space for the installation of solar panels. Overall, from the discussion had with the interviewees it also appears that regional and local authorities have been very responsive in enabling ECs on their territories, but there remain issues with the allocation of funds and the bureaucratic process (Interviewees 1I, 2I and 3I). From the perspective of the interviewees working in energy companies, municipalities have been very interested in developing ECs because of their "very beautiful narrative" in terms of economic, social and environmental benefits and they will be the main enabling actors in the Italian community energy sector (Interviewees 5I and 6I).

3.3 The Italian energy communities and the Actors

After having analysed several academic papers and interviews, it appears that the socioeconomic factors that have influenced the most (positively and negatively) the expansion of *CER* do not correspond with the ones influencing the German ECs' development. The factors which were not mentioned either by scholars or by the experts interviewed include the attitude of the local population towards the cooperative model, the history of energy activism, the citizens' trust in their communities and the RES social acceptance. For comparative purposes with the German community energy sector though, the dissertation looks into why these factors have not been influential in the development of ECs in Italy.

Firstly, Italy has a long and deep-rooted tradition of cooperatives but not as regards the energy sector. Indeed, Italy ranks first in Europe for the number of cooperatives (39.600) and fifth for the number of members being part of these initiatives (12.620.000) (European Parliament, 2019). Italian cooperatives are the most active in the sectors of large-scale distribution, agribusiness, credit and construction (Menzani, n.d.), but not energy and not often at the small level of communities. The regions where the cooperative culture is predominant are Emilia-Romagna and Trentino Alto-Adige, where the first ECs developed. Indeed, according to Confcooperative Consumo e Utenza (n.d.), in the latter region the representatives of the 73 alpine Alpine ECs still meet periodically to discuss the most relevant issues for their sector in the *Coordinamento delle Cooperative Elettriche dell'Arco Alpino* (Coordination of the Electric Cooperatives of the Alpine Arc). However, no other Italian regions have a long history of cooperatives for the energy sector and no such federations of energy cooperatives are active in Italy outside the Alpine regions.

Secondly, Italy has experienced only one significant movement of energy activism, namely the anti-nuclear movements of the 1980s. However, this movement lost significance after the 1980s as it managed to mobilize public opinion after the Chernobyl accident of 1986 and set up an institutional referendum that decreed the end of nuclear power production. Still today, some small-scale, local anti-nuclear groups exist in Italy but they campaign against the storage of nuclear waste in their territories, as also reported by Interviewee 3I whose island – Sardinia – s a few. Thirdly, according to Our World in Data (2020), Italians show a medium-high level of community trust as 76,9% of Italians trust "a lot" or "some" their neighbours. This is however a lower percentage compared to the rest of Western EU MS (Our World in Data, 2020). As previously mentioned, some scholars deem this element fundamental for the development of ECs, but Italy does not appear as

having a high level of trust able to foster the development of community initiatives such as ECs (Yildiz et al., 2014; Kalkbrenner & Roosen, 2016). Finally, social acceptance of renewable energy sources also has not been mentioned by the interviewees or in the literature as an enabling/ disabling factor for ECs' development. According to the European Commission (2019), Italian support for investments in RES is below the EU average, since only 50% of Italian citizens "totally agree" with promoting investments in clean energy compared to 60% of EU citizens. Moreover, it has also been noted that over the past decade, the NIMBY movement has been rising in Italy, especially in the energy sector and the North of Italy (Corrias & Felice, 2019). However, as mentioned in the previous chapter, scholars have concluded that ECs have been successful in increasing the level of RES social acceptance at the local level (Caramizaru & Uihlein, 2020; Bauwens et al., 2016).

After having analysed interviews and academic papers, the main influential factors identified for the *CER* development are the communities' financial capabilities and opportunities and the active role of local authorities, businesses and non-governmental organizations (NGOs) in engaging the citizens in community energy projects. To investigate how the financial conditions of the Italian population have influenced the development of ECs, one needs to look at data about the general wealth of Italian citizens and the differences in the country. Indeed, Italy is a very peculiar country when it comes to finances as it has been historically divided into two parts. Overall, the Italian average GDP per capita is slightly below the EU average (Eurostat, 2022b). The Northern part is richer and more industrial, while the Southern one is less wealthy, less industrially developed and more dependent on activities such as agriculture, tourism and services. More specifically, in 2019 the average GDP per capita for the North-West and North-East areas of the country was respectively €36.500 and €35.100 per year with an average unemployment rate of 6% (ISTAT, 2020; ISTAT, n.d.). In the *Mezzogiorno* instead, the GDP pro capita in 2019 was €19.200 per year and more than 17% of the population was unemployed in 2021, especially young people (ISTAT, 2020; ISTAT, n.d.). These financial conditions are reflected also in the distribution of energy consumption and energy poverty in the country. As regards the former, more energy is consumed in the North where the industries are allocated. The latter instead affects especially the *Mezzogiorno,* where 25% of the population was energy poor in 2020, a percentage much higher than the national average of 8.8% (Musolino et al., 2023).

Arguably, the financial conditions of the Italian population and this internal national divide have had various consequences for the development of *CER*. First, the interviewees stressed how

the potential of cost savings is an important enabling factor for the development of ECs, more significant than the environmental and social benefits that ECs can bring (Interviewees 1I, 2I, 3I and 4I). According to Interviewee 2I, lately, there has been a "reawakened interest" in ECs especially because of the recent energy crises, that have made reducing energy bills a priority for Italian citizens. Second, Musolino et al. (2023) argue that the financial capabilities of Italians have not impacted the numbers and distribution of newly created ECs, but they have rather influenced the scopes of community energy projects and what actors are involved in the different parts of the country. In the North, the newly founded ECs are of a bigger scale, involve energy firms and researchers and they have all been created with a top-down approach, namely starting from the will of either the local authorities or private companies. In the South instead, community energy projects have smaller sizes, focus more on energy poverty issues, NGOs play a greater role and some of them have been founded through a bottom-up approach, even if the majority remains of top-down character (Musolino et al., 2023).

