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Energy Communities Implementation in the European Union: Case Studies from Pioneer and Laggard Countries

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Abstract: Energy communities are a promising strategy for a global energy transition. European Union (EU) regulatory frameworks are already established and clearly explained, aiming to develop as many projects as possible in the different European countries. Accordingly, it is necessary to present two different types of countries: the laggards and the pioneers, two categories that highlight the discrepancies in policy, bureaucracy, culture, and usage of alternative sources and technologies, such as renewable energy, towards the implementation of energy communities. This work compares two representative case studies to qualitatively understand the differences between laggard and pioneer countries: Italy and the Netherlands, respectively. The regulatory framework and the solid points/shortcomings of each country are explained first. Thereafter, an accurate description of the two selected case study communities and their different peculiarities is provided. Finally, the main similarities and differences are stressed to discuss the lessons to be learned in laggard and pioneer countries. Five pillars for the development and uptake of energy communities are identified related to regulations, economic benefits, technical limitations, sustainability, and social awareness. These outcomes suggest the importance of policy management, and stress the limitations of governance in helping policymakers and experts to support the energy transition.

Keywords: energy community; energy transition; EU framework; EU policy; laggards; pioneers

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1. Introduction

The climate crisis is recognized worldwide, and international agreements have led humanity towards sustainable development and green transition goals. For example, in 2015, 196 Parties signed the Paris Agreement, which expresses the urgency to act against the climate crisis, limit the temperature increase, and reduce greenhouse gas emissions in the atmosphere [1]. Similarly, the 2030 Agenda for Sustainable Development recognized the urgent need to act to address the climate emergency (goal 13), the need to ensure affordable and clean energy for all (goal 7), and the need to realize sustainable cities and communities (goal 11). Concerning renewable sources, these goals primarily focus on the building and transport sectors, aiming to enhance the utilization of renewable energies in different fields and motivate the transition to cleaner and more sustainable energy [2]. This approach involves the empowerment of communities through sustainable development practices [3].

Accordingly, an energy transition is necessary to reduce the usage of fossil fuels and promote the implementation of renewable energies. Developing energy communities (ECs) seems to be a valuable solution among the strategies adopted for the low-carbon energy transition, as they aim to optimize the share and self-consumption of renewable energies at the local level and to promote urban sustainability and self-sufficiency from the network [4].

It is expected that 264 million European citizens will join the energy market as prosumers in 2050, generating up to 45% of the renewable electricity of the grid [5].

Given this scenario, the present study aims to understand the European legislative framework and the possible implementation of energy communities in the EU countries in its current state. Indeed, Renewable Energy Community (REC) seems to be an effective solution for reducing the urban carbon footprint and for improving the sense of community among "peers" with self-production and internal sharing of energy. Moreover, it can enhance human participation in and awareness of the energy system, guarantee inclusiveness, and have a long-term positive impact [6]. Nevertheless, national and local policies are the main factors responsible for properly implementing the RECs in their own countries, since these must transpose the EU directives into national and local regulatory frameworks [7]. In light of this, this work analyzes two EU Member States that nowadays present significant differences in the RED II transposition state concerning the ECs: Italy and the Netherlands, defined as "laggard" and "early adopter" or "pioneer" countries, respectively. The first term indicates those countries that present significant shortcomings and delays in policy definition and ECs setup and diffusion in their territory, while the second term refers to those countries that already have several active energy communities throughout their territory, and thus, have developed policies and strategies to support the implementation of energy communities and the related technical aspects [8,9]. The work analyzes the regulatory frameworks, the differences in ECs implementation between the two countries, and their benefits/shortcomings, trying to understand the potential implementation capability and readiness and suggest general guidelines for the improvement in the regulatory aspects, policy management, and exploitation of renewable resources. Therefore, lessons to be learned from pioneer countries can be derived from this study to define potential practical actions to be adopted in the Italian and similar scenarios for the uptake of RECs and the improvement of the citizens' engagement in the energy transition, but also vice versa, to solve the issues and the shortcomings in both countries. Therefore, the stakeholders of the outcomes of this study are mainly policymakers and experts—including professionals and companies—who support the energy transition.

