

# Towards a participatory energy transition. Critical issues and potentials of regulatory and financial instruments for Renewable Energy Communities (RECs) in Italy

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## Keywords

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## Abstract

The energy transition towards an economic model based on energy from renewable sources is considered a priority of strategic importance for the development of the European Union and Italy. In this context, Renewable Energy Communities (RECs) represent an opportunity to accelerate the decarbonisation process, to increase energy self-consumption and to replace centralised and hierarchical power plants with distributed and collaborative ones. This study aims to analyse how decarbonisation objectives are incorporated into national and regional regulatory and financial instruments that support the establishment of RECs. Starting from the comparison between the characteristics of REC and those of other energy community models with respect to a plurality of spheres (specifically, environmental, legal, economic-financial, technical, social and administrative spheres), the study provides a systematised framework of the advantages/disadvantages that influence the decision to invest in setting up a REC, and identifies the main critical issues that must be differentially addressed by the promoters, depending on whether they are public or private actors, assessing them through a system of nomenclators obtained following a focus group of experts. Furthermore, the analysis of regulations and available data on active RECs showed that Local Administrations play a central role in the dissemination of RECs, but also that the implementation of a sustainable and inclusive energy transition in the territories is hindered by a low level of social participation due to lack of knowledge of the benefits provided by RECs as well as actual difficulties for citizens to access REC projects, especially in their role as promoters.

## 1. Decarbonisation, energy transition, social participation

Needing to tackle global challenges related to climate change calls for a radical transformation of energy production and consumption patterns to achieve drastic reductions in CO<sub>2</sub> emissions. The European Union (EU) has taken a global leadership role in promoting policies aimed at supporting the diffusion of sustainable energy sources and decarbonization, committing to reconcile environmental sustainability with economic progress and improve the resilience of the energy system by fostering technological innovation. The European Commission (EC) has established

various regulatory instruments, as part of the European Green Deal, with the goal of changing the traditional energy paradigm and, simultaneously, increasing public and private investments in all economic sectors involved in the energy transition, as well as incentives and funding for innovative energy projects (The European Green Deal, COM 2019/640).

In the EU, measures promoting energy efficiency and the use of sustainable energy sources at the building scale have been active for several years, addressing both existing building stock and new construction projects (directive 2018/844/EU - Energy Performance of Buildings Directive; Directive 2018/2002/EU - Energy Efficiency Directive; directive 2023/1791/EU - Energy Performance of Buildings Directive IV); additionally, the European Commission has funded numerous pilot projects in various European cities to test efficient and replicable measures at the neighbourhood and city scale (My Smart City District, 2015; European Commission, 2022). These issues have been extensively discussed in the scientific literature and numerous studies, by adopting various approaches and methodologies, have analysed strategies and feasibility, and also the affordability of these measures for both public and private actors. Some studies have focused on proposals for sustainable urban strategies (Trovato and Cappello, 2022; Cappello et al., 2022), or sustainability assessments of urban and building projects (Abastante, 2023; Mecca et al., 2023; Canesi, 2023) and appropriate decision aid tools for selecting the best energy scenarios (Abastante et al., 2019; Napoli et al., 2020a). Other studies have addressed the economic and financial evaluation of energy efficiency measures at both urban and building scales (Napoli et al., 2021; Barbaro and Napoli, 2021) and in peculiar contexts and for different building typologies (Gagliano et al., 2017; Giuffrida et al., 2021; Napoli et al., 2022, 2020b; Trovato et al., 2020).

Within this framework, the adoption in EU countries of energy community models, that self-consume energy produced from renewable sources, becomes an important action that can significantly contribute to the reduction of greenhouse gas emissions and fossil energy consumption, but more importantly, it can be decisive for including social participation in economic models (European Commission, COM 2016/860). Indeed, the EC defines energy communities as organized groups based on consumer participation that can take part in any stage of the energy supply chain (directive 2018/2001/EU - Renewable Energy Directive II) by generating, consuming, sharing, storing or selling electricity. Thus, passive consumers are transformed into active producers and consumers (*prosumers*). In this way, it is possible to significantly increase the number of actors actively involved in the energy transition and, at the same time, to reverse the customer-supplier relationship in the energy market: there is a shift from a centralized and hierarchical production system, powered mainly by fossil fuels, to a distributed and collaborative one, powered by renewable sources, in which energy management is autonomous and democratic (Milčiuviene et al., 2019; Wahlund and Palm, 2022). Even the recent EPBD IV (directive 2023/1791/EU) recognises that energy communities using renewable energy contribute to the achievement of European climate neutrality and, in particular, to the energy savings required of Member States; it follows, therefore, that each state is required to take policy and regulatory, financial and fiscal measures to promote energy communities.

The introduction of energy communities in the EU legal system has given rise to numerous studies in different disciplinary areas, which are related to the very composition of the energy community (Moroni et al., 2018) or the technical and economic aspects inherent in shared energy distribution and management schemes (Cutore et al., 2023), and in the electricity market (Di Silvestre et al., 2021). In fact, energy communities may include different configurations of energy sharing, types of actors and technologies (Pellegrino and Coletta, 2021), also in relation to diverse objectives such as minimizing energy use from the power grid, maximizing each user's energy and monetary savings, minimizing environmental impact, etc. The spread of energy communities is also considered by the EU a key factor for sustainable economic development and social cohesion, because self-consumption of energy reduces the dependence on the national electricity systems and increases the number of actors who share the benefits of energy production activity, which has historically been controlled by a small number of large companies (Heuninckx et al., 2022). Business models (Cielo et al., 2021; Iazzolino et al., 2022) also exert, obviously, their influence on the attractiveness of investments in energy communities. Energy communities can make the energy

transition more inclusive and equitable, not only because citizens take a proactive role in the local energy system, but also because they contribute to energy poverty mitigation (Ceglia et al., 2022; Lazaroiu and Roscia, 2023), for instance, by setting discounted energy cost tariffs for the economically vulnerable community members and by establishing new forms of energy solidarity (Hanke et al., 2021).

The full development of energy communities has so far been limited by several factors, such as lack of implementing regulations and agreed legal definitions (Energy Communities Repository, 2024; Campos et al., 2020), as evidenced by studies that have addressed the different interpretations of European directives as expressed in the regulations of EU countries. Frieden et al. (2021) analysed the effects on the spread of collective self-consumption and energy communities in EU countries after the enactment of the *Clean Energy Package*. A comparison of the Italian situation with that of other EU countries was made by, among others, Barbaro and Napoli (2023) in relation to the economic feasibility of energy community initiatives receiving different types of financial support in Italy and Spain, and by Krug et al. (2022) who examined the transposition of the Renewable Energy Directive (Directive 2018/2001/EU) in Italy and Germany by comparing the respective regulatory and financial support systems.

The regulations on energy communities and the implementation process of directive 2018/2001/EU in Italy, Germany, France, Greece and Portugal were studied by De Santi et al. (2022); Tarpani et al. (2022) analyzed the regulations on energy communities, proposing a classification of European countries into laggards and pioneers and delving into the case studies of Italy and the Netherlands. The question of which legal forms may be the most suitable for renewable energy communities was investigated by Grignani et al. (2021), who compared the Italian context with the French, German and Spanish ones. The study by Tatti et al. (2023) focused on emerging trends in the development of renewable energy communities in Italy, starting from a general overview of regulations in EU countries; instead, the one by Bonifazi et al. (2022) carried out an analysis of the Italian Regions' and Autonomous Provinces' policy actions aimed at facilitating the processes of building renewable energy communities through mutual learning paths between groups of regional actors active in the energy transition.

This study aims to contribute to this research area by investigating the regulatory and financial instruments that specifically support Renewable Energy Communities (RECs) in Italy, at the national and regional levels, among other energy community models allowed in the EU and Italy. This analysis intends to compare the advantages/disadvantages that influence the decision to invest in the establishment of a REC rather than other energy community models and to identify the main critical issues that must be addressed differentially by promoters, as public or private actors. In particular, the role of Local Administrations in the activation of energy transition and social participation processes is examined to find out how they plan to directly involve citizens in the promotion, development and establishment of RECs.

From this analysis, therefore, some useful elements of knowledge and critical considerations may emerge on the following issues:

- declining national decarbonisation goals at the local level –i.e. how national decarbonisation policies are translated and articulated in regional regulatory and financial instruments that support the formation of RECs;
- role of local public administrations –i.e. what role Local Administrations play in the promotion, territorial dissemination and social participation of REC projects;
- critical issues of RECs –i.e. which types of critical issues may limit or make difficult the action of public or private promoters in the establishment, implementation and management of RECs in Italy.

The article is structured in several sections. The description of the methodology applied in the study is presented in paragraph 2. Paragraph 3 examines the energy community models provided for by the EU legislative framework. Paragraph 4 contains the analysis of the Italian legislation and financial instruments introduced for RECs and other energy community models. This is followed,

in paragraph 5, by a review of the regulation of funding calls issued by Italian regions to support the dissemination of RECs at the local scale. Paragraph 6 offers a discussion of the advantages/disadvantages of the main energy community models, the types of promoters and members of Italian RECs, and the main critical issues that public or private promoters must face to establish and manage a REC in Italy. Finally, in paragraph 7, conclusions on the study's outcomes and future research perspectives are presented.

