



Renewable Energy Communities in the Energy Transition Context

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ABSTRACT

Economic, social, and environmental sustainability is becoming increasingly important in territorial development policies in Europe and internationally. Among the sustainable development goals, the theme of the energy transition is particularly important, which translates not only into a move away from energy from fossil fuels in favor of renewable ones but also into an improvement in energy efficiency linked to energy production and greater awareness of energy consumption by citizens. To achieve a paradigm of sustainable development, combating the problem of resource scarcity and biodiversity loss, as well as the unsustainability of today's consumption and production systems, the Renewable Energy Communities can be a suitable model to support urban space redevelopment projects. Actions that aim to recover the pre-existing building heritage to give new life to abandoned areas are increasingly necessary for the protection of the environment. This encourages the propensity to act responsibly, promoting virtuous circles for the territories and communities of reference. This work aims to analyze and understand the actual development of the eco-friendly model of Energy Communities, understanding its real benefits. In particular, the case study of the Energy Community of East Naples is reported which, through the involvement of citizens and businesses of the territory, can produce, consume and exchange energy with a view to self-consumption and collaboration.

Keywords: Energy Community, Renewable Energy, Transition, Urban Areas, Italy

JEL Classifications: Q2, Q4, P28

1. INTRODUCTION

Issues related to sustainability, already central to the political agenda of the European Union, have acquired increasing importance within the priorities of the various actors in the economic sector, pushing them to redefine their objectives toward a direction of greater environmental sustainability. Thanks to the growing awareness of the importance of environmental, social, and governance issues, one of the objectives set by almost all business organizations are to find stable solutions that allow them to improve their performance in these areas. It is necessary to overcome or integrate the conventional business model based on maximizing economic well-being, with objectives aimed at other issues such as environmental protection, enhancement of natural resources, equity, inclusion, solidarity, and social cohesion.

The transformation of companies and organizations towards Environmental, Social, and Governance (ESG) criteria requires an evolution in the relationship with the resources necessary both for production and for the management of production processes or the provision of services, for example, saving in the use of fossil fuels through efficiency by companies (Elliott et al., 2006) is one of the ways to integrate ESG into business logic.

In an energy market full of variables and pitfalls, the pressure of the energy crisis has accelerated the ecological transition, given the sense of urgency that pushes to increase the use of renewables and reduce consumption. In today's economic and environmental scenario, energy efficiency is an absolute priority, and the elimination of any waste assumes a "double value", economic and environmental. This twofold interpretation of

economic activities, which is necessarily considered, finds full coexistence in the phenomenon known as the Energy Community. Their creation is an opportunity to experiment with a model of energy capitalization of the territory (Magnaghi, 2013). The territory energy is an integrated model in which the entire territory is involved producing local energy, through interventions calibrated on the local availability of resources and respectful of the patrimonial values of the territory, overcoming upstream the environmental criticalities that arise from an approach oriented to the intensive exploitation of resources. The characteristics of Energy Communities, the involvement of inhabitants/producers in the identification and appropriate use of energy resources with participatory techniques aimed at promoting the growth of awareness of place (Magnaghi, 2013), reinforce the concept that “there is no green economy without green society” (Bonomi, 2020). In this interpretation, the construction of the Energy Community, as a community of inhabitants in which citizens are not simply “users” who derive economic benefits from joining the community but take an active role as protagonists in the definition and management of the transition process of their territory towards a horizon of self-sustainability, turns out to be a possible solution to the current economic and environmental instability. To face the evolution that is expected for Energy Communities, towards active components of innovative forms of local development, it is necessary to support a precise regulatory framework.

The energy transition process requires, to be carried out, actions that combine an increase in energy production from renewable sources, a reduction in greenhouse gas emissions, and a reduction in energy demand. To give substance to the Paris Agreement¹, the transition to renewable sources must, first of all, take shape in the local dimension, acting on territorial contexts with appropriate and locally defined solutions based on the specificities of the places. Therefore, the objectives of this research are (1) to analyze the state of the art of the Energy Community in Italy, understanding its real benefits in terms of eco-efficiency; (2) present savings, in terms of consumption, through the adoption of this model, which translates into economic, environmental and social benefits, paying particular attention to the virtuous case of the Renewable Energy Communities (CER) of East Naples, promoter in its context of the ecological transition process and the enhancement of the territorial area of reference.

2. MATERIALS AND METHODS

2.1. REC: An Overview of the Literature

The change in today’s production and consumption systems towards more sustainable and eco-efficient forms is now more stringent than ever. Environmental issues pose not only economic actors but society, facing the challenge of contemporaneity: Rethinking their way of acting with a view to sustainability, for the benefit of the ecosystem. The energy transition towards more suitable forms that allow a reduction in consumption and a lower impact on the

environment, is one of the processes implemented by today’s society in response to the environmental crisis. In the literature there is growing attention to Community Energy, considering that, both in the academic and policy fields, the preventive interest of society towards new forms of energy sharing, to the transition towards sustainable use of the same, is considered propaedeutic. Being a concept of recent development, it emerges from the literature that the notion of Community Energy (similarly Energy Community), is not established in detail, so the concept cannot be identified as unitary, being accessible to multiple interpretations, connoting it with a widely acceptable flexible meaning. This would facilitate the spread of the concept of an Energy Community, functioning as a bridge concept that facilitates the treatment and dialogue concerning the theme between subjects and their different interests (Star and Griesemer, 1989). At the beginning of 2000, following some studies by English-speaking authors, the notion of Community Energy refers to a site of energy sharing by components to address issues related to climate change, the use of renewable resources, and sustainability (Pellizzoni, 2018).