2. Research Framework

In the existing literature, new strategies are under development in order to improve the usage of renewable sources and to foster the energy transition, as previously mentioned. Moreover, due to the recent Russo-Ukrainian war, the Sustainable Development Goals (SDGs) are adapting [10], with specific attention being given to the development of new production structures (e.g., smart factories), which are characterized by digital and interconnected processes [11]. The energy transition and the role of the neighboring countries are two main aspects of the decarbonization pathway for an improvement of energy efficiency [12]; a reduction of energy demand, and a transition from traditional fuels to renewable resources [13]. For instance, the phenomenon of Dutch disease contributes to fostering the de-industrialization through booming and lagging sectors. In detail, the Dutch disease syndrome represents a new trigger of de-industrialization, and is in contrast with the conventional approaches to reducing the impact of fossil fuels on the environment [14]. It guarantees the usage of the best technologies and the best administrative practices, even if, in some cases, it is considered a market failure because it generates negative effects in the other economic sectors of tradable goods and services [15]. For these reasons, it is fundamental to understand the most valuable solutions for each country in terms of energy management and energy savings, to reduce the impact of greenhouse gas emissions on the environment and enhance renewable and sustainable energy in various sectors.

One possible action that countries can adopt for reducing carbon emissions and the usage of fossil fuels is the development of a new energy management system, called energy communities, which are innovative strategies for enhancing the usage of renewable resources at the local scale. In detail, an energy community is a legal entity based on open and voluntary participation without discrimination [16]. As such, energy communities are autonomous and controlled by shareholders or members that can be consumers (passive citizens consuming the energy) or prosumers (users who are not limited to the passive role of consumers but actively participate in the various phases of energy production) (Figure 1) [17]. Prosumers own one or more energy generation systems, which allows for two main economic benefits: (i) reducing their overall expenditure for energy (through self-consumption) and (ii) getting an income by selling excess production.

Figure 1. Consumer vs. prosumer.

The framework of energy communities reflects the need to find an alternative solution for better organizing and governing energy systems while finally delivering a stable network where long-distance and local energy production compensate for each other. Energy communities can be energy cooperatives, limited partnerships, community trusts and foundations, housing associations, non-profit customer-owned enterprises, public-private partnerships, and public utility companies. Table 1 presents each legal structure previously mentioned with a brief description of its main characteristics [18].

In detail, the shareholders or members of the energy community can be individuals, small and medium-sized enterprises (SMEs), or local authorities, including municipalities; they can produce, share, and sell their energy with the primary goal of providing environmental, economic, and social benefits for the whole community rather than prioritizing profit-making. Energy community members most likely refer to different energy use profiles, which is a plus for the grid's stability, since it is possible to take advantage of the non-contemporaneity of energy needs and consumption. ECs play a key role in helping citizens and local authorities invest in renewables and energy efficiency and in facilitating the decentralization of the energy system, providing an energy transition inside the society [19]. In this context, ECs are also a unique opportunity in terms of technological and social innovation, fostering a new approach to energy production and consumption, in which the social context plays a fundamental role.

The European Union (EU) Directive 2018/2001/EU (revised Renewable Energy Directive—RED II) [16], detailed in the rules embedded into the Internal Electricity Market Directive 2019/944/EU (IEMD) [20], entered into force as part of the Clean Energy for all Europeans Package [21]. This European regulatory framework includes the European directives regarding renewable energy production and sharing and the various schemes of collective self-consumption and energy communities. The mentioned European directives introduced two types of EC: Renewable Energy Community (REC) and Citizens Energy Community (CEC), which differ in geographical and energy features. RECs manage energy from renewable sources in several forms, such as electricity, heat, and gas. Additionally, REC members must be near the renewable energy source (RES). CECs, on the other hand, manage only electricity produced from renewable and fossil sources. This framework abandons the principle of proximity and groups community members that can be virtual and located throughout the country. The differences between REC and CEC are inherent to the leading goals associated with the RED II and IEMD that define REC and CEC, respectively. The IEMD generally focuses on completing the internal energy market, with the new paradigm of the consumer/citizen at its center, while the objective of the RED II is to promote renewable energy generation [22].