## 2. Methodology

This study aims to contribute to the critical understanding of the dynamics that are driving the participatory energy transition in Italy and to identify the factors that hinder or facilitate the development of RECs. To achieve these objectives, this study is developed in several phases.

The first phase involves a qualitative analysis of European directives and Italian national and regional legislation and regulations related to RECs, and it focuses on specific areas of interest:

- RECs models – by surveying the characteristics of REC and other models of energy communities proposed by the EU and transposed and interpreted by Italian legislation;
- financial incentive tools – examining the requirements and constraints for accessing incentives and the types and size of financial incentives set up to support RECs by ministerial and regional regulations;
- promoters of RECs – highlighting the peculiar potential and limitations of promoters, distinguished in public and private entities, resulting from current legislation.

The information gained in the first part of the study flows into the subsequent discussion phase, where:

- the REC is compared with another energy community model (i.e. collective self-consumption) against numerous factors ascribable to a complex system of domains (i.e. environmental, legal, economic-financial, technical, social and administrative domains) in order to identify the main advantages and disadvantages that lead to the choice between the two types of energy community;
- specific critical issues of RECs are identified on the basis of the results of a *focus group* with experts in the main fields involved (photovoltaic systems, economic assessments, sociology);
- the political-normative, legal-administrative, economic-financial, technical, social and administrative-procedural criticalities that influence the establishment of the REC are assessed with respect to the public or private nature of the promoter.

## 3. Energy community models in the European Union

In the European Union, the *Renewable Energy Community* (REC) is a legal entity based on open and voluntary participation, whose members or shareholders are located in the proximity of renewable energy production plants. RECs, according to existing national rules, participate directly in the energy transition producing, selling and distributing energy produced from renewable sources. However, for small or medium-sized enterprises (SMEs), these activities should not constitute their main commercial or professional activity. EU Member States should ensure that RECs have the right to operate as legal entities and to manage and share renewable energy within the community. In any case, the primary objective of a REC should be to provide environmental, economic, or social benefits to the community, its shareholders or members, or the local areas in which it operates, rather than financial profits (Renewable Energy Directive II - RED II Directive).

Different energy community models regulated by other EU directives (directive 2018/2001/EU - Renewable Energy Directive II; directive 2019/944/EU - IEM Directive) are also:

- *collective self-consumption*;

- the *Citizens Energy Community* (CEC).

*Collective self-consumption* consists of a group of (at least two) self-consumers of renewable energy located in the same building or apartment block and acting collectively to consume, store and sell self-produced renewable electricity. If the user is a small or medium-sized enterprise (SME), these activities must not constitute the main commercial or professional activity (Renewable Energy Directive II - RED II).

The *Citizens' Energy Community* (CEC) is a legal entity controlled by its members or shareholders, who are not constrained to be located near power generation plants. CECs may operate in the electricity sector for the production and management of energy, also obtained from non-renewable sources, and may take on the role of actual energy distribution entities, as they are allowed to manage grid infrastructures and to provide numerous energy services. Moreover, CECs have no restrictions on the type of legal entity, as they can take the form of businesses or professional entities, as well as enterprises (Internal Markets Electricity Directive - IEM Directive).

All these energy community models have different characteristics in terms of, for example, legal entity, locational constraint or allowed activities, but share the same goal of environmental sustainability and decentralisation of energy production, as well as that of creating a favourable environment for the emergence of participatory energy models that actively involve citizens, businesses and public authorities (Table 1).

The opportunity, given to energy communities, to produce and distribute energy has made it necessary to update the regulation of the energy market to adapt it to new and multiple types of players. The latest rules aim to: strengthen the rights of end-customers in terms of transparency (regarding offers, contracts, and bills); regularize the conditions for the establishment of closed distribution systems; start the liberalization of retail energy markets, safeguarding the most vulnerable customers; open the

**Table 1.** Characteristics of RECs and other energy community models under EU directives (own processing and on data De Santis et al., 2022).

Scope	Renewable Energy Community (REC)	Collective self-consumption	Citizen Energy Community (CEC)
Legal entity	Whatsoever	Condominium or none	Whatsoever
Purpose	Environmental, economic or social community benefits to the REC members/ shareholders or to local areas where the REC operates	Self-consumption	Environmental, economic or social community benefits to the CEC members/ shareholders or to local areas where the CEC operates
Participation	Open and voluntary	Open and voluntary	Open and voluntary
Technology	Based on energy from renewable sources	Based on energy from renewable sources	Whatsoever
Locational constraints	Members/shareholders in direct physical proximity to the energy generating installation	Members/shareholders located in the same building or condominium	None
Members/ shareholders	Natural persons, local authorities, SMEs	Natural persons, local authorities, SMEs (whose participation does not constitute their primary commercial activity)	Natural persons, local authorities, SMEs
Activities	Generation, consumption, storage, sale and sharing of renewable energy	Generation, consumption, storage, sale and sharing of renewable energy	Generation, consumption, storage, aggregation, supply and distribution of electricity; energy efficiency services; charging services for electric vehicles and other energy services

services market to new types of entities; regulate the function of entities who play a public role in the management of the electricity system, such as transmission and distribution network managers, electricity market managers and regulatory authorities, given that energy communities often use the national power grid (Internal Markets Electricity Directive - IEM Directive).

Despite some differences, all types of energy communities under European directives are capable of generating environmental, social and economic benefits for the local population involved, such as, for example: reduction of environmental impacts and CO<sub>2</sub> emissions; greater security of energy supplies associated with lower energy dispersion and shorter energy transport distances; reduction of social inequalities and increase in social cohesion; fight against energy poverty. These benefits make it possible to address the challenges of climate change and energy transition, without neglecting the ethical need to implement a just transition.

However, the current European legislative framework requires further integrations and specifications of the rules, while the implementation of any model of self-consumption of shared energy is, however, strictly dependent on the transposition of European directives by each Member State. This transposition is an expression of economic policies and local territorial needs translated into national laws, rules and financial instruments (such as financing, incentives, tax deductions, etc.), causing a wide variety of regulatory discrepancies between Member States (Tatti et al., 2023).

#### 4. Regulations and incentives to support REC in ITALY

Italy transposed the EU directives on RECs and other energy communities into a body of legislation that, starting in 2019, tries to promote their dissemination throughout the national territory, also providing financial incentives and tax relief (REScoop.EU, 2024; Tatti et al., 2023) (Figure 1).

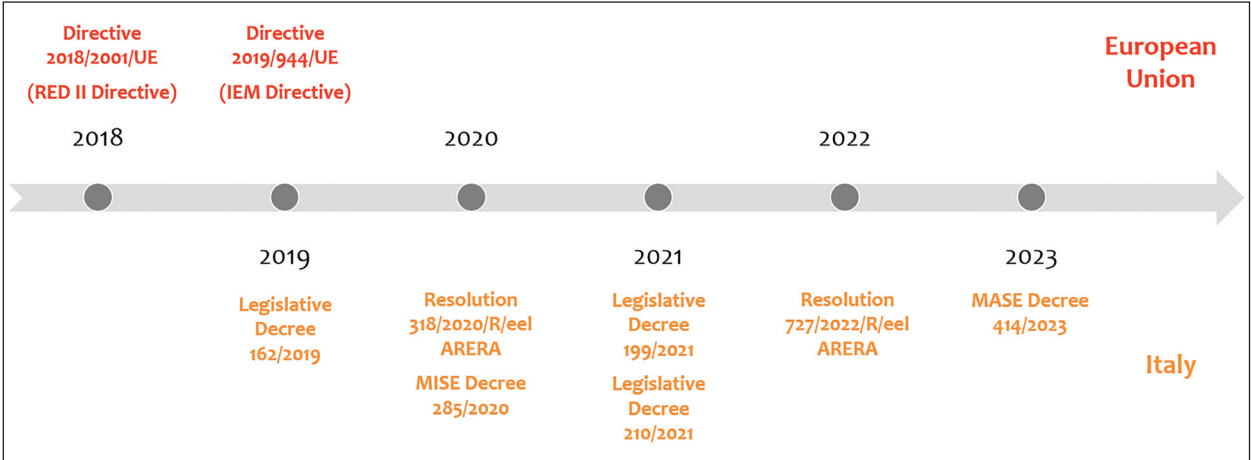


Figure 1. Timeline of Italian and European Union legislation on energy communities (own processing).

#### 4.1 National regulation of RECs and energy communities

RECs and other models of energy communities, envisaged by European directives, are incorporated into the Italian legislative corpus to outline their legal status and requirements, specifying which parameters to use, for example, to define the proximity to an energy production plant.

According to the interpretation expressed by Italian law, *Renewable Energy Community* (REC) is “a legal entity that is based on open and voluntary participation, autonomous and effectively controlled by shareholders or members who are located in the proximity of renewable energy production plants, held by the community, whose primary purpose is to provide environmental, economic or social benefits to its shareholders or members or to the local areas in which it operates, rather than financial profits” (Resolution No. 18 of 2021 of the Internal Revenue Agency). In Italy, therefore, a REC may be constituted by many types of actors, such as citizens, businesses,

associations, local authorities, condominiums, the third sector, cooperatives, religious bodies, and SMEs) that do not have the generation of monetary interests as their main goal. The constraint of proximity to energy production plants, in this case, is associated with the possibility of connecting the REC members to the same HV/MV primary transformer cabin.