As introduced above, energy companies have been very active in the development of ECs, especially in the North (Musolino et al., 2023). As confirmed by the employees working in two of the main energy firms in Italy interviewed (Interviewees 5I and 6I), energy companies are creating a business around ECs. For instance, these companies are offering services to assist local authorities and citizens in dealing with the RES installation, the *CER* management and bureaucracy, or by even proposing EC projects in cities and rural areas. However, the municipal employee interviewed (Interviewee 4I) stated that her municipality has denied all the EC project requests made by energy firms so far as they would take away the elements of energy democracy and citizens' auto-determination that the municipality is trying to promote.

As it stands out from the data and information on the latest development of ECs in Italy, one can argue that the role of local authorities and businesses has been much greater than the one of the citizens in promoting community energy projects. This is confirmed also by the Italian experts interviewed, who agree that citizens alone have little resources and cannot afford the membership financial contribution. Unfortunately, due to the recency of the phenomenon and the gap in the literature, data on the minimum average cost for membership has not been encountered. Because of financial issues, businesses and especially local authorities are the main enabling actors for the ECs' development as they can contribute with investments, expertise and, in the case of municipalities, public space to the project. Also the Sardinian mayor (Interviewee 3I) stated that the EC sponsored by his municipality could have not been implemented through a bottom-up

approach alone. Indeed, he reported that the local community not only would have not found enough members due to the scarce financial resources of the community but also that the local population would have felt reluctant to invest in such an unfamiliar and new business without the municipal guarantee.

Looking more specifically at the role of DSOs and TSOs in the Italian development of ECs, according to Italian legislation these actors will soon be obligated to cooperate with initiatives of community energy and also individual RES prosumers. More importantly, according to article 32b of the legislative decrees 199/08.11.2021, ARERA will adopt measures to ensure that DSOs provide community energy members with the relevant information on medium voltage sub-grids stations, which has been so far one of the main technical disabling factors in the development of ECs.

To summarize this chapter, the development of *CER* has been influenced by several factors. Starting from the Resource Systems & Units, natural resources have not impacted the creation of community energy projects but rather the RES project to exploit and valorize the territory (almost exclusively photovoltaic power for newly-born *CER*). As regards the technical side of ECs instead, the advanced stage in the rollout of smart meters could have advantaged ECs, however, overall technological issues have not significantly impacted the development of community energy either. Most importantly, the obsolescence of the grid and smart technologies could potentially have a disabling power in the future. Looking at the Governance Systems, the EU framework for community energy has been a revolutionary enabling factor in the *CER* sector in Italy, as it pushed for the Italian government to implement progressive (but flawed) legislation at the national level. Also at the local level, regions and municipalities have had an enabling influence on the ECs' development, promoting ECs with a top-down approach. Indeed, the bottom-up approach for ECS has been disabled partly due to the Italian local culture which lacks a tradition of energy cooperatives (except for the Alps), energy activism and high Western EU levels of community trust. Moreover, the lower financial capacities of the Italian population have also disabled citizens´ investments in projects for the energy transition. At the same time, the possibility of financial gains through ECs enhances the citizens' willingness to participate in *CER.* Overall, however, the development of newly-born ECs has been enabled by municipalities and businesses in the Northern regions, and by local authorities and NGOs in the South. The next section compares the findings on Italian ECs with the ones for the German community energy sector, drawing some conclusions

on the existing differences between the two countries and emphasising the contribution of this dissertation to the ongoing debate on ECs in Europe.

A comparative and concluding perspective

This dissertation has investigated how the sector of community energy has developed in Europe over the decades, especially in Germany and Italy after the introduction of an EU legislative framework for ECs. First of all, the dissertation presented the state of the art on the community energy landscape in Europe, the relative legislation at the EU level and what scholars have identified as main factors promoting and/or hindering the development of ECs. Later, the dissertation introduced two case studies: Germany and Italy. These two countries constituted a suitable multiple case study for the analysis of enabling and disabling factors for ECs. Indeed, they shared similarities in both their energy mixes and the historical development of community energy, but they took completely different paths in the development of ECs. On the one hand indeed, Germany has been a historically successful example of ECs development, while, on the other hand, Italy had not experienced any significant increase in ECs' numbers until the transposition of the EU regulations on community energy. The analysis of these case studies and the related enabling and disabling factors was conducted by reviewing the existing literature on community energy in the two countries and by interviewing thirteen experts from the German, Italian and European ECs' landscapes. The selection of enabling and disabling factors investigated throughout Chapters 1 and 2 was guided by the consultation of academic papers, the interviews conducted for this study and Ostrom's (2007) SES theoretical framework. The latter structured both the interviews and the dissertation's analytical chapters, whose results are discussed in the following paragraphs.

First, as regards natural resources, most interviewees from both countries agreed that the presence of sunlight, wind and other sources of energy has not affected the willingness of citizens to form an EC. There seems indeed to be no correlation between the higher number of ECs in Southern Germany and Northern Italy and the RES potential of those regions, especially from a European perspective rather than from a national one. Indeed, the RES potential in Germany is not significantly higher than other Mediterranean countries such as Italy but rather the contrary, and it still counts much higher numbers of ECs. Moreover, Interviewee 1E highlighted that community energy initiatives do not have to be strictly related to the production of energy but they can also rely on other services, such as car-sharing, and do not depend therefore on the presence of natural resources. For these reasons, it is arguable that natural resources do not significantly enable and/or disable the development of ECs but, as some interviewees affirmed, they influence the community's choice of what RES project to implement. Depending on the initial investments

needed to develop the most suitable RES project, natural resources can be seen both as an enabling and disabling factor.