Table 1. Possible legal structures for energy communities.

Legal Structure	Characteristics
Energy cooperatives	The fast-growing form of ECs benefits the members, and they are popular in countries where renewables and the energy community are diffused.
Limited partnerships	They allow individuals to share responsibilities and generate profits by participating in the energy community; the governance depends on the value of each partner's share (one member does not mean one vote).
Community trusts and foundations	The main aim is to provide social development rather than individual benefits; the profits are always used for the community.
Housing associations	They offer benefits to tenants in social housing, even if they cannot be involved in the decision-making.
Non-profit customer-owned enterprises	They are used by communities that deal with the management of independent grid networks.
Public-private partnerships	Local authorities and citizen groups can make a deal and ensure energy provision and other benefits for a community.
Public utility company	They are particularly suited for rural or isolated areas; the public utility company is run by municipalities that manage the utility of taxpayers and citizens.

In this framework, RED II not only defines RECs (art. 22) but also renewable self-consumption (art. 21) [16]. In detail, RED II art. 21 allows citizens to "produce renewable energy also for their own consumption", and energy citizens cannot be subject to "discriminatory or disproportionate procedures and grid charges that do not take costs into account". Users are also allowed to install and operate RES energy systems and receive remuneration for the energy they feed into the grid. Thereafter, RED II art. 22 refers explicitly to ECs and how the Member States (MS) must guarantee the production, consumption, storage, and sale of renewable energy. Indeed, the goal is to achieve a 32% share of final gross consumption from RES in all EU MS [23]. On 11 December 2019, the Commission successfully published the Communication on the European Green Deal (COM (2019)640), which established a detailed vision to make Europe a climate-neutral continent by 2050 through the provision of clean, affordable, and secure energy.

Furthermore, in September 2020, the Commission set up a mechanism (Regulation 2020/1294) based on art. 33 of the Governance Regulation ((EU) 2018/1999) as part of the Clean Energy for All Europeans package [21]. The main goal of this mechanism is to help countries achieve their individual and collective renewable energy targets, define the implementation framework, and to stipulate those actions that can be financed under the mechanism by the MS or through EU funds and private sector contributions [24]. Moreover, in addition to the regulations regarding energy production from RES, the EU promotes upgrading the Union's energy infrastructure through Regulation (EU) No 347/2013 [25]. This upgrade creates the Trans-European Energy Network allowing the interconnection of national grids [26].

In this scenario, thanks to the updated regulatory framework of the European policy, several ECs are developed in the European territory, with the usage of different renewable energy based on the resources of each country. A study conducted in Belgium provides several economic models able to assess the conditions needed for RECs and their economic benefits: the advantages are due to the available flexible technologies, which contribute to cost reduction and to the possible use of different mechanisms of peer-to-peer exchange within the REC [27]. Another study in Portugal highlighted how photovoltaic systems can influence the cost of electricity and the possible energy savings within the energy community. Indeed, a higher increase of photovoltaic capacity, equal to 23%, can provide a reduction of 8% in the electricity cost [28]. Furthermore, the correct selection of the optimal sizing of the installation system can lead to several economic savings for self-consumers inside the energy communities, improving their benefits and gains related to energy production [29].

3. Local Regulatory Frameworks

EC European regulation is somewhat complex as it depends strictly on the countries and their policy management. As a result, two types of countries can be defined based on the benefits and the lack of regulations and legislation about energy communities: laggard and early adopter (or pioneer), the first type being less advanced than the second [8]. In detail, laggard countries present several shortcomings concerning the policy and the regulatory framework, which is less developed than that of pioneers. On the other hand, pioneers present an accurate energy policy system and a developed framework for ECs. In general, over 1900 projects about energy communities exist across the EU, with the participation of over 1,250,000 citizens from different European countries [30]. Table 2 shows the number of active energy communities in several European nations by 2020 [31]; this number has been growing and is expected to evolve continuously.