*Collective self-consumption* occurs when a group of at least two self-consumers of renewable energy, located in the same condominium or building, act collectively under a private agreement. Collective self-consumption, therefore, operates within limited borders and has the condominium as its legal entity. Collective self-consumption is entitled to produce renewable electricity for its own consumption, as it is an end-customer; in addition, it may store or sell such energy, although such activities must not become commercial or professional activities (Legislative Decree No. 162 of 2019, Article 42 bis; Resolution No. 18 of 2021 of the Internal Revenue Agency).

A *Citizen Energy Community* (CEC) is defined as “an entity under private law that can take any legal form, it being understood that its deed of incorporation must identify as its main purpose the pursuit, for the benefit of its members or associates or the territory in which it operates, of environmental, economic or social benefits at the community level, financial profits not being able to constitute the main purpose of the community” (Legislative Decree No. 210 of 2021, Art. 14, paragraph 6d). Again, community membership must be open and voluntary. In contrast, unlike RECs, CECs have greater prerogatives because they have the right to participate directly in the generation, distribution, supply, consumption, aggregation and storage of electricity, including electricity from non-renewable sources, and the provision of energy services. This approach aims to encourage diversification of energy sources and to promote broad and widespread participation in the energy market. However, the lack of implementing rules seems to show an implicit preference, in Italy, for the model represented by RECs.

The Italian regulation, to facilitate the spread of energy communities, has progressively increased the flexibility of particular requirements such as:

- *ownership of renewable energy power plants and facilities.* It is not mandatory that the power plants and electrical systems are necessarily owned by the members or the community, given that they can also be made available by third parties (provided that these parties comply with the provisions and regulations in force);
- *physical proximity for aggregations in energy communities.* The initial requirement of a connection to the same MV/LV secondary transformer cabin for all members of an energy community (Legislative Decree No. 162 of 2019) — who, therefore, have to be located in a restricted area — has been replaced by the connection to the same HV/LV primary transformer cabin (ARERA Resolution 727/2022/R/eel), which implies expanding the area within which to acquire membership in the energy community;
- *energy power plant sizing.* The maximum size of the plants is made less stringent by increasing the overall power from 200 kW (Legislative Decree No. 162 of 2019) to 1 MW (Legislative Decree 199/2021), so as to enable greater energy production capacity;
- *the role of prosumers in the internal electricity market.* It is established that consumers can participate in the electricity market individually, as a group or energy community, and also have the right to sell self-produced electricity on the market (Legislative Decree 210/2021).

On the other hand, the same legislation has imposed stricter restrictions on the inclusion of existing renewable energy supply plants in new energy communities as well as on the corresponding application for incentives. In fact, currently, the plants eligible for incentives are those that entered into operation from 16 December 2021 (MASE Ministerial Decree No. 414 of 07/12/2023) — this date replaced the one previously set at 1<sup>st</sup> March 2020 (MISE Ministerial Decree No. 285 of Sept. 16, 2020).

However, other constraints remain in force and unchanged such as the ones related to the payment of system charges for using the existing power grid for energy sharing (Legislative Decree No. 162 of 2019) and the right of all REC members to choose their electricity supplier (ARERA Resolution 727/2022/R/eel).

## 4.2 National (financial and fiscal) incentives to grant energy communities

To support the self-consumption of electricity from renewable sources, the national regulatory framework is developing a system of financial and tax incentives from which both RECs and other energy community models may benefit. These incentives consist of a feed-in premium and capital grants, provided by the *Gestore dei Servizi Energetici* (GSE) (Gestore dei Servizi Energetici, 2024; MASE Ministerial Decree No. 414 of 07/12/2023), which replaced the previous feed-in premium and tax reduction (MISE Ministerial Decree No. 285 of 16/09/2020). The framework of the financial and fiscal instruments and their characteristics is summarised in Table 2.

The feed-in premium was initially established in 2020 to encourage the adoption of storage systems and to promote the convergence of production and consumption of electricity shared by both the RECs and collective self-consumption groups (MISE Decree No. 285 of 16/09/2020). This incentive remunerated, for a period of twenty years, the self-produced and self-consumed electricity from renewable sources with a premium differentiated by type of energy community (110 €/MWh for REC plants and 100 €/MWh for collective self-consumption plants). The feed-in premium was associated with a tax reduction (included in the energy bill) corresponding to the economic compensation for the cost items avoided as a result of not transferring the shared electricity to the national grid: RECs granted a refund of 8 €/MWh, while collective self-consumption obtained a rebate of 10 €/MWh (Table 1). However, taking into account the energy transferred to the grid through dedicated withdrawal or sale to the energy market, according to Barroco et al. (2022), the total financial remuneration could reach 150-160 €/MWh for both the energy community models.

**Table 2.** Financial incentives and tax reductions to energy communities in Italy (own processing).

Municipality size	Generation capacity of power plant	Incentives (MISE Decree 285/2020)		Incentives (MASE Decree 414/2023)			
		Feed-in premium	Fiscal reduction	Feed-in premium*	Capital grant		
Residents No.	kW	REC	Collective self-consumption	REC	Collective self-consumption	Amount max	Share max
		EUR/MWh	EUR/MWh	EUR/MWh	EUR/MWh	€/kW	%
	kW > 600					60 (max 100)	
> 5.000	200 < kW ≤ 600					70 (max 110)	0
	kW ≤ 200					80 (max 120)	
	kW > 1.000						0
	600 < kW ≤ 1.000	110	100	8	10	60 (max 100)	1.050
≤ 5.000	200 < kW ≤ 600					70 (max 110)	1.100
	20 < kW ≤ 200						1.200
	kW ≤ 20					80 (max 120)	1.500

\* A correction factor for photovoltaic systems is applied to the set values to take into account the different levels of insolation for Italian geographical areas. It is 10 or 4 €/MWh for the northern or central Italian regions respectively.



The financial benefits introduced by the recent MASE Ministerial Decree No. 414 of 07/12/2023, on the other hand, consist of a different feed-in premium and a capital grant. The new feed-in premium, which lasts 20 years, is not related to the type of energy community, but rather is differentiated on the basis of other factors, i.e. the power of the renewable energy production plants and the geographical location. In addition, this incentive is composed of a fixed part (60 to 80 €/MWh) and variable part (100 to 120 €/MWh) determined with respect to the differences between the zonal energy price and the European price-cap for energy sales (DossierSE, 2023). Finally, a correction factor for photovoltaic systems is applied to consider the different levels of insolation in Italy's geographical areas and is equal to 10 €/MWh for northern regions and 4 €/MWh for central regions (Table 1).

The capital grant, which can cover up to 40 percent of the eligible costs, is targeted at any type of energy community that uses renewable sources and is located in municipalities with a population of less than 5000. The grant varies depending on the power of the plants and is provided by the *Gestore Servizi Energetici* in two tranches: the first one, amounting to 90%, upon completion of 30% of the work; the second tranche constitutes the balance at the end the work (which should respect a maximum duration of 18 months). The eligible costs for subsidy purposes and the corresponding fundable percentages are listed in Table 3.

**Table 3.** Eligible costs for the capital grant (according to the MASE Decree) (own processing).

Eligible costs for the purpose of the non-repayable capital grant (MASE Decree 414/2023*)	Maximum share of costs (within the maximum amount fundable) (%)
<ul style="list-style-type: none"> <li>• Supply and installation of renewable energy generating installations</li> <li>• Supply and installation of the eventual energy storage facilities</li> <li>• Supply and installation of hardware and software equipment</li> <li>• Construction work strictly necessary for the implementation of the project</li> <li>• Connection to the national electricity grid</li> </ul>	100
<ul style="list-style-type: none"> <li>• Pre-feasibility studies and expenses necessary for preliminary activities, including expenses necessary for the establishment of the energy community</li> <li>• Project designs, geological and geotechnical investigations that are charged to the project designer</li> <li>• Construction and safety managements</li> <li>• Technical and/or technical-administrative inspections, consultancy and/or technical-administrative support that are essential to the implementation of the project</li> </ul>	10

\*Soon this grant can be applied for through the Gestore dei Servizi Energetici web portal. As of April 2024, this form has not yet been activated.

Ultimately, the incentives that have recently come into force are extended indiscriminately to RECs and collective self-consumption groups that install energy production plants using any kind of renewable sources (such as e.g., photovoltaic, wind, hydroelectric and biomass plants), and it is worth noting that the introduction of the capital grant turned this incentive into a territorial rebalancing tool that supports development in small municipalities. Moreover, the latest legislation tends to favour the public or non-profit entities as promoters of energy communities, since it establishes an exemption from the reduction of feed-in premium, linked to the cumulation of financial benefits, when territorial entities or local authorities, religious or third sector entities, as well as environmental protection entities are the owners of the energy withdrawal points.

In the national regulatory framework, therefore, the formation of RECs (or collective self-consumption groups) generates social and environmental benefits from the increased use of renewable energy, contributes to the spread of participatory and cooperative forms of energy production, and provides financial benefits to the promoters in the form of capital grants and incentives on self-produced and self-consumed energy.