Looking at the technical side of community energy, issues such as problems of connection to the national grid and the need for electrification are not considered enabling factors for the development of ECs in either country anymore. However, both Italy and Germany have been facing technical challenges that are and will possibly disable the development of ECs such as the upgrading of the grid and smart technologies. For Italy in particular, smart meters do not present a significant disabling factor as much as the lack of access to information on the maps and assets of medium voltage sub-grids.

Second, as regards the Governance Systems, the German and Italian cases present many differences. Indeed, on the one hand, the German development of ECs has not been enabled by the introduction of a European legislative framework for community energy but rather by national legislation. Indeed, the federal government started promoting the expansion of renewable energy and *e.G.*s respectively at the end of the 1980s and in the mid-2000s. However, federal support transformed into a disabling factor over the 2010s with the recasts of the *EEG*, which increasingly cut financial aid, introduced a tendering procedure for the attribution of financial aid for RES projects, and complicated legislative and bureaucratic procedures for ECs. In this context, *Länder* and municipalities have played an important enabling role in the expansion of ECs. The former have implemented over the years climate and energy policies and strategies, while the latter have offered practical support to ECs' members. Overall, German municipalities have been an enabling factor for the development of ECs by helping citizens' initiatives by, for instance, using public space for installing renewable energy infrastructure such as solar panels or helping them with permits and planning procedures. However, it has also been reported that their involvement in community energy projects has not always been positive as they would impose their decisions over the communities' will.

On the other hand, the Italian ECs' sector has been recently gaining momentum only thanks to the EU CEP and the relative directives. In this sense, the EU legislative framework on ECs has been the first and main enabling factor for the revived growth of community energy projects. The transposition of the EU directives into Italian legislation has been overall satisfactory and it has enabled the start of an experimentation period for new community energy projects all over the country. However, interviewees agreed that national legislation in the ECs' field still presents issues that are disabling the development of the sector, such as the fragmentation of the regulations and

the slowness of the bureaucratic procedures. As regards subnational levels of governance, regions and municipalities have played an enabling role, like for the German ECs sector but to a greater extent. Not only had some regions already included ECs in regional climate and energy plans before the CEP was even transposed into Italian legislation, but municipalities have been the main actors supporting the creation of ECs, more than the citizens and communities themselves. This constitutes another major difference with the German community energy sector, whose growth instead has been favoured by socio-cultural factors such as anti-nuclear movements, a strong cooperative culture related to the energy sector and an exceptionally high sense of trust in the community.

Third indeed, passing to the Actors category of the SES framework, the successful development of German ECs has been led by the citizens, in particular highly-educated, wealthy, middle-aged men. The main objective of ECs' members has been to have a positive impact on the environment rather than reducing the costs of energy bills. However, even if German citizens can benefit from a higher GDP per capita and banks that often offer financial support to ECs, the financial capabilities of the population remain a disabling factor for the development of new community energy initiatives in less wealthy regions.

In Italy, as previously mentioned, the picture of the Actors involved in ECs is very much different from the German one given the secondary role of citizens. Compared to Germany indeed, Italy does not have (anymore) a history of anti-nuclear movements, energy activism and cooperative culture in the energy sector, except for the Northern regions of the Alps. Italians also have a lower level of trust in their local communities compared to Germans and other Western EU countries in general. Moreover, a significant disabling factor for the development of ECs is the lack of financial resources of the population, which in Italy (like in Poland and Spain) are often not enough to afford solar panels without financial incentives (Bertel et al., 2022). The experts interviewed agreed that the limited economic capacities of the citizens do not allow them to form ECs alone, which is the reason why municipalities but also energy businesses and NGOs have taken the lead in the development of the community energy sector in Italy.

Indeed, the involvement of energy companies so far has been an enabling factor in the revived development of Italian ECs, as they see them as a new business opportunity where they can offer both municipalities and citizens services such as the installation of renewable energy infrastructure, management of data and bureaucratic support. However, their involvement is not always welcome by the community, as they could disable the EC's principle of energy democracy

and citizens' empowerment. As regards grid operators specifically, according to Italian law TSOs and DSOs will be required shortly to collaborate with ECs, especially DSOs, which will need to make information on medium voltage sub-grids available to community energy members. On the contrary, energy companies in Germany have not been significantly involved in the development of ECs over the decades, except DSOs specifically. Indeed, these actors have historically tried to hinder the growth of ECs, until the *EEG* imposed the obligation to give priority to RES for grid access. The comparison between the enabling and disabling factors for the development of ECs in Germany and Italy is summarised in Table 3 below.

Table 3:

Summary of the enabling and disabling factors for the development of ECs in Germany and Italy

SES framework´s categories and sub-categories of variables and factors		**Germany**	**Italy**
Resource Systems & Units	**Natural resources**	• They have not been influential in the development of ECs • Possible enabling or disabling factor only as regards the initial investments needed to form the EC depending on the RES project	• They have not been influential in the development of ECs • Possible enabling or disabling factor only as regards the initial investments needed to form the EC depending on the RES project
	Technical issues	• They have enabled the development of historical energy cooperatives • They have not been influential in the development of ECs so far • The grids´ state and rollout of smart technologies could become disabling factors if unaddressed	• They have enabled the development of historical energy cooperatives • Only the access to data on medium voltage sub-grids is disabling the development of *CER* • The successful smart meters rollout might have advantages for ECs' members • The grids´ state and the second rollout of smart