Centralized energy installations thus give way to a new way of consuming energy, using the opportunity to hold individual citizens and business forces accountable, directing them towards collaborative forms to bypass the political conflict over energy issues and rebuild the social and natural foundations that capitalism and the market need but are unable to reproduce (Dardot and Laval, 2014). Over the years, the field of investigation of Energy Communities changes considerably and brings with it the succession of different terminologies adopted to identify the phenomenon. Alongside Community Energy, expressions such as REC (Walker and Devine-Wright, 2008) collective and politically motivated renewable energy projects (Becker and Kunze, 2014), energy democracy (Szulecki, 2018), *sustainable energy communities* (Romero-Rubio and de Andrés Díaz, 2015). Despite the different terminology used, the intrinsic meaning is shared. Community Energy identifies initiatives in which the community itself benefits from the collaboration that is established between the participants in terms of energy, obtaining advantages regarding the generation, management, acquisition, and consumption of the same. These initiatives have a positive impact on the community through the development of renewables promoted and the significant reduction of energy consumption, in a context of social cohesion and innovation. According to Burchell et al. (2014), six distinct but interrelated meanings of the activity carried out by Energy Communities can be identified: A local or location-related activity; an interest-based activity; a collaborative, community-managed process with locally distributed benefits in an equitable manner; an activity at the intermediate level between the individual and that of large organizations or the state; an agency actor; an experimental niche (Pellizzoni, 2018). Whatever definition is given to the notion of Community Energy, there is no doubt that the benefits of this new model of energy sharing are multiple and disparate. They can be deduced both from the texts of the articles and from the policy documents, which illustrate a broader vision of the Community, as a social form capable of responding simultaneously to the limits of the activities carried out at the macro level and to those of individual action on consumer decisions (Pellizzoni, 2018). This means that the characteristics of the community such as the sense of identity,

¹ The document produced by COP 21 in 2015, the Paris Agreement, identifies a limit to be imposed on global warming to avoid its most serious consequences, i.e. to limit the temperature increase within 2°C compared to the pre-industrial period.

the sharing of places, values, visions, and interests, solidarity, the ability to participate and mobilize collectively, and resilience, give it the appointment of an ideal site to explore alternative ways to the production, use, and sharing of energy, from a technological, organizational and economic point of view. Energy Communities represent a new model that promotes the link between energy choices and economic, environmental, and social perspectives (Torabi Moghadam et al., 2020). The Community becomes a place where the willpower of all social actors, located in a specific area, to share the will to self-produce and self-consume energy from renewable energy sources is expressed.

2.2. The Regulation of CERs: Regulatory Aspects in Europe and Italy

In recent decades, the European Union has committed itself to fight climate change by adopting strategies aimed at achieving a 40% reduction in greenhouse gas emissions, to achieve climate neutrality in 2050, making the EU economy sustainable (Barroco et al., 2020). The energy sector is the most responsible for greenhouse gas emissions into the atmosphere, especially in the production of heat and electricity. For this reason, policies to combat climate change are aimed at the energy sector and are aimed at promoting the energy transition, i.e., the transition from a system based on fossil fuels to one with low emissions thanks to the use of renewable sources. Many national and European sustainability policies call, in a circuitous way, to collectivize renewable energy resources, to influence and optimize their production and consumption, promoting the energy transition.

Among the most important actions promoted at the international and European levels, to outline the most suitable governance mechanism to follow, there are the 2030 Agenda and the Green New Deal. Some of the objectives promoted by the Agenda, give importance to the energy issue, conveying the possibility of being able to take advantage of the sustainable model of the Energy Communities to profoundly change the organization of energy systems and the relationships between subjects, constituting real synergistic and sustainable systems in which all citizens consciously use energy. In particular, the SDGs that include the theme are goal 7 and goal 11, which respectively commit to ensuring access to affordable, reliable, sustainable, and modern energy systems for all and to making cities and human settlements inclusive, safe, durable, and sustainable. These objectives, which translate into concrete actions, could act as a reference point for communities in the energy transition, helping them to experiment with innovative resources and mechanisms, coming to define an integrated system aimed at meeting both energy and anthropic quality priorities. The new global policies, in this way, favor new technologies and mechanisms (e.g., distributed storage, demand-response, electric vehicles) contributing to the emergence of new players in the energy sector, bringing profound transformations to the traditional model, giving space to decentralized production even in locations accessible to the grid (Berka and Dreyfus, 2021). At the European level, the Green New Deal (or New Green Pact), is a binding law for all EU countries, with the aim not only of combating climate change and promoting the energy transition, but also any transformation of the productive fabric towards the circular economy.

With Directive 2018/2001/EU (known as *Renewable Energy Directive II*, REDII) and Directive 2019/944/EU for the internal market in electricity (also called *Internal Energy Market Directive*, IEM), the European Union introduced its policy to promote the spread of the use of renewable sources, thus sensitizing society's consciences towards the energy transition, which translates into significant benefits for the entire ecosystem. Article 2 of the REDII Directive defines the "CER as an 'a legal entity based on open and voluntary participation, autonomous and effectively controlled by shareholders or members that are in the vicinity of renewable energy production facilities that are developed by the community'." Members can be natural persons, small and medium-sized enterprises, or local authorities, including municipalities, the main objective is to provide environmental, economic, or social benefits to the local area in which it settles. To facilitate the spread and formation of Energy Communities, Article 22 of the REDII Directive requires EU Member States to address obstacles to the realization of the model and to remove any unjustified regulatory barriers, to protect the rights and obligations of members acting as final customers of the community. That article also required individual States to ensure the production, consumption, storage, and sale of renewable energy, as well as collaboration between the energy distribution system operator and the communities themselves, to facilitate the passage of energy within the CERs. In REDII the definition of "renewable energy consumer cars acting collectively" is introduced, i.e., a group of at least two renewable energy consumer cars that are located in the same building or condominium, thus meaning a final customer who is a producer and consumer of renewable electricity, which in turn can store or sell, provided that these activities do not constitute their main commercial or professional activity (European Parliament and Council, 2018.). In this way, becoming part of an Energy Community or in a collective self-consumption scheme, can guarantee advantages of different natures to the citizens involved and to the territory, acting as a springboard towards self-sustainability and energy efficiency.