## 5. The REC as a local instrument of energy and social policies

The national framework in Italy for regulating and incentivising RECs is made complex by the presence of regional laws (Bonifazi et al., 2022) that have common elements but also introduce substantial variations. The main differences concern the definitions and purposes of energy communities and the requirements for their establishment. In fact, in some Italian regions, the energy communities are defined as a group of entities that share the common goal of production, distribution and consumption of renewable energy, while in other regions the legislation focused more on citizen participation.

### 5.1 The regional regulation of energy communities

The Piedmont region, first in Italy, linked the accreditation of energy communities as «energy producing entities» to compliance with a performance requirement that set up a minimum share, not lower than 70%, of energy from renewable energy sources (RES) to be destined to self-consumption by the community members (R.L. No. 12 of 2018). Subsequently, other regions set similar constraints, specifically, this minimum share is equal to 60% in Calabria (R.L. No. 25 of 2020), Campania (R.L. No. 38 of 2020), Puglia (R.L. No. 45 of 2019) and Sardinia (R.L. No. 15 of 2020), and 40% in Marche (R.L. No. 10 of 2021).

In addition, many regional authorities (including those of Abruzzo, Basilicata, Emilia-Romagna, Liguria, Marche, Puglia, Piedmont and Veneto) decided to establish a permanent “Technical Board” to encourage dialogue and synergies among the various stakeholders in the energy sector, with the aim of reducing energy consumption from non-renewable sources thanks to self-consumption of energy from renewable sources and the establishment of energy communities. The policies and legislations of some Regions have a distinctive feature in the rules that promote some actions to fight energy poverty, for example, through different models of energy community (Lombardy, R.L. No. 2 of 2022; Calabria, R.L. No. 25 of 2020; Emilia-Romagna, R.L. No. 5 of 2022; Sardinia, R.L. No. 15 of 2022; Veneto, R.L. No. 16 of 2022).

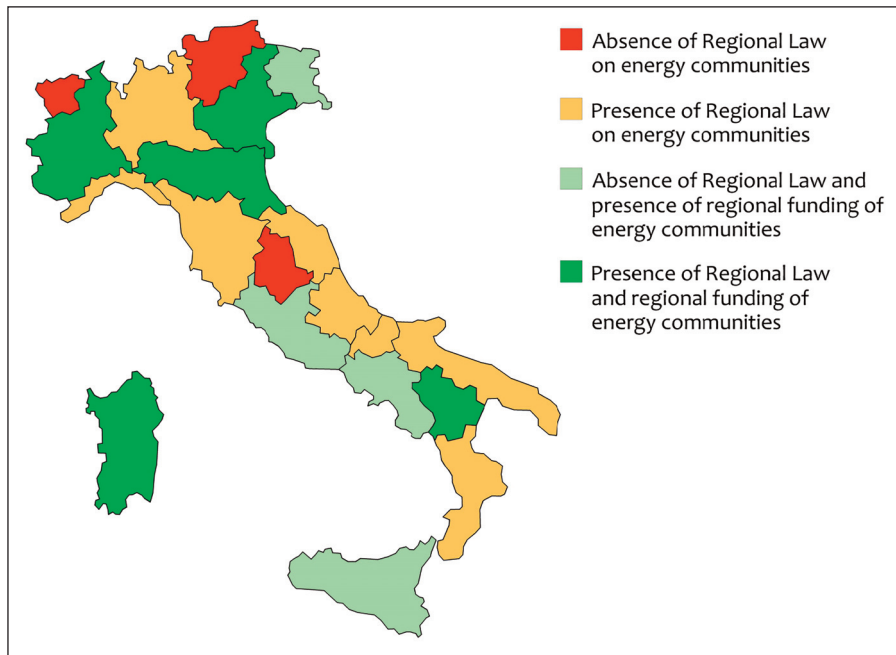
Other regions promoted specific actions based on priority objectives. The Calabria Region, in particular, planned to incentivize the development of RECs through the signing of Memoranda of Understanding and collaborations with Municipalities to simplify and standardize the authorization procedures and to involve both local energy distributors and the GSE in the establishment and management of the energy communities. In addition, it was established and regulated the “Renewable Energy of Calabria” eco-label, which aims to allow energy traceability and certify the ecological quality of energy production systems from local renewable sources, also in relation to their landscape impact and the protection of natural sources (R.L. No. 20 of 2023).

The common elements among the regions are numerous and related to, among others, the right to establish energy communities, which is recognized to all types of actors, both public and private, including citizens and businesses, local authorities and associations; or linked to the purpose of energy communities—which should not be profit-seeking but primarily the production of energy for self-consumption—, but also the demand for transparent and democratic management of energy communities, in order to ensure members’ participation in the decision process and to increase social cohesion and collective responsibility.

The establishment and management of energy communities are supported in some regions by a series of targeted actions, including: economic grants; education and information campaigns on energy communities; technical and administrative support. Specifically, nine regions (Basilicata, Campania, Emilia-Romagna, Friuli-Venezia Giulia, Lazio, Piedmont, Sardinia, Sicily, and Veneto) promoted calls for funding to support the development of RECs in their territories (Figure 2).

### 5.2 Regional financial support instruments for RECs

Several Italian regions decided to support RECs by financing grants. A comparison among the different regional rules was made by relating the phases of establishing a REC (initial,



**Figure 2.** Presence/absence of regional laws and funding inherent to energy communities (own processing).

Actions	Establishing of a REC Phases	Costs
F1_A Technical and economic feasibility study	<b>1. Initial phase</b>	Costs for the techno-economic feasibility study
F1_B Formation of the legal entity		Legal and administrative costs
F1_C Definition of the project		Design costs
F2_A Construction works necessary for the power plant	<b>2. Implementation phase</b>	Costs of construction works
F2_B Construction of the power plant		Costs of supply and placement of facilities
F3_A Connection to the electrical grid	<b>3. Start-up phase</b>	Charges for grid connection
F3_B Registration of the REC at the GSE web portal		Any compensation for external professionals
F4 Activation of the REC		–

**Figure 3.** Phases of establishing of a REC (own processing).

implementation and start-up phases) and the related costs to be covered (Figure 3) with the main features of the tenders set by some Italian regions (Table 4).

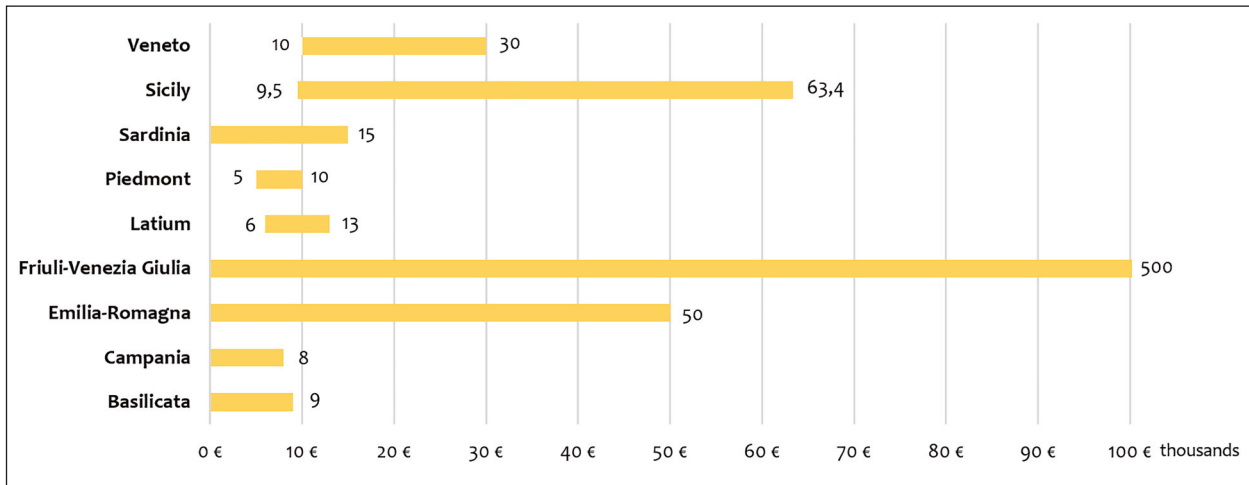
An aspect of particular interest, that is present in many of the analysed tenders, is the decision to identify the Public Entities or Municipal Administrations as the only entities eligible for RECs funding. It expresses the political will to give them the role of central actors in the process of spreading energy communities at the local level and to move the regional strategy away from the national strategy that does not establish differences between types of promoters or members of energy communities, except for the exemption from the feed-in premium reduction in case of combination with other incentives (this case was previously mentioned in section 4.2).