			meters could be disabling factors if unaddressed
Governance Systems	**EU level**	• The EU First Energy Package (1996) has been both enabling and disabling for ECs depending on the context • The CEP has not been influential in the development of ECs	• The CEP has been the initial main enabling factor for the revival of community energy in Italy
	National level	• The *EEG* was one of the main enabling factors for ECs from 2000 to 2012 • The recasts of the *EEG* made this law a disabling factor for the development of ECs due to: o cuts in financial incentives o tendering system o complex bureaucracy and law	• The Italian legislative framework has enabled the recent growth in ECs' numbers, but there remain disabling factors such as: o complexity, fragmentation and slowness of the legislative process o delays in the publication of implementing decrees o delays in authorization processes
	Subnational level	• *Länder:* they have been an enabling actor through states´ policies • Municipalities: they have been one of the main enabling actors given their direct support for ECs´ initiatives	• Regions: some have been enabling actors through regional policies and funds • Municipalities: they have been one of the main enabling actors given their direct involvement in ECs´ initiatives with a top-down imprint
Actors	**Citizens and culture**	• The German culture has enabled the development of ECs thanks to: o The environmental consciousness (main enabling factor for the citizens' willingness to participate in ECs) o The cooperative culture o The energy activism	• The Italian culture and mentality have not enabled the development of ECs due to: o Lack of tradition of energy cooperatives (except the Alps) o Lack of energy activism o Low levels of community trust for EU-standards

		○ The exceptionally-high community trust • The financial capacities of the population have been a <u>disabling factor</u> in poorer regions	• The financial capacities of the population: ○ have been a <u>disabling factor</u> in the whole country ○ influenced the development of ECs by creating a difference between the North and South of Italy ○ financial gains constitute the <u>main enabling</u> factor for the <u>citizens' willingness</u> to participate in *CER*
	DSOs and energy companies	• DSOs have been a <u>disabling actors</u> for ECs before the 2000s • The *EEG*'s obligation for DSOs to provide ECs with priority of connection has made them a <u>non-influential factor</u>	• Energy businesses have been <u>enabling actors</u> for the development of ECs (especially in the North of Italy) • DSOs have <u>disabled</u> the development of *CER* by delaying the access to information on medium voltage sub-grids

Overall, one can conclude that, even if ECs started spreading in both countries as energy cooperatives at the beginning of the 20th century, the development of ECs in Germany and Italy over the past decades has been quite different and influenced by disparate factors. On the one hand, the German EC sector has been enabled mainly by early-progressive national legislation in terms of renewable energies and cooperative associations, but also by the local culture, the people's considerable financial capacities (especially in the Southern-Western region), and, to a limited extent, by the local authorities. On the other hand, the Italian sector of community energy has been revived only recently, enabled mainly by the European legislative framework, a satisfactory national regulation and the involvement of municipalities, energy businesses and NGOs in spreading EC initiatives. The factors that still nowadays hinder the development of Italian ECs concern mostly the financial capabilities of the population and the slowness of legislation. In Germany instead, the main current disabling factors regard the complexity of bureaucratic rules

and the cuts in financial aid that the federal government has implemented through the amendments of the *EEG* over the years.

The analysis and findings obtained present some limitations, which were discussed and addressed in the previous chapters. Despite these, the dissertation managed to give a general overview of the main enabling and disabling factors for community energy in Germany and Italy, bringing together two case studies rarely investigated together. The findings and the comparison of factors highlighted how the sector of community energy is very different in the two countries and, to a certain extent, also between Northern and Southern Europe. Indeed, the cultural heritage and political, economic, technological, environmental and legislative factors that characterize each country form altogether a specific socio-ecological system that determines the development of ECs for each Member States and, more generally, also for certain geographical areas of the European continent.

Apart from the findings on the specific enabling and disabling factors for ECs in Italy and Germany, this dissertation contributed to the ongoing academic and political debate on the European community energy and decentralization of the energy system in other two ways. Firstly, the dissertation presented the current and future challenges that the field of ECs faces in this historical moment of energy transition. Secondly, one lesson drawn from the dissertation´s findings is that Italy, Germany and all other EU Member States need to identify what variables are contributing to support or undermine the development of community energy in order to address their unique needs and implement targeted policies that can foster the spread of ECs.

To address the limitations of this study and further enrich the academic literature on these topics, future research could address a greater variety of factors and actors involved in the community energy sector in Italy, Germany and other EU countries. For instance, researchers could complement the findings of this study by interviewing representatives of NGOs involved in the field and by surveying the participants in the existing ECs across Europe. Moreover, future academic work on the topic could also focus on specifically-tailored policy recommendations that can promote the development of ECs in specific European countries, so to accelerate the spread of community energy for a just energy transition in the hands of the citizens.

References:

Abada, I, Ehrenmann, A., & Lambin, X. (2022). *On the viability of energy communities.* Energy Policy Research Group, University of Cambridge. http://www.jstor.org/stable/resrep30354

Appunn, K., & Russell, R. (2021, June 10). Set-up and challenges of Germany's power grid. *Clean Energy Wire*. https://www.cleanenergywire.org/factsheets/set-and-challenges-germanys-power-grid

Arybilia, M., Bertram, R., Bolle, A., Corovessi, A., Dembski, F., Fouquet, D., Giňová, P., Księżopolski, K., Mantzaris, N., Ondřich, J., Maćkowiak-Pandera, J., Primova, R., Rüdinger, A., Santini, M., Scheuer, S., Szymalski, W., Torres, J. H., Claude, T., Tsoutsos, T., & Walsh, M. (2018). *Energy Atlas 2018 - Facts and figures about renewables in Europe*. Heinrich Böll Stiftung, Friends of the Earth Europe, European Renewable Energies Federation, Green European Foundation. https://www.boell.de/sites/default/files/energyatlas2018_facts-and-figures-renewables-europe.pdf.pdf

Barroco, F., Borghetti, A., Cappellaro, & Palumbo, C. (2020). *Le Comunità Energetiche in Italia.* ENEA. Doi: 10.12910/DOC2020-012.