The IEM Directive introduces the innovative figure of the "active customer" or *prosumer*, referring to the user who is not limited to the passive role of consumer (consumer), but to the one who actively takes part in the different phases of the production process of the resource (producer). The *prosumer*, being a subject that owns its energy production plant of which it consumes only a part, feeds the remaining share into the network, and exchanges it with physically close consumers, accumulating it in a special system and returning it to the consumption units at the most appropriate time. He is therefore an active protagonist in the management of energy flows and can enjoy not only relative autonomy but also economic benefits: This sharing model allows for reduction of the energy supply costs of the various subjects that participate in it. In Italy, the transposition of the European REDII Directive resulted in the enactment of Legislative Decree 162/2019 (converted with Law no. 8/2020 of 28 February 2020) and the related implementing measures (resolution 318/2020/R/eel of ARERA and Ministerial Decree 16 September 2020 of MiSE) and Legislative Decree 199/2021, fully implementing the project designated by the EU on the promotion of the use of energy from renewable sources, experimenting immediately,

the model of Renewable Energy Communities and the related collective self-consumption. The regulation seeks to collect data and elements so that the Directives are fully implemented nationally, as well as directing useful investments to allow the pursuit of the objectives established in the National Integrated Energy and Climate Plan (PNIEC). From the Milleproroghe decree, it is clear that ‘collective self-consumption means that carried out by a plurality of consumers, located inside a building in which there are one or more plants powered exclusively by renewable sources. The provision relating to Energy Communities provides that the participating subjects must produce energy for their consumption with plants powered by renewable sources with a total power not exceeding 200 kW. To share the energy produced, users can use existing distribution networks and use forms of virtual self-consumption. For consumers/producers of this shared energy to be able to access the incentives provided for by the decree, the plant must be new, i.e., installed after 1 March 2020. The incentive rate will be cumulative with tax deductions, where available, and will be established in different values, according to the type below (Barroco et al., 2020):

- a) Shared energy in the context of collective self-consumption (same building or condominium):
100 €/MWh
- b) Shared energy within renewable Energy Communities (same medium/low voltage electrical substation):
110 €/MWh

However, to facilitate the dissemination and implementation of the CER model, a series of legal and economic enabling conditions are necessary. The legal nature that a CER can assume differs in terms of governance structure, decision-making process, and responsibilities and the legal forms with which it can be established are varied: Cooperatives according to the provision of Article 2551, recognized and non-recognized associations, foundations, social enterprises according to Legislative Decree. 112/2017, benefit companies, third-sector bodies, etc. The wide category of legal vestments that a community can assume has the purpose of promoting and encouraging its constitution, allowing its members to establish the most desirable legal case. The law does not specify the renewable technology to be adopted, but the one that lends itself to better exploiting the advantages of the provision is undoubtedly photovoltaics. Article 42-bis of the European Directive 2018/2001, defines the treatment of energy produced and shared as follows (Pisello et al., 2020): (i) The energy produced may only be shared using the existing distribution network; (ii) shared energy is equal to the minimum, in each hourly period, between the electricity produced and fed into the grid by renewable energy installations and the electricity withdrawn by associated final customers; (iii) energy is shared for instant self-consumption also through storage systems built near buildings/condominiums. The relationships of end customers who take part in the form of energy collaboration envisaged by the CER are governed by a private law contract, which identifies a delegated subject as responsible for the shared energy distribution. This subject could be an external consultant or the condominium administrator to whom customers delegate the management of payment and collection items to the sellers and the energy services manager (GSE), playing a fundamental role in accessing the forms of incentive provided.

Resolution 318/2020/R/eel of 4 August 2020 of the Regulatory Authority for Energy, Networks, and the Environment (ARERA), an active part of this implementation process, established the requirements for access to incentives and calculation models to determine the fees to be paid by the GSE to self-consumers and members of the Energy Communities. With the aforementioned resolution, ARERA designated the regulatory model to be applied to the CERs, identifying the benefits that the participants bring to the network and the tariff components that consequently must not be applied to them. The introduction of Law 8/2020, has meant that the Energy Communities have become a real “extended” collective self-consumption scheme, from which to draw both electro-energy and social benefits, in fact with the construction of new plants powered by renewable sources, the CERs can give answers to collective needs, for example in the fields of welfare, of local development, of the fight against energy poverty (De Vidovich et al., 2021). On 8 May 2021, Law no. 53 of 22 April 2021, better known as the “European Delegation Law 2019–2020”, came into force, with which the Parliament and the Senate of the Republic delegated the Government to implement some European Directives, including the RED II Directive and the IEM Directive. According to Article 5 of the aforementioned law, the Government is required to follow a series of principles with the overall transposition of the European directive. In particular, regarding CERs (and collective self-consumption schemes), the Government is invited to identify incentive measures for the promotion of renewable energy communities aimed at encouraging the participation of local communities in the construction of plants, enhancing the existing electricity grid and maximizing the local use of the related energy production, with consequent lower use of the electricity grid deriving from diffuse generation, without prejudice to the application of general system charges on energy taken from the public grid by final customers and on energy produced and shared using the existing distribution network. To that end, provide that renewable energy installations in collective own consumption configurations and energy communities are guaranteed equal and non-discriminatory access to all relevant regulatory or regulatory support schemes, in particular self-consumption valorization mechanisms and mechanisms for recognizing the avoided costs for the electricity system that such self-consumption entails. However, avoiding distortive effects on the market and providing for simplified mechanisms according to which the share of shared energy, as it is self-consumed locally, is separated a priori and does not fall within the items subject to supply by third-party sellers².