The categories and percentages of fundable costs determined by the tenders vary among the regions, which have allocated economic resources to partially or totally cover the expenses to be incurred in the preliminary stages of establishing a REC. These expenses are mainly related to those of the technical-economic feasibility studies and the formation of the legal entity of the REC, with shares ranging from 80% to 100%. However, it should be noted that the Friuli-Venezia Giulia region is an exception, as grants can be requested for all types of costs. The diversification between regions is also reflected in the maximum amount of grants awarded, which is almost always less than or

**Table 4.** Characteristics of tenders funding REC in some Italian Regions (own processing).

Region	Regional Law	Regional funding	Eligible subjects	Fundable costs	Fundable share (%)	Grant		Disbursement of funding
						Min (€)	Max (€)	
Basilicata	Regional Law No. 12/2022	Resolution No. 775/2023	Municipalities	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> </ul>	100	0	9,000	50% down payment 50% balance
Campania	-	Regional Council Decree No. 451/2022	Municipalities with population No. < 5000	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> </ul>	100	0	8,000	50% down payment 50% balance
Emilia-Romagna	Regional Law No. 5/2022	Regional Council Decree No. 2151/2022	Any entity (except Large Enterprises)	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> <li>• F1_C Definition of the project</li> </ul>	80 (90 in caso di premialità*)	0	50,000	Single solution
Friuli-Venezia Giulia	-	Decree No. 4966/AMB/2022	Public bodies	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> <li>• F1_C Definition of the project</li> <li>• F2_A Construction works necessary for the power plant</li> <li>• F2_B Construction of the power plant</li> <li>• F3_A Connection to the electrical grid</li> <li>• F3_B Registration of the REC at GSE web portal</li> </ul>	80	0	500,000	N.A.
Latium	-	Determination No. G18124/2022	Any entity (except Enterprises)	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> </ul>	100	6,000	13,000	N.A.
Piedmont	Regional Law No. 12/2018	Determination of the Executive No. 547/2019	Municipalities	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> </ul>	100	5,000	10,000	N.A.
Sardinia	Regional Law No. 15/2022	Resolution n° 35/108/2022	Municipalities	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> </ul>	100	0	15,000	50% down payment 50% balance
Sicily	-	Decree of the Director General No. 707/2022	Municipalities	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> </ul>	100	9,500	63,398	N.A.
Veneto	Regional Law No. 16/2022	Regional Council Decree No. 1568/2023	Any entity (except Large Enterprises)	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> </ul>	80	10,000	3,000	Single solution

\* This bonus is granted to RECs: which are located in mountainous or inland areas; which have members in energy poverty; whose owners or operators are Public Housing or Social Housing entities; which have facilities located in areas granted by public entities.



**Figure 4.** Min-max amount of grants to RECs financed by some regional tenders in Italy (own processing).

equal to €50,000 (reaching a maximum of €500,000 in Friuli-Venezia Giulia); while the Sicilian Region established the maximum amount granted to be calculated as a combination of a fixed fee of €9,500 and a variable fee based on the number of inhabitants of the applicant municipality (Figure 4).

Emilia-Romagna and Sicily were the only regions to include the issue of energy poverty in their respective tenders for grants to RECs: in Emilia-Romagna, the maximum grant percentage is increased by 10 per cent when the REC includes members in energy poverty conditions; the regulations of the Sicilian region specified that Municipalities are eligible for grants only if they undertake to establish one (or more) RECs as promoters and to involve an initial group of participants, of which at least 10% are in energy poverty conditions.

Among the regions that have not yet published tenders for grants, Lombardy and Tuscany are notable because they launched instead other valuable initiatives to develop RECs. The Lombardy Region promoted a call for Expressions of Interest in the submission of REC projects by Municipalities. This call aims to collect information on the potential of the Lombardy region related to the development of communities dedicated to the generation and sharing of electricity and thermal energy from renewable sources (Decree No. 11097/2022). The Tuscany region, observing the limited diffusion of RECs in its territory, undertook to promote RECs by offering support in terms of dissemination and communication actions, as well as the configuration of guidelines and drafting of administrative acts (Council Resolution No. 336 of 21/03/2022).

### 5.3 The financial support of private entities to RECs

The activity of public administrations to promote the establishment of RECs, including through the provision of incentives and grants, is complemented by initiatives of private entities (i.e. foundations, chambers of commerce and cooperatives) rooted in the territory and operated in large areas, such as groups of regions or provinces, which agree with the principles and objectives of the energy transition to be implemented through energy communities. Some initiatives deemed interesting were selected as examples by geographical area (Northern Italy, Central Italy, Southern Italy) and by type of private financing entities, each of which pursues its own specific objective.

The Trentino Federation of Cooperatives, through its “Energia inCooperazione” initiative, decided, in August 2023, to allocate an extraordinary contribution of €5000 to the RECs cooperative located in the territory of the Trentino-Alto Adige Region. This grant is aimed at already existing or in the process of establishment RECs (regardless of the type of promoters, funders and members) as long as they meet the following requirements: to be established as a cooperative; to be associated with the Trentino Federation of Cooperatives; to have defined a package of services provided by the Federation itself to the REC (Energia inCooperazione).

The «Fondazione Cariverona» actively supports the REC projects by public entities

(Municipalities, Unions of Municipalities and Third Sector entities) in the provinces of Verona, Vicenza, Belluno, Ancona and Mantua, with the aim of: installing new production capacity from renewable source plants, which guarantee greater energy autonomy to the territories and decrease the anthropic impact on the environment; spreading the culture of sustainability; revitalizing the community feeling and democratic tools of active and shared participation; tackling situations of energy poverty and responding to local social issues. The Foundation has published a call for proposals that finances 40% of the cost of implementing RECs' facilities by granting a maximum contribution of €60,000 (Fondazione Cariverona).

The Chamber of Commerce of the Umbria Region decided to promote the energy transition in the regional territory and, therefore, committed to give to enterprises, through a call for proposals, a contribution of € 2000 for the preparation of technical and economic feasibility studies of REC projects to micro-size enterprises and SMEs (Camera di Commercio Regione Umbria).

The "Fondazione con il Sud" launched a call for proposals in 2022 to support the establishment of energy communities in the southern regions (Basilicata, Calabria, Campania, Puglia, Sardinia and Sicily) through the disbursement of a grant (up to a maximum of €150,000), with the aim of fostering bottom-up participatory processes of ecological transition and reducing the conditions of energy poverty faced by low-income households. The call was reserved exclusively for nonprofit organizations (association; social cooperative or their consortium; ecclesiastical organization; foundation; social enterprise) that had to set up a project partnership composed of at least three organizations of which one, belonging to the Third Sector, has the role of «responsible party» and a technical partner able to support the future energy community in all the phases of design, installation and management (Fondazione con il Sud).

Therefore, in conclusion, in these initiatives to support RECs, the funding beneficiaries were identified consistent with the role and purpose of the proposing private entities and limited to the territorial areas in which these entities operate. The main characteristics of the financing tenders are shown in Table 5.

## **6. REC: discussion on models, promoters and critical issues**

REC become an essential part of European and Italian strategies of decarbonization and reduction of CO<sub>2</sub> emissions. The analysis of Italian legislation and regulations outlined a national framework in line with the contents of the EU directives and with the objective of facilitating the spread of RECs and other energy community models in the territory. Many Regional Administrations, in turn, legislated on this issue by including, sometimes, minimum performance requirements, in order to ensure a minimum share of self-consumption of energy within energy communities, and introduced various measures promoting the establishment and management of RECs.

These measures include education and training programs on RECs, technical and administrative assistance through permanent Technical Board, and financial grants provided through special tenders. In some regions, local financial instruments became tools of territorial and social rebalancing policies, when some regulations that benefit small municipalities, inland areas and people in energy poverty were introduced. Although energy poverty mitigation by REC is a line of action proposed by the European Union, the analyses conducted in this study show that this action was not adequately implemented by national regulations and legislation, and only the Emilia-Romagna and Sicily Regions included a reference to energy poverty in their tenders for RECs. At present, however, it is impossible to assess the actual impact that these regional financing instruments have had on the REC diffusion in the Italian regions, because a complete and up-to-date database of RECs is not available or consultable, as some reports lack essential data, such as the year the energy communities were established or whether regional contributions were granted; moreover, the postponement of the issuing of some implementing regulations caused significant delays in the completion of REC initiatives, altering the overall outcomes.

Furthermore, as it is reflected in the definitions of the eligible entities contained in the regional funding notices, there is a prevalent trend to assign to public authorities and, in particular,

**Table 5.** Characteristics of REC financing tenders promoted by private entities in Italy (own processing).

Territorial area	Proposing entity	Objective	Eligible subjects	Eligible costs	Fundable share (%)	Grant		Disbursement of funding
						Min (EUR)	Max (EUR)	
<b>North</b> Trentino-Alto Adige Region	<b>Cooperative</b> Federazione Trentina della Cooperazione	Green transition and sustainable development	Cooperatives	N.A.	N.A.		5000	Single payment
<b>North</b> Provinces of Verona, Vicenza, Belluno, Ancona, and Mantua	<b>Foundation</b> Fondazione Cariverona	Energy transition, social inclusion and tackling energy poverty	Municipalities, Unions of Municipalities, Third Sector Entities (TSE)	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> <li>• F1_B Formation of the legal entity</li> <li>• F1_C Definition of the project</li> <li>• F2_B Construction of the power plant (for public or private)</li> </ul>	40	0	60,000	N.A.
<b>Centre</b> Umbria Region	<b>Chamber of Commerce</b> Camera di Commercio dell'Umbria	Green Transition in Enterprises	Micro, Small and Medium Enterprises	<ul style="list-style-type: none"> <li>• F1_A Technical and economic feasibility study</li> </ul>	50		2000	Single payment
<b>South</b> Regions Basilicata, Calabria, Campania, Apulia, Sardinia, Sicily	<b>Foundation</b> Fondazione con il Sud	Green transition from the bottom up and energy poverty reduction	Non-profit organizations	<ul style="list-style-type: none"> <li>• F1_C Definition of the project</li> <li>• F2_A Construction works necessary for the power plant</li> <li>• F2_B Realization of the plant</li> <li>• F3_A Connection to the electrical grid</li> </ul>	80 (variable by type of fundable costs)	0	150,000	40% advanced payment 20% first down payment, 20% second down payment, 20% upon completion

Municipalities, the key role of promoters of energy communities. In fact, these tenders are often reserved to the Municipal Administrations that assume the task of promoting innovative and sustainable solutions for the implementation of the energy transition and, in addition, involving citizen participation in local initiatives as well as activating synergies between the public and private sectors. The active involvement in RECs of public authorities, in general, could generate broad social and economic benefits because it helps to make local communities more cohesive and resilient. However, the concentration of grants in favour of public entities raises questions about the lack of diversification of the actors involved and the risk of excluding potential innovative contributions from the private sector, and about the limitation of the process of citizen empowerment. On the other hand, it is easily assumed that the current regulatory and administrative procedures for establishing and launching a REC are problematic to manage by a group composed exclusively of private citizens.