Table 2. Active energy communities in different European countries (data from [31]).

Country	Number of Energy Communities
Germany	1750
Denmark	700
The Netherlands	**500**
United Kingdom	431
Sweden	200
France	70
Belgium	34
Poland	34
Spain	33
Italy	**12**

In this study, two countries are selected and presented as representatives of a pioneer and a laggard reference within the EU MS—i.e., the Netherlands and Italy—to understand their differences concerning legislation, policy management, and societal uptake.

3.1. Dutch Regulatory Framework

The Netherlands is considered an early adopter (or pioneer) country, since it presents several active energy communities throughout its territory, which have settled down for years and have developed solutions and strategies to support the implementation of energy communities. The Ministry of Economic Affairs and Climate Policy incentivizes the development of the ECs to reduce CO_2 emissions and increase the amount of renewable energy. The idea is to reach the goals defined by the Energy Agreement, which provides a percentage of production from renewable sources equal to 16% by 2023 [32]. The current legislation in the Netherlands does not define "energy communities" but allows recognized associations of citizens (e.g., cooperatives) to install and own local grids and to participate in the electricity market with a limited number of rights. In particular, there are two principal regulations:

- Elektriciteitswet (1998) or Electricity Act: it is a law that does not consider peer-to-peer activities and precludes prosumers' role in the ECs and electricity generation.
- Experimenten Elektriciteitswet (2015–2018) or Experiment Electricity Act: the legislator created a legal exemption opportunity for a "Project-Net", that established several rights and obligations for the CEC. This regulation was valid for cooperatives and owners' associations to deviate from the previous law of 1998, but unfortunately, it was closed in 2018.

In recent years, attempts to implement a successive experiment regulation have failed due to their ambitious scope extension and interference with new EU regulations [33]. The most relevant legal development in this regard is the new Energy Law, a comprehensive law to replace the Electricity and Gas Act (1998)—foreseen to be effective by the end of 2022. This law is intended to become the foundation for the energy transition in the Netherlands [34], aiming to develop a futureproof regulatory framework for the rapidly changing electricity market and system. The New Energy Law intends to empower both individuals and communities to actively participate directly in the energy market or through market services such as demand response. Finally, municipalities also play a critical role in the energy transition, since they carry out smart strategies to implement national policy goals.

3.2. Italian Regulatory Framework

Italy is considered a laggard country since it presents significant shortcomings and delays in policy management and ECs setup and diffusion in its territory. The following list presents the principal regulations in the Italian regulatory framework regarding energy communities:

- "Milleproroghe" Decree 30 December 2019 n.162 (converted into law on 28 February 2020 n.8) [35]: it legally defines the energy communities through the art. 42bis, which specifies the two possible schemes of energy community feasible in Italy: collective self-consumption and Renewable Energy Communities (REC). It considers RED II principles and defines the specific characteristics of the two schemes. In particular, it defines the scale at which the REC can operate since communities must be connected to the same medium voltage/low voltage (MV/LV) substation with the maximum incentivized power for each renewable energy system fixed at 200 kWp. Moreover, the users can share energy instantaneously and use a storage system.
- Legislative Decree 8 November 2021 n.199 [36]: establishes that the REC participants regulate their relationship through a private law contract, which defines the rights and obligations of the individuals. It transposes the RED II Directive and allows incentives on the "shared energy", evaluated as the net difference between the electricity fed into the grid and the energy taken from the grid. These incentives equal 100 €/MWh for self-consumption and 110 €/MWh for REC.

Thanks to the Legislative Decree 8 November 2021 n.199, Italy fully integrates the RED II into its legislative body. However, the executive directions from ARERA (Regulatory Authority for Energy, Networks and Environment) and MiSE (Italian Ministry of Economic Development) for the factual and operational implementation are still pending. The Legislative Decree n.199/2021 should be transposed into law at the end of 2022, involving the modification of the requirements of the renewable system used for the community: it will allow a maximum incentivized power for a single plant equal to 1 MW and the physical extension of the community, recognizing as potential members of the same EC all the utilities connected to the same primary station (instead of the MV/LV substation). In this scenario, the energy transition and the related reduction of carbon emissions through an energy symbiosis are the potential outcomes for a more sustainable energy supply system [37].