Further steps in terms of legislation on CERs were taken with Legislative Decree no. 199/2021 on “Implementation of Directive 2018/2001/EU of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources”, published in the Official Gazette on 30 November 2021, and entered into force on 15 December of the same year. Article 3 of the Legislative Decree, in line with the indications of the PNIEC, establishes the objective pursued, to bring at least 30% of the overall share of energy from renewable

2 https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2021-04-23&atto.codiceRedazionale=21G00063 (last accessed: 2023.01.28).

sources on gross final consumption and to reduce greenhouse gas emissions by at least 55% by 2030. Article 14 of the Legislative Decree transposing the RED II then defines the specific criteria for coordination between the measures introduced by the National Recovery and Resilience Plan (PNRR) and the sectoral incentive instruments how the benefits of the PNRR will be granted are regulated. In paragraph i.e., it is specified that “in implementation of the measures Mission 2, Component 2, *Investment 1.2 ‘Promotion of renewables for Energy Communities and self-consumption’ are defined criteria and methods for the granting of zero-interest financing up to 100% of eligible costs, for the development of the Energy Community, as defined in Article 31, in small municipalities through the construction of RES production plants, also combined with energy storage systems*”. The PNRR provides zero-interest loans to encourage the spread of self-production and collective self-consumption methods, providing for the disbursement of 2.2 billion euros to be allocated to the development of Energy Communities. The first line of investment aims to increase the share of renewable energy by accelerating the development of Energy Communities, guaranteeing them support. A key point of the national program – divided into six missions – is represented by the national ecological and digital transition, which suffers from tangible shortages, and is confronted with the decisive phases of the green transition in access to energy sources and consumption. To do this, the PNIEC aims to define an organic and synergistic strategy on the five dimensions of energy. These are energy efficiency, renewable energy, greenhouse gas emission reductions, interconnections, and research and innovation. The national PNIEC 2021–2030 has already been prepared and notified to the European Commission, outlining a future update of the long-term objectives and strategy, reflecting the changes that will take place in the meantime at the European level.

Table 1 shows the main targets, including:

- 30% of gross final energy consumption must come from RES (32% is the EU target);
- 22% of gross final energy consumption in transport must come from RES (14% is the EU target).

The 55% reduction in CO₂ emissions by 2030 (data still to be updated in the document stopped at 33% initially expected). The Plan, therefore, provides for the promotion of CERs to support the economies of small municipalities where self-consumption is particularly difficult. Through appropriate information tools, we try to increase the degree of development, the establishment and management of communities, as well as the enhancement of energy production. Central is the issue of energy poverty and how Energy Communities are an adequate tool to combat and promote a conscious and sustainable use of energy resources. Over time, the state has tried to provide Italy with legal instruments suitable to accommodate the new models of use, production, and energy consumption, with the common intention of implementing a new energy policy that ensures the full environmental, social, and economic sustainability of the territory, preparing guidelines to accompany the energy transition and beyond.

3. DATA ANALYSIS: CONSUMPTION AND BENEFITS

3.1. The State of the Art of CERs in Italy

According to the Legambiente³ 2022 Renewable Communities report, in Italy between Renewable Energy Communities and Collective Self-Consumption Configurations, 35 are operational, 41 are planned and 24 are being established. The Energy Communities that are being born are extremely heterogeneous in the social, environmental, and geographical contexts in which they develop (from Friuli-Venezia Giulia to Sicily, from metropolitan areas to mountains, from small towns to large areas), for the actors involved (municipalities, companies, third sector bodies, citizens) and their motivations. What unites their constitution is undoubtedly the desire to seek sustainable and responsible ways of producing, consuming, and using energy, in addition to the incentives that come from it in economic terms. Concerning impacts, four macro-categories of benefits can be identified (Giusti, 2022):

3 https://legambiente.it/wp-content/uploads/2021/11/Comunita-Rinnovabili-2022_Report.pdf (last accessed: 2023.01.28).