### 6.1 Energy community models in Italy: RECs vs. collective self-consumption

RECs and collective self-consumption are two non-equivalent models of energy communities, so their comparison is useful to identify the respective advantage/disadvantage factors that are decisive in a decision-making process. A systematic framework of these factors is provided with respect to a plurality of areas as follows: environmental, legal, economic-financial, technical, social and administrative spheres (Figure 5).

Renewable Energy Community			Collective self-consumption		
Advantages	Sphere	Disadvantages	Advantages	Sphere	Disadvantages
<ul style="list-style-type: none"> <li>– High reduction in CO<sub>2</sub> emissions</li> <li>– High reduction in use of non-renewable energy sources</li> </ul>	<b>Environmental</b>	<ul style="list-style-type: none"> <li>– None</li> </ul>	<ul style="list-style-type: none"> <li>– Low reduction in CO<sub>2</sub> emissions</li> <li>– Low reduction in use of nonrenewable energy sources</li> </ul>	<b>Environmental</b>	<ul style="list-style-type: none"> <li>– None</li> </ul>
<ul style="list-style-type: none"> <li>– Right to join or to leave a REC</li> </ul>	<b>Legal</b>	<ul style="list-style-type: none"> <li>– Complexity in choosing the most appropriate legal entity</li> <li>– Obligation to establish a legal entity</li> <li>– Complexity of drafting statutes and regulations</li> </ul>	<ul style="list-style-type: none"> <li>– Right to join or to leave a REC</li> <li>– It is not mandatory to establish another legal entity in addition to the condominium</li> </ul>	<b>Legal</b>	<ul style="list-style-type: none"> <li>– None</li> </ul>
<ul style="list-style-type: none"> <li>– Possibility of regional funding</li> <li>– Possibility of reinvestment of revenues obtained from incentives and energy sale</li> </ul>	<b>Economic-financial</b>	<ul style="list-style-type: none"> <li>– High difficulty in raising investment capital</li> <li>– High difficulty in revenue sharing among REC members due to absence of guidelines</li> <li>– Low incentive tariff</li> </ul>	<ul style="list-style-type: none"> <li>– High incentive tariff</li> </ul>	<b>Economic-financial</b>	<ul style="list-style-type: none"> <li>– Medium difficulty in raising investment capital</li> <li>– Medium difficulty in revenue sharing among REC members due to absence of guidelines</li> </ul>
<ul style="list-style-type: none"> <li>– Low proximity constraint (connection to same HV transformer substation)</li> <li>– Wide territory in which to identify an adequate area for plant installation</li> <li>– High share of self-consumed energy due to the integration of differentiated consumption curves</li> </ul>	<b>Technical</b>	<ul style="list-style-type: none"> <li>– Connection to the national power grid with limited capacity to absorb incremental energy flows</li> </ul>	<ul style="list-style-type: none"> <li>– Facility of connection to the national power grid, which is done virtually</li> </ul>	<b>Technical</b>	<ul style="list-style-type: none"> <li>– High proximity constraint (group members must be in the same condominium or building)</li> <li>– Limited availability of condominium areas suitable for adequate plant installation</li> <li>– Limited share of self-consumed energy due to low diversification of members and uniform consumption curves</li> </ul>
<ul style="list-style-type: none"> <li>– Potentially extensive social cohesion</li> <li>– Potential diversification of REC members (citizens, enterprises, public administrations, etc.)</li> </ul>	<b>Social</b>	<ul style="list-style-type: none"> <li>– Complexity of management and cooperation among many members</li> </ul>	<ul style="list-style-type: none"> <li>– Simplicity of management and cooperation among a small number of members</li> </ul>	<b>Social</b>	<ul style="list-style-type: none"> <li>– Spatially limited social cohesion at building or condominium scale</li> </ul>
<ul style="list-style-type: none"> <li>– Legal entity established specifically for the formation and management of the REC</li> </ul>	<b>Administrative</b>	<ul style="list-style-type: none"> <li>– Complexity and lengthy times of administrative procedures</li> </ul>	<ul style="list-style-type: none"> <li>– Simplicity and short times of administrative procedures</li> </ul>	<b>Administrative</b>	<ul style="list-style-type: none"> <li>– Constraint of membership by more than half of the millesimal value of the building or condominium</li> </ul>

**Figure 5.** Advantages and disadvantages of RECs and collective self-consumption of energy in Italy (own processing).

- *Environmental sphere.* The establishment of any model of energy communities undoubtedly provides environmental benefits that tend to grow proportionally to the capacity of the renewable energy systems that are installed and to the increase in the number of members who self-consume that energy. The environmental benefits produced by RECs are, therefore, particularly significant.
- *Legal sphere.* The identification of the best legal entity to adopt for the establishment of the REC (association, cooperative, etc.) may be problematic and requires, as well, the drafting of a Memorandum of Association, Articles of Association, Regulations and eventual private law contracts (respecting the ARERA and GSE guidance on shared energy management). For collective self-consumption groups, on the other hand, the formation of a legal entity additional to the pre-existing condominium is not required. However, both the RECs and collective self-consumption models are required to guarantee members the right to join or leave the group, and this is a common legal benefit.
- *Economic-financial sphere.* An important disadvantage, which is significant in RECs, is the need to have the investment capital, since subsidies to some types of costs are not yet in force and are, in any case, constrained to the plants located in small municipalities. The arrangement of schemes for allocating among the group members incentives and revenues from the sale of excess energy self-produced is also challenging, especially in RECs, due to the absence of specific



regulations. The operating revenues obtainable as incentives (feed-in tariff and capital grants) are no longer differentiated by energy community models, but depend on other parameters (power plant capacity, territorial location and geographical location). RECs, on the other hand, have the advantage over collective self-consumption in terms of accessing regional financing.

- *Technical sphere.* The possible advantages and disadvantages related to the two energy community models, in this case, are linked to the constraint of proximity, the availability and identification of adequate areas for plant installation, the management of self-generated energy, and the connection to the national electricity grid with low capacity to absorb incremental energy flows. In addition, the potential integration of diversified consumption curves, due to the number and differentiation of members, would also allow RECs to achieve a greater share of self-consumed energy and, thus, positively affect the efficient use of plants.
- *Social sphere.* The greater spatial extent of RECs than the one of collective self-consumption groups may promote social cohesion and a greater variety in the social composition of the community but, at the same time, managing a large number of members could accentuate the potential conflicts that complicate governance activities.
- *Administrative sphere.* The procedures for establishing and starting a REC are more complex than those of a collective self-consumption group. Nonetheless, RECs benefit from the creation of a specific legal entity that represents them, as well as regulations and statutes designed to ensure their functioning. Contrarily, problems may arise in the collective self-consumption model related to, e.g., achievement of the minimum quorum of condominium members who join the group.