Bateson, I. (2021, October 25). Will Germans change their minds about nuclear power? *DW*. https://www.dw.com/en/nuclear-power-are-energy-price-hikes-prompting-a-german-rethink/a-59594913

Bauwens, T., Gotchev, B., & Holstenkamp, L. (2016). What drives the development of community energy in Europe? The case of wind power cooperatives. *Energy Research & Social Science, 13*(2016)*,* 136-147.

Bertel, M., Gutschi, C., Lurger, B., Szymańki, P., Rozwadowska, M., & Ryszawska, B. (2022). *D3.3 Catalogue of potential legal and economic barriers and facilitators of energy citizenship.* EC^2. https://online-raketen.at/sites/site0261/media/downloads/d3.3_catalogue_of_potential_legal_and_economic_barriers_and_facilitators_of_energy_citizenship_final.pdf

Biresselioglu, M. E., Limoncuoglu, S. A., Demir, M. H., Reichl, J., Burgstaller, K., Sciullo, A., & Ferrero, E. (2021). Legal Provisions and Market Conditions for Energy Communities in Austria, Germany, Greece, Italy, Spain, and Turkey: A Comparative Assessment. *Sustainability*, *13*(20). https://doi.org/10.3390/su132011212

Breton, A., & Fraschini, A. (2016). *Is Italy a federal or even a quasi-federal state?* (ISSN: 2038-7296) [Università del Piemonte Orientale "Amedeo Avogadro"]. ResearchGate. https://www.researchgate.net/publication/299408807_Is_Italy_a_Federal_or_even_a_Quasi-Federal_State

Brummer, V. (2018). Community energy – benefits and barriers: A comparative literature review of Community Energy in the UK, Germany and the USA, the benefits it provides for society and the barriers it faces. *Renewable and Sustainable Energy Reviews*, *94*(2018), 187–196. https://doi.org/10.1016/j.rser.2018.06.013

Bundesnetzagentur (2023). *Gas supply status report.* German Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway. https://www.bundesnetzagentur.de/EN/Areas/Energy/SecurityOfSupply/GasSupply/Downloads/2023/06_June/20230609.pdf?__blob=publicationFile&v=2

Busch, H., Ruggiero, S., Isakovic, A., & Hansen, T. (2021). Policy challenges to community energy in the EU: A systematic review of the scientific literature. *Renewable and Sustainable Energy Reviews*, *151*. https://doi.org/10.1016/j.rser.2021.111535

Candelise, C., & Ruggieri, G. (2020). Status and Evolution of the Community Energy Sector in Italy. Energies, 13(8), 1888. https://doi.org/10.3390/en13081888

Candelise, C., & Ruggieri, G. (2021). The Community Energy Sector in Italy: Historical Perspective and Recent Evolution. In F. H. J. Coenen, T. Hoppe (Eds.), Renewable Energy Communities and the Low Carbon Energy Transition in Europe (pp. 97-119). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-84440-0

Capellan-Perez, I., Campos-Celador, Á., & Teres-Zubiaga, J. (2018). Renewable Energy Cooperatives as an instrument towards the energy transition in Spain. *Energy Policy 123*, 215–229. https://doi.org/10.1016/j.enpol.2018.08.064

Caporale, D., & De Lucia, C. (2015). Social acceptance of on-shore wind energy in Apulia Region (Southern Italy). *Renewable and Sustainable Energy Reviews, 52*(2015), 1378-1390. https://doi.org/10.1016/j.rser.2015.07.183.

Caramizaru, A., & Uihlein, A. (2020). *Energy communities: an overview of energy and social innovation.*(ISSN 1831-9424). Joint Research Centre (European Commission). https//:doi.org/10.2760/180576.

Confcooperative Consumo e Utenza (n.d.). *Settore elettrico.* https://www.consumo.confcooperative.it/I-SETTORI/Elettrico

Corrias, P., & Felice, B. (2019). *Accettazione Sociale delle Tecnologie Energetiche: il Territorio tra Vocazioni, Sviluppo Locale e Obbiettivi di Decarbonizzazione. Il ruolo di una pianificazione condivisa.* ENEA. file:///C:/Users/39348/Downloads/accettazione_sociale_tecnologie_energetiche%20(1).pdf

DeMattee, A. J., Gertler, N., Shibaike, T., & Bloodgood, E. A. (2022, February 23). *Supplemental Information for: Overcoming the laws-in-translation problem: Comparing techniques to translate legal texts*. https://doi.org/10.31219/osf.io/jc5p9

DGRV (2021). *DGRV annual survey of energy cooperatives.* DGRV. https://www.dgrv.de/news/dgrv-jahresumfrage-energiegenossenschaften/

DGRV (2022). *Energy Cooperatives in Germany: State f the Sector 2022 Report.* DGRV. https://www.dgrv.de/wp-content/uploads/2022/07/DGRV_Survey_EnergyCooperatives_2022.pdf

DGRV (n.d.). *Facts and figures.* DGRV. https://www.dgrv.de/bundesgeschaftsstelle-energiegenossenschaften/

Di Nucci, M. R., & Prontera, A. (2021). The Italian energy transition in a multilevel system: between reinforcing dynamics and institutional constraints. *Z Politikwiss* (2021). https://doi.org/10.1007/s41358-021-00306-y

Directorate-General for Energy (2019). *Clean Energy for all Europeans.* European Commission. https//:doi.org/10.2833/9937

Directorate-General for Energy (2022, December 13). *In focus: Energy communities to transform the EU's energy system.* European Commission. https://energy.ec.europa.eu/news/focus-energy-communities-transform-eus-energy-system-2022-12-13_en

Drisko, J.W., & Maschi, T. (2016). *Content analysis.* Oxford University Press.