Table 1: Main energy and climate objectives of the EU and Italy for 2020 and 2030

Aspect of energy and climate	Goals 2020		Goals 2030	
	EU	Italy	EU	Italy
Renewable energies				
Share of energy from renewable energy in gross final energy consumption	20%	17%	32%	30%
Share of energy from renewable energy in gross final energy consumption in transports	10%	10%	14%	21,6%
Share of energy from renewable sources in gross final energy consumption for heating and cooling			+1.3% annual (approximate)	+1.3% annual (approximate)
Energy efficiency				
Reduction in primary energy consumption compared with the 2007 primes scenario	-20%	-24%	-32.5% (approximate)	-43% (approximate)
Reduction of final consumption through energy efficiency mandatory schemes	-1.5% annual (without transport)	-1.5% annual (without transport)	-0.8% annual (with transport)	-0.8% annual (with transport)
GHG emissions				
GHG reduction versus 2005 for all ETS-constrained installations	-21%		-43%	
GHG reduction versus 2005 for all non-ETS sectors	-10%	-13%	-30%	-33%
Overall reduction of greenhouse gases compared to 1990 levels	-20%		-40%	

Source: Own processing on Italian Government, 2021

- Technical-energetic: The electricity system benefits from considerable positive effects deriving from the collective action of producers and consumers who, by aggregating collectively in local energy projects, contribute to the reduction of network losses, to the improvement of voltage profiles as well as the lower stress of the distribution network, with a consequent increase in self-consumption and self-sufficiency indicators.
- Environmental: With the CER model, there is a proportional increase in the production and share of renewable energy consumption at a local level. Legambiente quantifies in 17.2 GW the new renewable capacity expected by 2030 through the establishment of renewable energy communities and self-consumption models (equal to about 30% of the PNIEC targets) that would allow a reduction in CO₂eq emissions by 2030 estimated at 47.1 million tons (considering the average consumption of 2700KWh of Italian families). To these direct benefits can be added the indirect effect of increasing awareness of the use of energy resources by members.
- Social: Social impacts can be seen both in the process of construction and operation of the ERC (increase in participation in the decision-making process), and in the allocation of the value generated that can be partly used to remunerate members, but also to provide services to members, to affect the cost of bills or to finance initiatives identified by the community as priorities (fight against energy poverty, education projects, provision of welfare services, support for local development). In this way, the fight against energy poverty can be addressed directly, for example by reducing the energy expenditure of households in difficulty, or indirectly, by providing tools and information for proper management of household equipment.
- Direct and indirect economic impact on local development trajectories: The direct benefits were given by the savings in the bill of households, deriving from a conscious use of energy. The indirect benefits are associated with the possibility that the coordination between the subjects of the territory experienced within the ERCs and the collaboration with other relevant local actors (PA, companies, etc.), can trigger virtuous processes of shared construction of strategies and actions for local development.

Even the Politecnico di Milano has investigated the benefits deriving from Energy Communities a report on *Smart grids* has provided three classifications of advantages (Chiaroni and Frattini, 2014):

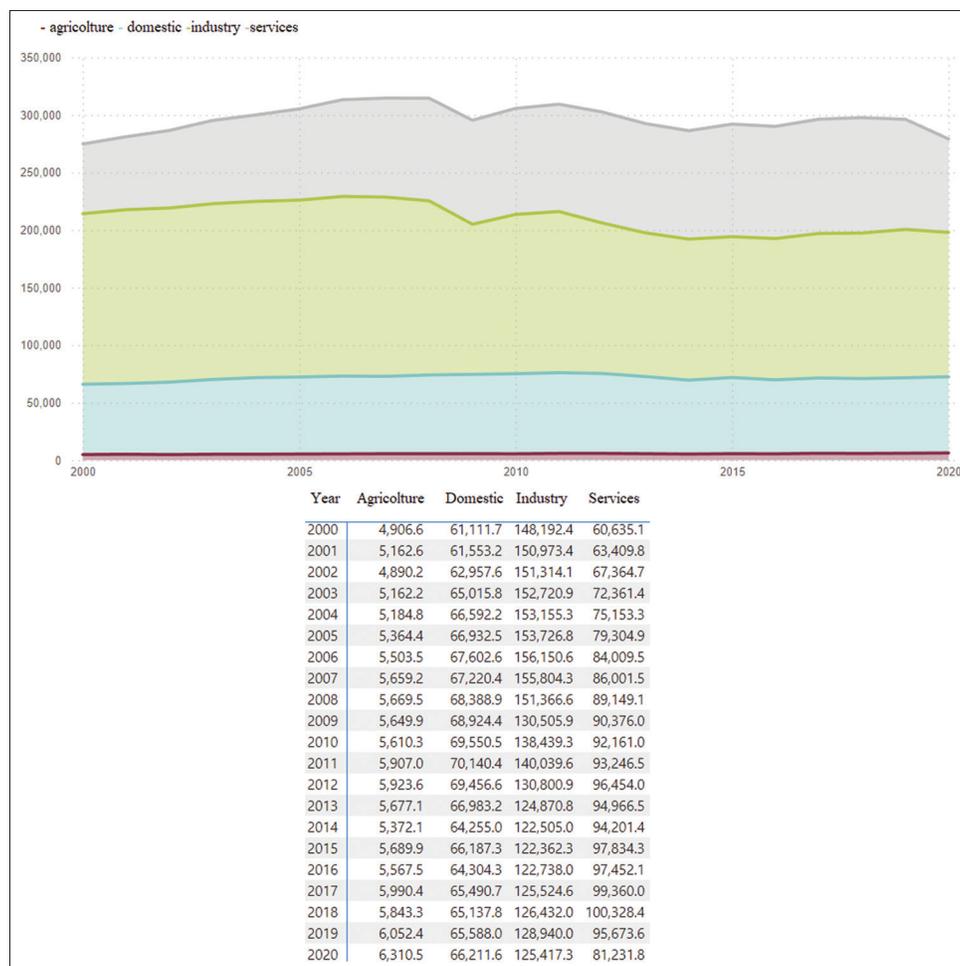
1. Benefits for energy users: The active participation of the population in the various sustainable projects would bring greater awareness of the need to adopt and implement renewable technologies, increasing their acceptability by citizens. This would lead to the optimization of energy expenditure, with an economic advantage in terms of economies of scale, given by Community participation in the project from which a reduction in per capita cost results.
2. Benefits for the electricity system: With greater use of renewable sources, our country would decrease its energy dependence on foreign supply sources, ensuring greater stability and reliability of the system.
3. Benefits for the territory: The production of energy from renewable sources brings benefits to the environment, considering the reduction of pollutants released into the atmosphere, and promoting and raising awareness of a green image of the territory. It is also important to consider the resulting increase in the employment rate resulting from new installations that produce jobs in the long term.
4. Benefits for the consumer: The Energy Community model is characterized by a collegial approach to energy management since it involves a plurality of energy users. Such an approach would therefore make it possible to achieve a series of benefits compared to individual ones, the main ones referring to those concerning the synergies obtained from the union of several energy users.