## 6.2 The typologies of promoters and members of RECs in Italy

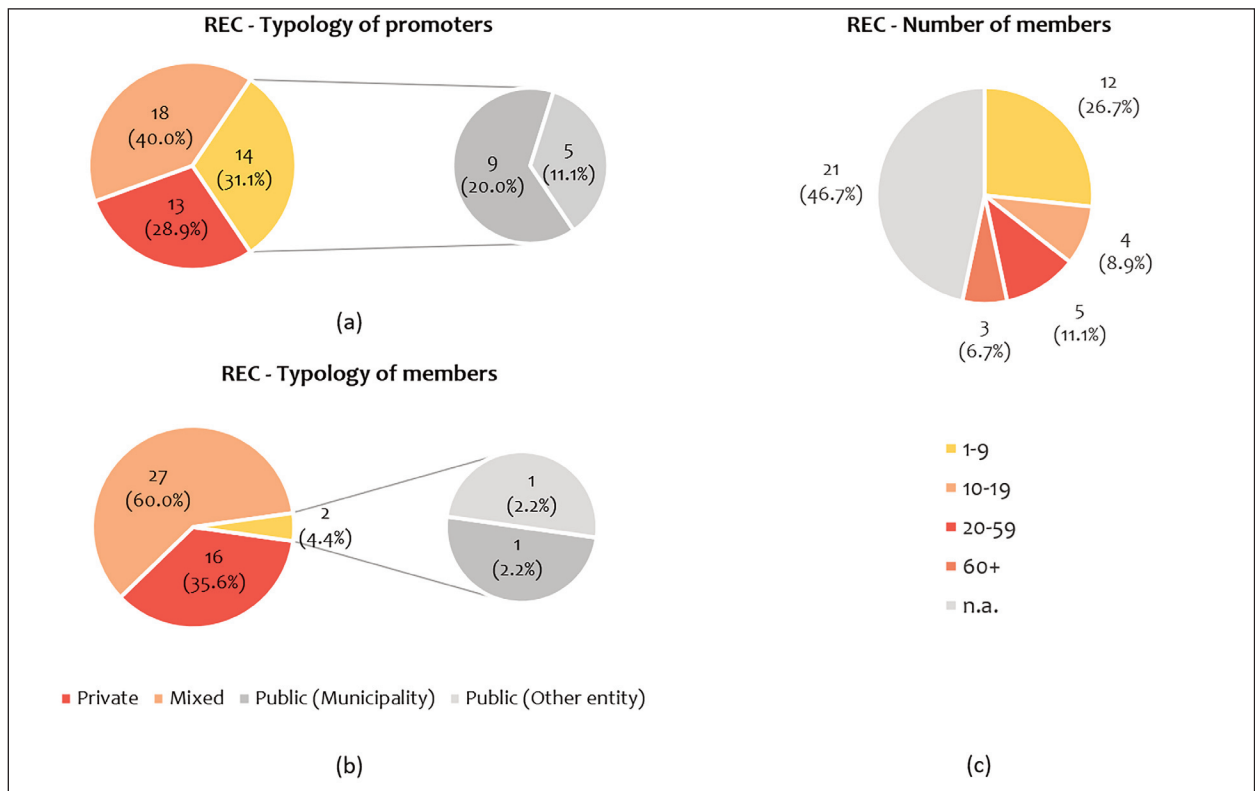
To examine the implication on RECs arising from the typologies of promoters and members, the data from a survey conducted by Legambiente on the national territory were consulted (Legambiente 2020, 2021, 2022) showing that, by the end of 2022, No. 45 RECs were established in Italy. In many cases, their implementation was still incomplete and/or susceptible to change, especially from the point of view of member participation; however, their analysis revealed that the promoters of 14 RECs were public entities (31.1%) and predominantly municipalities (20.0%). In 18 RECs (40.0%), public entities collaborated with enterprises and/or citizens, giving rise to communities characterized by a mixed, public-private composition. In contrast, the role of promoter was played by private entities (company, corporation, etc.) only in 13 RECs (28.9%) and the promoters never were exclusively citizen groups (Figure 6a).

These data take on even greater significance when compared with those on the classification of RECs members. In fact, members in the Italian RECs are predominantly mixed (60.0%), i.e., they are both public and private entities that share the self-produced energy, the economic benefits in the form of incentives and revenues deriving from the sale of excess energy produced. In contrast, public entities are the sole member in just 4.4% of RECs (Figure 6b). Unfortunately, in almost half of the cases, information on the number of REC members is missing (46.7%). The data available for 24 RECs show that 12 of them are very small (i.e. they have fewer than ten members) and formed mainly by private entities (only two RECs have more than one public member). It should be noted that the RECs that have a single member are related, in one case, to a port authority and, in another case, to a university institution (Figure 6c).

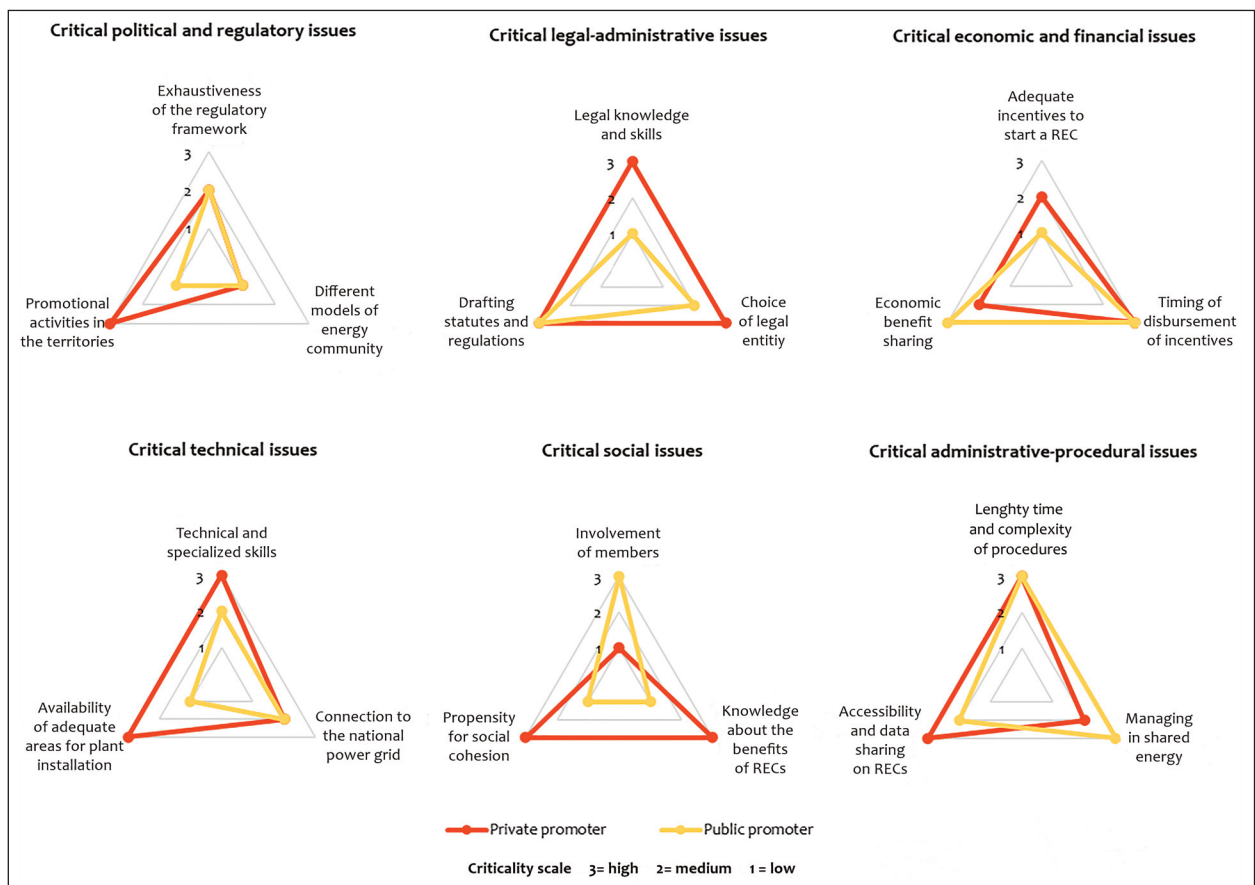
An interpretation of the data indicates that, even up to 2022, the level of social participation is still low and the citizens have great difficulty accessing REC projects, especially as promoters. It becomes, therefore, essential to support and facilitate private participation and to ensure a balanced and socially sustainable development of energy communities in the territories.

## 6.3 The critical issues of RECs for public and private promoters

Despite the actions already taken to promote and incentivize RECs, several issues remain unsolved in Italy about the involvement of private promoters and, more importantly, citizen promoters compared to public ones. The main critical issues can be ascribed to the six following areas of analysis: political-



**Figure 6.** RECs in Italy up to 2022: (a) typology of promoters; (b) typology of members; (c) numerosity of members (own processing on data Legambiente 2020, 2021, 2022).



**Figure 7.** Main critical issues for public and private promoters of RECs in Italy (own processing).

Critical issues and potentials of regulatory and financial instruments for Renewable Energy Communities (RECs) in Italy

normative; legal-administrative; economic-financial; technical; social; and administrative-procedural (Figure 7). Each of these critical issues is assessed with reference to a system of nomenclators based on the results of a *focus group* of experts in the main sectors involved (photovoltaic systems, economic assessments, sociology) and according to a three-level scale of intensity (Figure 8).

As previously reported, Italian legislation introduced several regulations to promote REC dissemination, however, there are still some regulatory gaps and unclearly defined elements that complicate the process of establishing a REC. A strong imbalance was also observed in the activities of REC promotion, which are mainly oriented towards informing and involving the public rather than private actors. In fact, according to a survey conducted in 2022, just 13% of citizens and 32% of enterprises were aware of the existence of RECs and their related advantages (Natale, 2023).