3.3. Level of Implementation in the Two Countries

Based on the number of active energy communities listed in the JRC report about European ECs in 2020 [31] (about 500 registered cases in the Netherlands vs. only 12 in Italy), the gap between these two countries is evident. This vast difference is due to relevant technical, legal, financial, and social barriers hindering the laggard, mainly due to the delay in defining the regulatory framework, as described in the following sections. Indeed, the Netherlands shows a well-developed and well-defined policy, where shared renewable energy already contributes to the energy transition [38,39], as a tool for market decarbonization. On the contrary, Italy is somewhat underdeveloped from this point of view and still presents several issues regarding system governance and management, involving shortcomings and delays in the regulatory field and in the technological part. Although rapid progress has been made during the last two years—following the publication of the first laws on this topic [40,41]—considerable efforts are still necessary to reach the level of the pioneer countries. To this aim, the proper definition of the upcoming policy framework plays a pivotal role in driving the successful future of Italian energy communities to enhance renewable energy sources and reduce greenhouse gas emissions through energy synergies and energy exchanges [42].

Following the regulatory shortcoming, Italy falls back in the definition and acknowledgment of technologies enabling the efficient operation of energy communities. The Dutch situation is more developed compared to the Italian situation. In detail, in the Netherlands, the smart meter grid is organized with a specific framework. Privacy, security, operation, and costs are the main important factors for a smart electricity system to provide detailed data for each energy community member [43]. In addition, the electricity grid is managed at the local level to accommodate collective energy generation [44]. As regards the financial aspects, critical enablers for the growth of Dutch energy communities in the past years have been financial incentive schemes. The most relevant are:

- "net metering" [45]: allows produced renewable energy to be crossed out against consumed energy, which eliminates the dominant tax component in energy tariffs;
- "Dutch postal code scheme" [46] or its successor SCE (Subsidy Cooperative Energy production): is a financial scheme that incentivized the creation of a local EC that collectively invests in renewable energy somewhere nearby of the postal area, without the necessity to have photovoltaic panels on a member's roof. This scheme was initiated in 2013.

Finally, the largely ineffective and insufficient public communication of the ECs operation and their associated benefits contributes to low citizens' knowledge [9]. Tailored communication campaigns or specific events could spread more transparent information throughout the country and improve citizens' awareness of the importance of renewable energy communities. Indeed, public awareness of the topic in the Netherlands is addressed through several activities based on a unique knowledge-sharing platform (i.e., HIER Opgewekt) set up at the national level [47], which develops communication tools and shares initiatives for the improvement of energy communities awareness and energy transition through the renewable energies. In Italy, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) [48] is taking the lead on this directive by providing guidelines and tools for the development and assessment of ECs. However, the current level of awareness raised is far below that of the Dutch. As a result, Dutch citizens can understand the importance of local energy production and improve their knowledge and awareness in terms of energy communities and energy transition [49], while Italians are just starting to get familiar with this opportunity. Table 3 summarizes the main characteristics and aspects of implementation and regulatory framework for ECs in the two selected countries, the Netherlands and Italy.

Table 3. Comparative characteristics between the Dutch and Italian level of implementation and regulatory framework.

The Netherlands	Italy
• About 500 active ECs (in 2020). • Well-developed and suitable policy: ▪ convenient incentives and rates based on the type of installation and on the market price for energy; ▪ well established incentives for renewable energy production; ▪ proximity of the renewable energy plant, but no specific requirements in extension. • Well-developed smart meter grid and smart electricity system. • Tailored strategies and communication tools for enhancing citizens' awareness and engagement. • Development of specific platforms that provide guidelines and demonstrate the advantages of ECs.	• 12 active ECs (in 2020). • Underdeveloped and limiting regulatory framework: ▪ fixed incentives for shared energy (110€ for REC/100€ for self-consumption); ▪ limited incentivized renewable energy power (from 200 kW to 1 MW); ▪ proximity of the renewable energy plant and connection to the same primary station. • Lack of relevant and specific technologies for the smart electricity system. • Lack of specific strategies for improving citizens' knowledge and participation in the transition to ECs. • Recent development of preliminary guidelines and tools for improving the ECs assessment and development.