Another study by Seyfang et al. (2012) also highlighted that the key factors for the success of Energy Communities are:

1. Group: A group of members that synergistically and in an organized and cohesive way, acts for a common purpose, and overcomes adversity.
2. Project: An idea supported by relevant knowledge and skills, financial and material resources;
3. Community: Benefits from the implementation of projects.
4. Support network: Adequate information on the population of renewable energy and Energy Communities, represents concrete support for the realization of sustainable projects.
5. Policy: Without a policy framework to support ERCs, their development is not desirable. The examples of Energy Communities show that renewable technologies are now ripe to give life to communities, but also that the obstacles concern the involvement of the population and the political-regulatory support for these projects.

As reported, the benefits, advantages, and components that coexist in the creation of communities to pursue energy efficiency, with a view to self-consumption and collaboration, are many. However, achieving climate and energy goals does not only come through Energy Communities. It must be considered that, although sustainable development has also entered the Italian political agenda, translating into a series of interventions, the consequences generated by the COVID-19 pandemic, and the most recent conflict in Ukraine, have also accelerated the energy crisis, undermining the sustainability of the industrial system and the country.

As Figure 1 shows, in the Italian production system, there is an exponential increase in disbursements for the supply of electricity, as well as gas, which reflects the inevitable consequences on all industrial companies. In this scenario, it is necessary to think about a major restructuring in energy management in all fields. In Italy, industry uses almost half of the electricity with 44% of consumption, followed by the service sector, with 30% of consumption, the domestic sector with 23%, and the agriculture sector, which represents just over 2% of electricity consumption. Analyzing in detail the consumption of electricity in industry, we note the sectors most dependent on the availability and costs of electricity: Metallurgy, food industries, manufacture of chemicals, metals, plastics, paper, and many others. These are large, medium-sized, small, and very small enterprises that generate employment

Figure 1: Energy consumption by the industrial sector

Source: <https://www.collaudo.terna.it/it/sistemaelettrico/statistiche/evoluzione-mercato-elettrico/consumi-energia-elettrica-settore>

and contribute significantly to the economy and social well-being. The challenge lies in finding more and more ways to ensure “green” electricity independently, without depending too much on foreign countries and the risks of shortage of the same and price increases that would bring supply difficulties to the industry and would put at risk the prospects of sustainability of the country. After the promising beginning of 2010, and until 2015, the growth of renewable sources did not continue the expected development in the following years, as can be seen from the following Terna chart (Figure 2).

As many as 161.7 TWh, equal to 58%, were produced in 2020 from traditional imported thermal sources, mainly oil and gas which, together with electricity imported from other countries, bring our electricity dependence to exceed 70%. PNRR resources should be useful to improve and make the country’s energy system resilient, investing in research, photovoltaics, and all renewable energy sources. Precisely because of the great unknowns that characterize future energy prospects, the international news agency Bloomberg, among the best-known in the world, hypothesizes three possible scenarios (Figure 3).

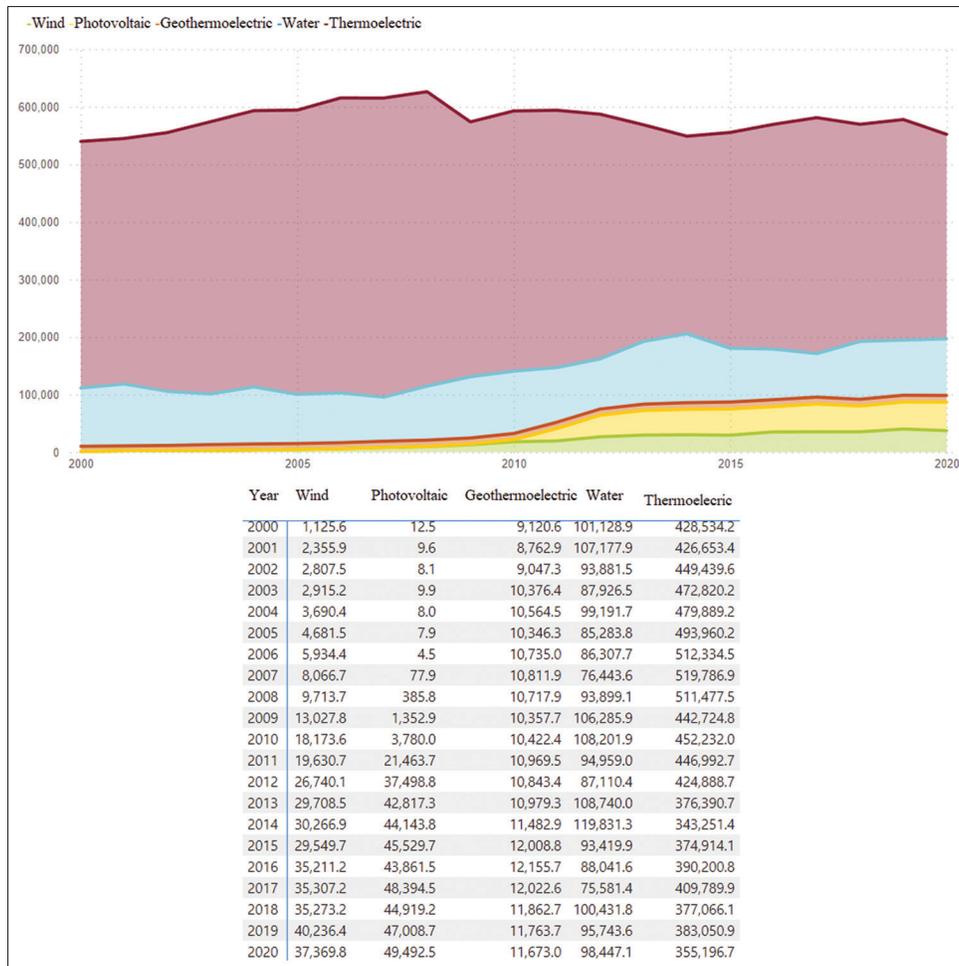
In 2019, 83% of the world’s energy is mainly produced from fossil energy sources and only 12% from renewable sources, and 5% from nuclear power.