European Commission (2019). *Europeans Attitudes on EU energy Policy.* European Commission. https://europa.eu/eurobarometer/surveys/detail/2238

European Commission (n.d.a). *Energy Communities Repository.* https://energy-communities-repository.ec.europa.eu/index_en

European Commission (n.d.b). *Renewable energy directive.* https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

European Commission (n.d.c) *Rural Energy Community Advisory Hub.* https://rural-energy-community-hub.ec.europa.eu/index_en

European Parliament (2019, February). *Cooperatives: Characteristics, activities, status, challenges.* European Parliament. https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/635541/EPRS_BRI(2019)635541_EN.pdf

European Parliament (2022). *Internal energy market.* https://www.europarl.europa.eu/factsheets/en/sheet/45/internal-energy-market

European Parliament (2023, March 28). *Greenhouse gas emissions by country and sector (infographic)*. European Parliament. https://www.europarl.europa.eu/news/en/headlines/society/20180301STO98928/greenhouse-gas-emissions-by-country-and-sector-infographic

Eurostat (2022a, January). *Energy production and imports.* Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_production_and_imports#The_EU_and_its_Member_States_are_all_net_importers_of_energy

Eurostat (2022b, December). *GDP per capita, consumption per capita and price level indices.* Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=GDP_per_capita,_consumption_per_capita_and_price_level_indices#Relative_volumes_of_GDP_per_capita

Frieden, D., Tuerk, A., Neumann, C., JOANNEUM RESEARCH, d‘ Herbemont, S., Roberts, J., & REScoop.eu (2020). *Collective self-consumption and energy communities: Trends and challenges in the transposition of the EU framework.* REScoop.eu. https://www.rescoop.eu/toolbox/collective-self-consumption-and-energy-communities-trends-and-challenges-in-the-transposition-of-the-eu-framework

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research policy 31*(2002), 1257-1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions, 1*(2022), 24-40. https://doi.org/10.1016/j.eist.2011.02.002

Global Wind Atlas (n.d.). *Welcome to the Global Wind Atlas.* Global Wind Atlas. https://globalwindatlas.info/en/

GSE (2022). *Energia e Clima in Italia Rapporto Trimestrale.* GSE. https://www.gse.it/documenti_site/Documenti%20GSE/Rapporti%20statistici/GSE%20Trimestrale%20energia%20e%20clima.pdf

Hanke, F., & Guyet, R. (2023). The struggle of energy communities to enhance energy justice: insights from 113 German cases. *Energy, Sustainability and Society, 13,* 16. https://doi.org/10.1186/s13705-023-00388-2

Heidecke, L., Kustova, I., Flickenschild, M., Larmi, I., Van Til, H., Van Benthem, M., Dijkhof, Y., & Nguyen, N. (2022). *The Revision of the Third Energy Package for Gas.* Directorate-General for Internal Policies (European Parliament). https://doi.org/10.2861/353075

Holstenkamp, L., & Kriel, C. (2022). *Assessment of Barriers and Drivers for Energy Communities: Literature Review (Background Paper #2).* REScoop.EU & ECOLOG. https://zenodo.org/record/7301507

International Trade Administration (2022). *Italy – Country Commercial Guide.* Department of Commerce, United States of America. https://www.trade.gov/country-commercial-guides/italy-natural-gas-renewable-energy

ISTAT (2020, December 22). *Conti Economici Territoriali, anni 2017-2019.* ISTAT. https://www.istat.it/it/files//2020/12/REPORT-CONTI-TERRITORIALI_2019.pdf

ISTAT (n.d.). *Unemployment rate – regional level.* http://dati.istat.it/Index.aspx?QueryId=20744&lang=en

Joint Research Centre (2006). *PV solar electricity potential in Europe.* European Commission. http://re.jrc.ec.europa.eu/pvgis/

Kalkbrenner, B. J., & Roosen, J. (2016). Citizens' willingness to participate in local renewable energy projects: The role of community and trust in Germany. *Energy research & Social Science, 13*(2016), 60-70. https://doi.org/10.1016/j.erss.2015.12.006

Keating, D. (2021, June 30). *EU renewables auctions are crowding out community energy projects.* Energy Monitor. https://www.energymonitor.ai/finance/regulation-policy/eu-renewables-auctions-are-crowding-out-community-energy-projects/

Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic Management,* 10(2), 175-198. https://doi.org/10.1080/09537329808524310

Krug, M., Di Nucci, M. R., Caldera, M., & De Luca, E. (2022). Mainstreaming Community Energy: Is the Renewable Energy Directive a Driver for Renewable Energy Communities in Germany and Italy? *Sustainability, 14*(12). https://doi.org/10.3390/su14127181

Kurmayer, N. J. (2023, January 12). *Germany announces ´acceleration´ of smart meter rollout.* Euractiv. https://www.euractiv.com/section/electricity/news/germany-announces-acceleration-of-smarter-meter-rollout/

Kyllmann (2022, October, 10). *Bavaria's turbine distance rules delayed wind power expansion – govt report.* Clean Energy Wire. https://www.cleanenergywire.org/news/bavarias-turbine-distance-rules-delayed-wind-power-expansion-report

La Repubblica (2022, April 6). *Oltre 3miliardi per le smart grid e per aumentare la distribuzione di energia rinnovabile. https://www.repubblica.it/green-and-blue/2022/04/06/news/smart_grid_decreto_mite-344421215/*

Lauber, V., & Mez, L. (2004). Three decades of renewable electricity policies in Germany. *Energy & Environment, 15*(4), 599-623. http://www.jstor.org/stable/43734671

Legambiente (2022). *Comunità Rinnovabili.* Legambiente. https://www.comunirinnovabili.it/legambiente-presenta-comunita-rinnovabili-2022/

Lehner, B., Czisch, G., & Vassolo, S. (2001). *EuroWasser: Europe's hydropower potential today and in the future 8-1 8 EUROPE'S HYDROPOWER POTENTIAL TODAY AND IN THE FUTURE.* [University of Kassel]. https://www.transnational-renewables.org/Gregor_Czisch/projekte/europes_hydropower_bernhard.pdf