4. Case Studies

As previously mentioned, this work aims to understand the differences between two specific countries representing pioneer and laggard countries in the implementation of ECs, i.e., the Netherlands and Italy, respectively. The following subsections analyze two selected case studies of renewable energy communities, one for each country, to highlight the different development in the countries in terms of assets and operation, legal framework, and social peculiarities. For the Netherlands, the case of *Schoonschip* (Amsterdam), while for Italy, the case of *Marsciano Community* (Perugia) are selected. These two renewable energy communities are among the case studies of the Horizon 2020 (H2020) project NRG2peers [8]. This project aims to support the uptake of the next generation of European peer-to-peer energy communities through a gamified platform to be tested in different EU ecosystems such as the Italian and the Dutch ecosystems.

4.1. Schoonschip, Amsterdam, The Netherlands

The energy community of *Schoonschip* is an ecologically and socially sustainable neighborhood located in a sustainable residential area in the north of Amsterdam, in the Netherlands [50]. It was realized after more than ten years of work by its residents, who had the ambition to create a frontrunner and pioneer floating residential neighborhood in Europe. The project initiators has already started preparations in 2008, but the EC started in 2016. The neighborhood includes 46 residential units—on 30 floating plots—and more than 140 residents. A peculiarity of *Schoonschip* is its nature as a bottom-up community initiative that first started with the creation of a social community, and the sense of community has taken root over the years, as the basis for the efficient operation of the energy community. Indeed, the community's residents organized workgroups that take care of the different aspects of the community, e.g., smart grid and energy, ecology, mobility, water quality, etc.

Moreover, they have shared spaces where they regularly meet to cooperate, build trust among the community's citizens, and inspire others to live sustainably. The main goals of the community are promoting sustainable living and clean energy, improving the system's reliability, and participating in the energy transition and the battle against climate change. Moreover, essential aspects of the local community are the local economy's development, the energy system's democratization, and the assurance of community well being. Accordingly, the different workgroups ensure that the following aspects are managed and preserved within the community: local and sustainable materials that fit within a circular economy, water saving and reuse, energy efficient technologies and smart grid, ecology and biodiversity, local and sustainable food and diet, social community and residents engagement, residents well-being, well-organized legal framework, collective and transparent financial investment [51]. Therefore, this community is not only an EC where members share renewable energy, but one in which the numerous sustainable development goals are shared. Figure 2 shows a scheme of the aspects taken care of by the members of the *Schoonschip* energy community.