Critical political and normative issues	Critical legal-administrative issues	Critical economic and financial issues
<b>Level 3 - High Criticality</b>		
The establishment of a REC is hampered by serious regulatory gaps and lack of clarity between different energy community models. Promotion activities in the territories do not reach all stakeholder categories.	Difficulties in accessing the multiple specialized legal skills required by both the complexity of the REC's activation and the management procedures that penalize promoters.	The establishment of the REC is hampered by the amount of incentives, which differs by type of entity, and the uncertainty about the timing of disbursement. Absence of guidelines for sharing economic benefits among the REC members.
<b>Level 2 - Medium Criticality</b>		
The establishment of a REC needs to overcome some regulatory gaps and the uncertainty of choice between different energy community models. Promotion activities in the territories reach many stakeholder categories.	Promoters' access to the multiple specialized legal expertise required by the REC activation and management procedures is facilitated by support tools (e.g., one-stop desks or dissemination activities).	The amount and timing of incentive disbursement do not significantly hinder the establishment of the REC. Guidelines for sharing economic benefits among REC members are available.
<b>Level 1 - Low Criticality</b>		
The regulatory framework is clear and comprehensive. Promotion activities in the territories reach all stakeholders categories.	The REC activation and management procedures are well-known and simplified, enabling all promoters to apply them easily.	Incentives are of an appropriate amount and disbursed within a certain time frame. Rules for sharing economic benefits among the REC members are available.
Critical technical issues	Critical social issues	Critical administrative-procedural issues
<b>Level 3 - High Criticality</b>		
Promoters face difficulties in accessing specialized technical expertise and connecting to a national power grid with limited capacity to absorb high energy flows. Promoters do not easily have adequate areas for the REC facilities.	Social involvement of the REC members is hindered by the lack of educational and awareness-raising campaigns aimed at enhancing social cohesion. Knowledge about the benefits of the REC is absent.	Complex and slow administrative procedures penalize promoters. Shared energy management is problematic, and data sharing on RECs is unreachable.
<b>Level 2 - Medium Criticality</b>		
Access to specialized technical expertise and connection to a national power grid capable of supporting the input of additional energy flows have few limitations for some promoters. Some entities face difficulties in having adequate areas for the REC facilities.	Divisions or resistance to participation and social cohesion are present among the REC members. Knowledge about the benefits of the REC is limited to few members and promoters.	Administrative procedures are slow and unfriendly for some typologies of promoters, and shared energy management is quite difficult. Data sharing on RECs is limited to some promoters.
<b>Level 1 - Low Criticality</b>		
Easy access for all promoters to specialized technical expertise and connection to a national power grid capable of absorbing additional energy flows. Ease of obtaining adequate areas for the REC facilities.	There is broad social consensus and support among the REC members. Knowledge about the benefits of the REC is good and widespread among all stakeholders.	Administrative procedures are expeditious and smooth for all promoter entities, and shared energy is managed with shared protocols. Data sharing on RECs is easy to consult for all types of promoters.

Figure 8. Systems of nomenclators for assessing the REC critical issues (own processing).

From a legal-administrative perspective, the establishment of a REC requires satisfying several complex, time-consuming and resource-intensive bureaucratic obligations. Among the most problematic ones are the choice of the most suitable legal entity for the energy community with respect to the number and type of members, but also the drafting of statutes, regulations and contracts suitable to give the right to the members of joining or leaving the community, without compromising its normal functioning (Krug et al., 2022; Grignani et al., 2021).

At the economic-financial level, the main critical issue for members and promoters is the finding and/or availability of investment capital, especially to cover the initial costs. The main costs are those of building the power plants and facilities and of connecting them to the electricity grid; although the costs of preliminary studies and consultancy, and administrative management costs are also significant. Part of these costs could be refunded by national or regional incentives; however, as the legislation is still evolving, uncertainty about the validity period and the timing of disbursement of incentives may dissuade potential promoters, especially citizens, who usually have a high aversion to investment risk. Another element of difficulty is the establishment of Statutes and Regulations in which to determine how to make the distribution among community members of the economic benefits deriving from national incentives and from the sale of the excess energy produced (Lazaroiu and Roscia, 2023; Casalicchio et al., 2022; De Lotto et al., 2022).

A crucial technical aspect for the formation of a REC is the availability, or acquisition, of areas where renewable energy production plants can be installed. In fact, it can be difficult, especially for private entities to find suitable areas in terms of characteristics and size, while many RECs of/with public entities may place the plants on the roofs of public buildings, such as schools and sports facilities (Legambiente 2020, 2021, 2022). At present, connection to the national electricity grid also presents some restrictions, i.e. about its capacity, in the medium term, to absorb energy flows introduced by an increasing number of prosumers. Moreover, the energy markets do not yet seem fully mature and resistance may emerge from some players who fear that the deployment of RECs could undermine their stability in the market (De Lotto et al., 2022). The management and maintenance of plants and facilities and their potential modification due to the accession or exit of REC members may constitute a further hindering factor, such as the demand for specialized technical expertise in the establishment and operation phases of a REC that must be acquired through external professionals.

Regarding the social sphere, the main critical issue is the large share of citizens who are unaware of the existence of RECs and the advantages available, or who are not confident of REC's potential to provide energy in a continuous, reliable, and cost-effective manner. This critical issue may slow down the acceptance of shared energy self-consumption models and reduce the demand for both the establishment of RECs and the active involvement of other actors, even when the promoters are public entities (Tarpani et al., 2022).

Finally, from an administrative-procedural point of view, actors interested in setting up a REC must deal with many bureaucratic tasks, including establishing a legal entity, applying for permits and obtaining certifications. Among these, the procedure to register a REC on the GSE web portal is very laborious and could hinder especially private promoters, who may lack the necessary know-how and administrative skills, and be forced to use external consultants. Finally, a dedicated telematic platform for collecting and sharing data and information on RECs was not adequately developed. This inadequacy caused another critical issue as it limits accessibility to crucial information for other potential promoters and/or stakeholders in energy communities; moreover, it constitutes a missed opportunity for the promotion of RECs and the dissemination of knowledge in the energy sector (De Lotto et al., 2022).

The analysis carried out in this study has outlined a complex picture of the critical issues within which public and private actors promoting RECs or interested in taking part in them must operate. The complexity of the issues could be addressed through new measures proposed by coordination between various institutions and actors: the national legislative system for the integration to the existing regulatory framework; the national administrations and local institutions to drastically simplify bureaucratic procedures and to allocate more financial and human resources to support private actors along the bureaucratic process of setting up a REC.

Public administration, in particular, has the possibility (and responsibility) to act on several levels. At the operational level, it could become a virtuous model to be replicated in the role of REC promoter which: self-consumes sustainable energy; obtains financial savings by reducing energy consumption; enhances its own assets (i.e. unused or underused public areas or buildings) by locating the REC plants in them. At the administrative level, it is an institution that could offer assistance to private entities on the bureaucratic requirements associated with RECs and promote the training of technical and administrative skills necessary for the REC establishment and management. At the educational and dissemination level, it is an entity that provides knowledge on RECs and their benefits (including the social and economic ones) and works to raise citizens' awareness on the issues of energy transition, decarbonisation and environmental sustainability, so as to progressively replace the traditional energy production model with energy community models.

Future research perspectives may follow different lines, but the preferred one, also because it is still underdeveloped in Italy, is inherent to any actions, measures and norms that could reduce, or better eliminate, informational and economic barriers to the realisation of RECs, in terms of increase of social and financial accessibility of collective initiatives to share self-produced energy for citizens in energy poverty, who risk being effectively excluded from the energy transition.

## 7. Conclusions

Global challenges caused by the strong exploitation of fossil energy sources and climate change impose a transformation of energy production and consumption patterns that can no longer be postponed. In this phase of energy transition, RECs, defined in general terms as open aggregations of citizens, enterprises and public institutions working together to produce, self-consume and exchange renewable energy, emerge as a promising solution to ensure an autonomous and decentralized supply of energy and to fight energy poverty.

The results of this study show the variety of domains and the complexity of the critical issues within which public and private actors planning to establish a REC have to operate. In fact, the national transposition of the energy community models provided for by EU legislation produced a multiplicity of models among EU countries that, moreover, change over time. In Italy, the regulatory and financial instruments to support the diffusion of RECs were recently modified, introducing some requirements and constraints that vary based on the capacity of the power plants and their geographical location. In addition, the decision to opt between a REC or another energy community model depends on a different set of advantages/disadvantages and critical issues that were investigated in this study.

Another level of territorial differentiation is derived from the energy policies and funding instruments proposed at the regional scale that aim to promote the deployment of RECs. The survey showed that the action of individual citizens in the formation and development of RECs risks being subordinate to the leading role that is, instead, given to local public administrations. These authorities, in fact, could play a facilitating role, catalysing energy-sharing initiatives, conveying financial resources and should provide technical and administrative support to private entities in untangling complicated bureaucratic requirements. Local Administrations played the role of promoter of many RECs, participating directly in their establishment and management, although the inclusion of other private entities remains essential to achieve the widespread social participation that is strategic in the EU in order to weaken and replace the centralized and hierarchical system of energy production.

Furthermore, the survey carried out on the type of promoters and members of the RECs established in Italy (up to 2022), revealed an interesting distribution of roles and a peculiar balance between public and private entities: while the REC promoters are primarily public entities and local administrations, the REC members are mainly private or mixed entities. This indicates the relevant involvement of the private sector in the participation in energy communities in relative terms (since absolute values are very small), but also the numerous critical issues related to the establishment of RECs by private citizens. The resolution of these critical issues should therefore

become the common agenda on which a close public-private partnership could converge to achieve a sustainable and participatory energy transition.

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### Author Contribution

The work should be attributed equally to the Authors.

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