In a vision of the implications in 2050, the scenarios that can be hypothesized according to Bloomberg are three:

1. A grey perspective, with a reduction, not entirely significant, in the use of fossil fuels from 83% to 52%; the increase from 12% to 42% of renewable sources and the stability of nuclear energy to 5%.
2. A green perspective, fully focused on the transition to renewable energy, with a use of 85%, a considerable reduction of fossil fuels to 10%, and stability of nuclear power to 5%.
3. The third red perspective, so defined because there would be a development of new generation nuclear power, respectful of the environment, up to represent 66% of energy sources, with a substantial part - equal to 27% - of renewable sources and 7% of residual fossil fuels.

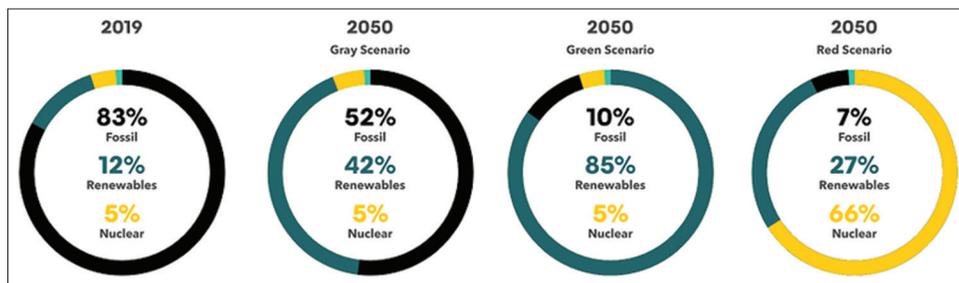
Given the implications that are expected in the future, the most appropriate strategies to be adopted would be to increase investment in renewable energy to guide the transition to green sources, avoiding the impoverishment of the country and contributing to the rebirth of the ecosystem; Turning research towards nuclear power to increase its use rate. Given this, the diffusion of *Energy Communities*, therefore, seems fundamental, considering the benefit in terms of reducing the costs incurred by

Figure 2: Production (GWh) by source



Source: <https://www.collaudo.terna.it/it/sistema-elettrico/statistiche/evoluzione-mercato-elettrico/produzione-energia-elettrica-fonte>

Figure 3: Three possible Bloomberg’s prospects for 2050



Source: <https://www.rinnovabili.it/energia/politiche-energetiche/zero-emissioni-al-2050-bnef-strade>

the electricity system by about 10–20% (Chiaroni and Frattini, 2014). Support of an adequate regulatory framework, which appropriately considers the benefits inherent in the model and the impacts it would bring on network operators, would favor this diffusion.

3.2. Focus on East Naples’s Energy Community

The vision of the *Energy Community*, as an active and integrated component of a territorial community of self-government with the growth of forms of community democracy (Bolognesi and Magnaghi, 2020), goes far beyond the only technical-administrative purpose linked to the energy saving of the inhabitants, it is rather a

much more articulated process, of a socio-political nature, which develops together energy wealth, self-production capacity of the local energy system and enhancement of the heritage that becomes a common good. With the retrieval of European directives on community energy, the first Energy Communities arose in Italy, in the legal form of Third sector bodies, social enterprises, and community enterprises, to promote the CER model and spread its underlying ideological vision. One of the first examples of The Energy and Solidarity Community (so defined), in the national panorama that fully embodies the socio-environmental purpose of the model, is that of East Naples, established in 2020 in the district of San Giovanni a Teduccio. Thanks to the precious contribution

of Legambiente Campania, which has provided the community with all the technical skills for its development, and to the Famiglia di Maria foundation, with the support of Fondazione con il Sud which co-financed this virtuous project.