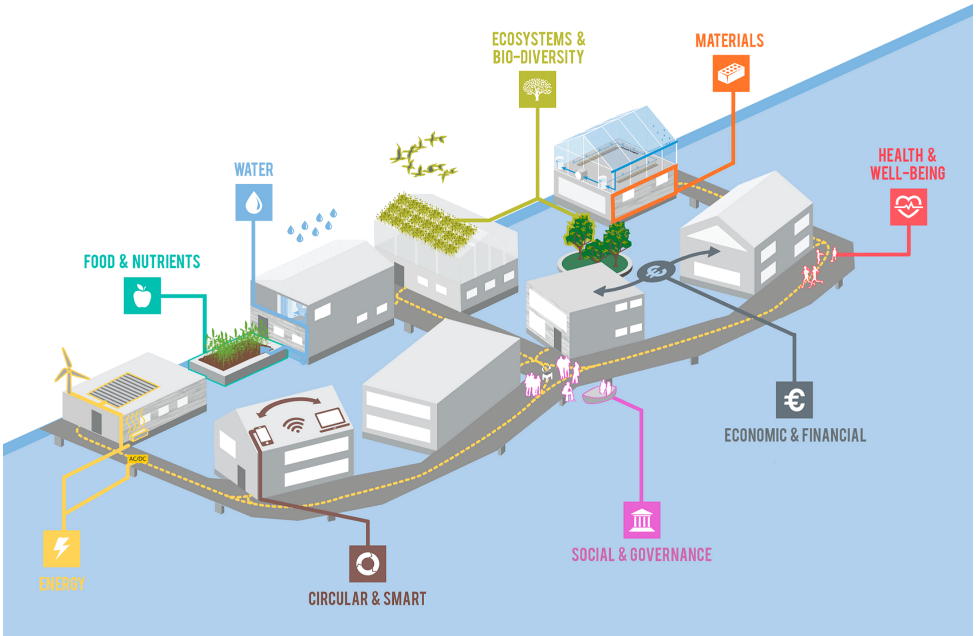

Figure 2. A scheme of *Schoonschip* energy community [50].

Regarding the energy aspects, each house is very well isolated—using sustainable materials as much as possible—has a green roof, and equips a smart heat pump that exchanges heat with the water in the canal. Moreover, houses are provided with shared photovoltaic solar panels—a total of 516 panels—and local batteries for electricity—no connection to the gas system—and solar water heaters and heat recovery systems for domestic hot water. Buildings are all connected to the community smart grid and equipped with smart-grid-ready appliances to share renewable energy produced locally within the community. The community as a whole has only one standard connection to the national energy grid. Additionally, residents share electric cars and bikes. Some households have a rainwater collection system, while all have separate streams for the disposal of black water (from toilets) and grey water (from the shower, washing machine, etc.) to reuse black waste water in a local bio-refinery station to harvest nutrients and produce electricity [52]. An intelligent community platform shows the energy sharing within the community grid network, displaying real/time energy flows from and to the households. Each household has access to an overview of their system's actual energy flows and status to help residents efficiently manage their energy performance by considering the whole community balance.

As regards the legal framework, the *Schoonschip* community was awarded an experimental legal exemption, which allowed them to develop their private microgrid with a single central grid connection. Therefore, the legal organization had to be well-designed, including innovative elements, resulting in the establishment of multiple entities:

– The foundation—is established by the board of founders;
– The cooperative association—is established in a second step to take on tasks concerning the execution of the project;

– The owners' association—governing the collective components of the project to secure collaboration from all residents;
– The Pioneer Vessel foundation—is a new foundation established by the owners' association to coordinate the sustainable initiatives shared by the community.

During this process, the *Schoonschip* community encountered various obstacles, mainly because the law considers houseboats as movable property, which led to years of delay. Nevertheless, the successful implementation of the floating community allowed the development of a model ready to be replicated by others.

Finally, the financial framework also followed a pioneering approach, where residents are engaged in a risky collective investment of money, time, and energy. During the development of the project, the collective budget for standard technologies and infrastructures was managed by the foundation. Moreover, the plan was designed to make homes affordable to people of multiple paygrades by including semi-detached houses, which did not exist for movable property and involved legal complications.

4.2. Marsciano Community, Marsciano, Italy

Marsciano Community is one of the first renewable energy communities established in Italy. It is located in an industrial area of a small town (Marsciano) about 25 km south of Perugia, central Italy. This energy community was formally established in January 2022 by four clusters physically located in two adjacent buildings with different end-uses. Indeed, the four members are a medical center, a household (apartment within one of the buildings), a dairy, and an engineering studio. The only "prosumer" of the EC is the household, which owns the shared photovoltaic panels—a total of 10 kWp—installed on the roof of one of the buildings. All the other members of the *Marsciano Community* are "consumers". The owner and resident of the household is also the owner of the entire two buildings. Therefore, the energy community was born of their willingness to invest in installing renewable energy systems. On the other hand, the engineering studio was the promoter of the EC, which engaged the other members in the building and facilitated the feasibility analysis and the design of the shared photovoltaic plant. The establishment of an EC would be the only chance for the studio to take advantage of the local production of renewable energy since it has no legal property to install a renewable generation system. In addition to installing the photovoltaic panels, smart meters were installed for the members of the new EC and connected to a unique platform for the energy management of the whole community. The platform aims to optimize energy sharing and possibly raise members' awareness of virtuous energy behaviors. Furthermore, during the EC design stage, possible benefits from the EC structure were identified in upgrading some technological assets that now depend on natural gas as the primary energy vector (e.g., the heating system) into electricity-based systems. Figure 3 shows a scheme of the two buildings and the members involved in the EC.