Lowitzsch, J. (2019). Investing in a Renewable Future – Renewable Energy Communities, Consumer (Co-)Ownership and Energy Sharing in the Clean Energy Package. *Renewable Energy Law and Policy Review, 9*(2). https://www.jstor.org/stable/26743437

McGinnis, M. D. (2011). An Introduction to IAD and the Language of the Ostrom Workshop: A Simple Guide to a Complex Framework. *Policy Studies Journal, 39*(1). 169-183. https://doi.org/10.1111/j.1541-0072.2010.00401.x

McGinnis, M. D., & Ostrom, E. (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecology and Society, 19*(2). https://doi.org/10.5751/ES-06387-190230

Meister, T., Schmid, B., Seidl, I., & Klagge, B. (2020). How municipalities support energy cooperatives: survey results from Germany and Switzerland. *Energy, Sustainability and Society, 10*(18). https://doi.org/10.1186/s13705-020-00248-3

Menzani, T. (n.d.). *Le imprese cooperative nelle regioni italiane*. Treccani. https://www.treccani.it/enciclopedia/le-imprese-cooperative-nelle-regioni-italiane_(L'Italia-e-le-sue-Regioni)/

Ministero dell'Ambiente e della Sicurezza Energetica (2022, November 15). *Comunità energetiche: Pichetto, a breve consultazione pubblica su nuovo decreto.* Governo Italiano. https://www.mase.gov.it/comunicati/comunita-energetiche-pichetto-breve-consultazione-pubblica-su-nuovo-decreto

Ministero dell'Ambiente e della Sicurezza Energetica (n.d.). *Investimento 2.1: Rafforzamento smart grid.* Governo Italiano. https://www.mase.gov.it/pagina/investimento-2-1-rafforzamento-smart-grid

Musolino, M., D´Aleo, E., & Nicita, A. (2023). Three case studies to explore relevant features of emerging renewable energy communities in Italy. *Renewable Energy, 210,* 540-555. https://doi.org/10.1016/j.renene.2023.04.094

Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences of the United States of America, 104*(39), 15181-15187. https://doi.org/10.1073/pnas.0702288104

Our World in Data (2020). *Share of people who trust others in their neighbourhood, 2020.* Our World in Data. https://ourworldindata.org/grapher/share-people-trust-neighborhood?tab=map

Partelow, S. (2015). Coevolving Ostrom's social-ecological systems (SES) framework and sustainability science: four key co-benefits. *Sustainability Science, 11,* 399-410. https://doi.org/10.1007/s11625-015-0351-3

Radtke, J., & Ohlhorst, D. (2021). Community Energy in Germany – Bowling Alone in Elite Clubs? *Utilities Policy, 72*(2021). https://doi.org/10.1016/j.jup.2021.101269

REScoop.eu (n.d.a). *About our federation.* REScoop.eu. https://www.rescoop.eu/about-us

REScoop.eu (n.d.b). *Germany.* REScoop.eu. https://www.rescoop.eu/policy/germany-rec-cec-definitions

REScoop.eu (n.d.c). *Italy.* REScoop.eu. https://www.rescoop.eu/policy/italy-rec-cec-definitions

REScoop.eu (n.d.d). *Q&A: What are ´citizen´ and ´renewable´ energy communities?* REScoop.eu. https://www.rescoop.eu/toolbox/q-a-what-are-citizen-and-renewable-energy-communities

Rinnovabili.it (2022). *Donnarumma (Terna): 280 GW rinnovabili in attesa di connessione alla rete.* Rinnovabili.it. https://www.rinnovabili.it/energia/infrastrutture/donnarumma-terna-280-gw-rinnovabili-in-attesa-di-connessione-alla-rete/

Ritchie, H., Roser, M., Rosado, P. (2022a). *Germany: Energy Country Profile.* Our World in Data. https://ourworldindata.org/energy/country/germany?country=~DEU#citation

Ritchie, H., Roser, M., Rosado, P. (2022b). *Italy: Energy Country Profile.* Our World in Data. https://ourworldindata.org/energy/country/italy#citation

Romero-Rubio, C., & de Andrés Díaz, J. R. (2015). Sustainable energy communities: a study contrasting Spain and Germany. *Energy Policy, 85*(2015), 397-409. http://dx.doi.org/10.1016/j.enpol.2015.06.012

Ruggiero, S., Busch, H., Hansen, T., & Isakovic, A. (2021). Context and agency in urban community energy initiatives: An analysis of six case studies from the Baltic Sea Region. *Energy Policy, 148*, 111956. https://doi.org/10.1016/j.en-pol.2020.111956

Sccale203050 (2022). *Community Energy Municipal Guide.* https://energy-cities.eu/wp-content/uploads/2022/12/SCCALE-Municipal-Guide-Final-view.pdf

Schönberger, P., & Reiche, D. (2016). Why Subnational Actors Matter: The Role of *Länder* and Municipalities in the German Energy Transition. In: Hager, C., Stefes, C. (eds) Germany's Energy Transition. Palgrave Macmillan, New York. https://doi.org/10.1057/978-1-137-44288-8_2

Spinicci, F. (2011). Le Cooperative di Utenza in Italia e in Europa. Euricse Research Report (Publication N.002/11) [Università di Firenze]. https://euricse.eu/wp-content/uploads/2015/03/1323957261_n1894.pdf

Stagnaro, C. (2019). *Second-generation smart meter roll-out in Italy: A cost-benefit analysis.* [Istituto Bruno Leoni]. https://fsr.eui.eu/wp-content/uploads/smart_meter-CS.pdf

Staudenmaier, R. (2022, July 4). *Ukraine war sparks major shift in Germany's energy opinions.* DW https://www.dw.com/en/ukraine-war-sparks-major-shift-in-germanys-energy-opinions/a-61401277