The Family of Mary Foundation is a philanthropic institution of Catholic origin that in the nineteenth century ran an orphanage in the neighborhood; today it is a secular educational institution that collaborates with the social services of the municipality and manages a socio-educational center in San Giovanni a Teduccio. Legambiente Campania and Fondazione con il Sud believed in the realization of this project, starting the process of establishing an Energy Community that led, in fact, to the redevelopment of the area. The Famiglia di Maria Foundation, in the same way, promoter of the idea, represents an important educational and cultural garrison within the district of San Giovanni a Teduccio, welcoming everyday children who live a difficult reality, offering them canteen, after-school and various training activities, also carrying out projects with families. Fondazione Con il Sud has installed a photovoltaic system on the roof of the foundation's main building, which benefits 20 families of consumers who use the energy produced sustainably. The plant consists of 166 photovoltaic panels that generate a total power of 53 KW, with a storage system to store the unused energy produced (Bernardoni et al., 2022). Thanks to self-production and internal distribution of energy, community members can enjoy significant advantages in terms of reducing costs in the bill, drawing considerable economic benefits; environmental benefits deriving from the use of energy produced from renewable sources; and cultural benefits as being part of an Energy Community, on the one hand, increases citizens' awareness of the problems environmental (De Vidovich et al., 2021) and on the other hand, represents a tool for spreading values and a civic sense that can be applied in other areas of social and economic life.

With the help and mediation of the Fondazione Famiglia di Maria, an important "community work" was made possible, which led to the creation of the REC, although the site in which it stands is a neighborhood characterized by strong mistrust. The activism and the desire for redemption have led the community, from the three families that made up the first founding nucleus, to sensitize other families in the neighborhood, up to involving the 20 families currently members. The birth of the ERC represents an important result for the Famiglia di Maria foundation, a form of social redemption with a symbolic value, as well as economic, to combat energy poverty. The adhesion by the families of the district of San Giovanni a Teduccio to the Energy and Social Community does not bring with it only economic benefits but represents an active engine of cultural change in an entire neighborhood. A challenge that Legambiente defines as "revolutionary", with important repercussions not only environmental but also social, is a concrete opportunity for the regeneration of the suburbs. For the reasons explained above, it is called "Energy and Solidarity Community", becoming an opportunity for people and for the territory to be promoters of the ecological transition, which also keeps within the change of society itself. In this way, attention is generated toward the environment and towards a community that will provide a chain of mutual aid to feed good practices (Bernardoni et al., 2022). In

Italy, there are over two million families in conditions of energy poverty, which with the self-production and sharing of energy from renewables, and through interventions that reduce the consumption of homes, could improve their living conditions. Environment, solar energy, and educational equality are the components that define the Energy Community born in Naples and that guarantee a fairer future for the current and future generations, promoting, in fact, sustainable development.

4. CONCLUSIONS

Energy, like other natural resources, is a limited solution, so it is necessary to find suitable solutions to decouple economic growth from the consumption of resources. Renewable Energy Communities, as a consolidation of a spontaneous process of involvement of social actors along the entire energy chain, can be protagonists of the sustainable transition of the contemporary energy system. Their impact in terms of local self-consumption and distortion of the rules of operation of the energy market identifies suitable components for the energy transition. The diffusion of CERs represents a great opportunity to experiment with new energy models based on the self-organization of members and on the enhancement of the resources available to the territories. The CERs have above all great social value as well as economic and environmental, as they can represent models of synergy and cooperation spread throughout the national territory, helping to experiment with innovative solutions in the management of the common good, in the implementation of new local development policies and the experimentation of new welfare models. The proposed changes must be confronted with market and regulatory challenges. The directives and national transposition have created an enabling environment and the prerequisite for making CERs attractive to public and private investments. The cultural resistance and inertia of the system cannot be removed by law so that CERs can evolve from a niche of radical innovation to a new energy regime in contemporary Europe. The theoretical model must adapt to the nascent concrete cases, starting from the ability to penetrate urban systems, facilitated by self-consumption schemes, which remains a great challenge for any ecological transition policy. In this perspective, an important role must be played by business networks, associative networks, universities, and research centers, foundations of banking origin, which will be able to carry out specific training courses on the energy transition dedicated to organizations, such as the support of subjects specialized in the energy sector.

The different degree of development of the Energy Communities compared to other European realities, will bring heterogeneity in the development paths of the Renewable Energy Communities, but an advancement of their state of the art cannot be excluded, with the adoption of more detailed common rules at the supranational level. The *Energy* sector is facing a great transformation process, encouraged by the digital revolution that is encouraging the opening of new forms of energy management, control, and trading. The scenarios that can be envisaged for the energy sector can be different and radical, the desirable one is a prosperous energy future, with significant growth processes for energy companies and a greater diffusion of renewable supply sources, which can

support and counteract the possibility of a decline in current energy systems, caused by disintermediation and customer behavior. The Energy Communities will play a key role in the future ‘golden age’ of energy, a framework of stable rules, a strong simplification of authorization procedures, and inclusive operating models with wide freedom of action for prosumers would be useful tools so that they can quickly establish themselves throughout the national territory and, in this way, contribute significantly to the planned objectives. All this must be combined with the rational exploitation of resources, compatible with environmental constraints, which respects the territories, encouraging the development of ‘ethical’ initiatives. If it were possible to coordinate the production and consumption of energy from renewable sources, the activities of the Energy Communities, and all circular economy actions such as the reuse of different types of waste (Energy recovery) and the use of energy that normally without the use of specific technologies (cogeneration-refrigeration), a mix of virtuous actions would be generated.

The latter, if used simultaneously, could implement a strategy that fully respects the decarbonization objectives, with a view to efficiency and sustainability, able to protect and enhance the environment, and that can reduce the dependence on imports from third countries. Being an Energy Community means embarking on a path that starts from the community dimension to adopt new ways of producing and consuming energy. This strengthens the link with the environment with the use of renewable sources, for the realization of a sustainable economic and social system for present and future generations. Energy Community means reciprocity, collaboration, exchange, synergy, and values at the base of the analyzed model that become inspiring principles of living together.

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