Terna (2023, March 15). *Terna: presentato il piano di sviluppo 2023 della rete elettrica nazionale.* Terna https://www.terna.it/it/media/comunicati-stampa/dettaglio/piano-sviluppo-2023

Tounquet, F., De Vos, L., Abada, I., Kielichowska, I., & Klessmann, C. (2020). *Asset study on Energy Communities in the European Union.* Luxembourg: Publications Office of the European Union. https://doi.org/10.2833/232112

Wainer, A, Petrovics, D., & van der Grijp, N. (2022). The grid access of energy communities a comparison of power grid governance in France and Germany. *Energy Policy, 170,* https://doi.org/10.1016/j.enpol.2022.113159

Walker, G. (2008). What are the barriers and incentives for community-owned means of energy production and use? *Energy Policy, 36*(12), 4401–4405. https://doi.org/10.1016/j.enpol.2008.09.032

Wehrmann, B. (2017, November 30). *High hope and concerns over onshore wind power auctions.* Clean Energy Wire. https://www.cleanenergywire.org/factsheets/high-hopes-and-concerns-over-onshore-wind-power-auctions

Wehrmann, B. (2019, July 22). *Auctions and support cuts put brakes on Germany's citizen energy cooperatives – survey.* Clean Energy Wire. Retrieved May 28, 2023, from https://www.cleanenergywire.org/news/auctions-and-support-cuts-put-brakes-germanys-citizen-energy-cooperatives-survey

Wettengel, J. W. (2018, October 25). *Citizens' participation in the Energiewende.* Clean Energy Wire. https://www.cleanenergywire.org/factsheets/citizens-participation-energiewende

Wettengel, J. W., (2023, June 8). *Polls reveal citizens´ support for climate action and energy transition.* Clean Energy Wire. https://www.cleanenergywire.org/factsheets/polls-reveal-citizens-support-energiewende

Wierling, A., Schwanitz, V. J., Zeiss, J. P., Bout, C., Candelise, C., Gilcrease, W., Gregg, S. J. (2018). Statistical Evidence on the Role of Energy Cooperatives for the Energy Transition in European Countries. *Sustainability, 10*. https://doi.org/10.3390/su10093339

Wierling, A., Zeiss, J. P., Lupi, V., Candelise, C., Sciullo, A. & Schwanitz, V. J. (2021). The Contribution of Energy Communities to the Upscaling of Photovoltaics in Germany and Italy. *Energies, 14*(8). https://doi.org/10.3390/en14082258

Yildiz, Ö. Rommel, J., Debor, S., Holstenkamp, L., Mey, F., Mullerr, J. R., Radtke, J., & Rognli, J. (2014). Renewable energy cooperatives as gatekeepers or facilitators? Recent developments in Germany and a multidisciplinary research agenda. *Energy Research & Social Sciences 6*(2015), 59–73. https://doi.org/10.1016/j.erss.2014.12.001

Zulfiqar, S., Wahab, M. F., Sarwar, M. I., & Lieberwirth, I. (2018). Is Machine Translation a Reliable Tool for Reading German Scientific Databases and Research Articles? *Journal of Chemical Information and Modeling, 58*(11), 2214-2223. https://doi.org/10.1021/acs.jcim.8b00534

Annex 1

Template of the interview guideline

SES Framework categories	Factors of agency obtained through the operationalization of the SES framework	Interviews' questions

Resource Systems and Units	• Presence of natural resources:
	  ○ Sun
	  ○ Water
	  ○ Wind
	  ○ Etc.
	• Resource unit mobility
	• Conformation of the citizens' households (villas, building blocks, etc.)
	• Grid connection and state
	• Presence of energy storage
		• Can the natural resources of the territory be considered an enabling factor for the development if ECs?
		• Are ECs in Germany developed also in response to technical issues with the management of the grid? (for instance issues with connection to the national grid)

Governance Systems	• International policy
	• EU regulatory framework
	• At the national level:
	  ○ Regulatory framework
	  ○ Incentives scheme
	  ○ Experimental programmes
	  ○ Climate and energy strategies and targets
	• At the municipal level:
	  ○ Regulatory framework
	  ○ Incentives scheme
	  ○ Permitting and planning procedures
	  ○ Promotion of initiatives on community energy
	  ○ Involvement with the citizens
		• How has the EU policy framework for ECs impacted on the development of these latter in Germany/ Italy?
		• How have the Italian/ German national framework for ECs impacted on the development of ECs?
		• How have the federal/ regional/ municipal authorities administered the developed of ECs?
		• Would you consider the involvement of local authorities an enabling or disabling factor for the ECs´ development?

Actors	• Civil society and NGOs:
	  • Local population's attitudes towards the cooperative model
		• Civil society and NGOs:
		  • Has the local population shown openness or opposition to the creation of ECs?

	• Culture of local energy activism
	• Citizens' trust in the institutions
	• Presence of anti-nuclear movements
	• Local sentiment of community
	• Financial capabilities of local population and authority
	• Culture of entrepreneurship
	• Awareness and know-how about community energy
	• Civil society organisations (e.g. energy poverty)
	• Businesses and DSOs:
	  • Attitude of energy companies and DSOs and TSOs toward community energy
		• Has the public opinion changed over time and why?
		• Are there regions in the country with a story of energy activism and anti-nuclear movements? If yes, is it still alive today and is it related to the development of ECs?
		• Business and DSOs:
		  • Have local businesses and energy companies supported the development of ECs so far?
		  • Do you consider the relation between ECs and the local DSOs and TSOs an important factor for the development of ECs?

	Additional	• How would you explain the recent drop in the number of new ECs and cooperatives in Germany? • How would you justify the difference in development of ECs between Northern EU countries and Southern EU countries?