The feasibility analysis was supported by the simulation of the energy community operation realized through the dedicated online service RECON (Renewable Energy Community economic simulator) provided by the ENEA [53]. The simulation tool requires at least one year of energy bills from the community members, possibly distinguishing electricity consumption hourly to match the internal share of energy in addition to the prosumer self-consumption. Calculations show a reasonable time of return for the investment in the installation of the photovoltaic modules is going to be around 7/8 years for this EC, taking into account the energy savings and the current incentive tariffs.

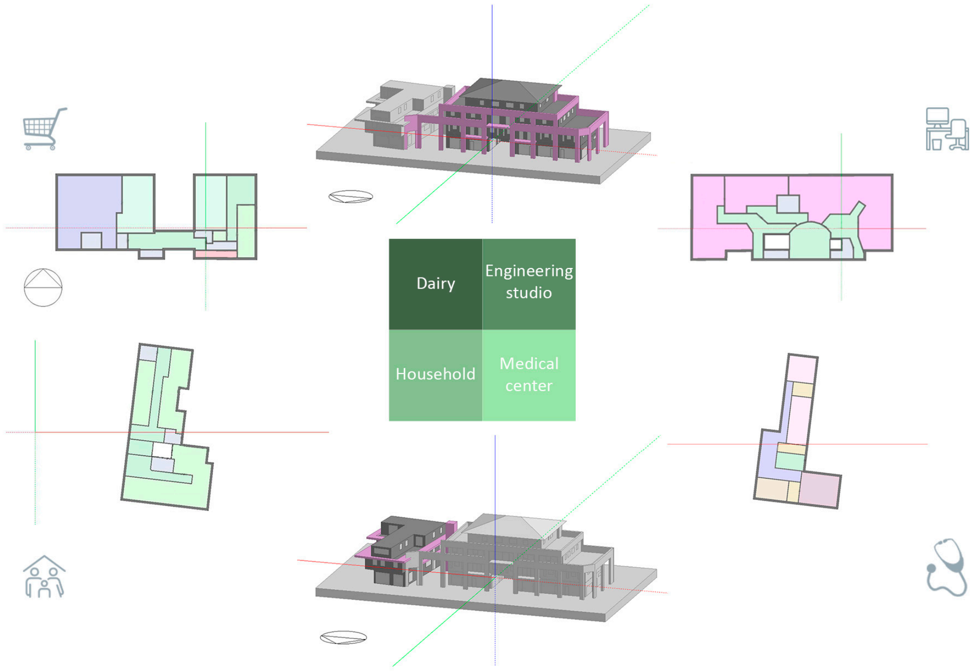

Figure 3. An overview of *Marsciano Community*.

5. Discussion

In this section, we first compare the selected case studies and later discuss what kinds of lessons could be learned by the laggard community to improve ECs development in the future.

5.1. Comparison between the Two Case Studies

Comparing the two countries, we can define crucial differences between them in terms of regulations, technical characteristics of the grid and the energy systems within it, and economic context. Additionally, several differences arise between Dutch and Italian community members regarding their approach to ECs and their nature.

First, concerning the national regulatory framework, a considerable difference arises: in the Netherlands, dedicated regulations were available years in advance, compared to Italy. Indeed, since 2013, the "Dutch postal code scheme" stimulated the creation of ECs, and in 2015, the Experiment Electricity Act monitored citizens' rights and obligations within energy communities. On the other hand, in Italy, ECs were only officially "created" at the end of 2019. This time gap gave the Netherlands more time to develop successful models and technologies for renewable energy communities and build public awareness about the topic. Furthermore, current Italian regulations limit the incentivized nominal power of any renewable system in the community to 200 kW. This is a massive limitation since it affects the type of renewable system a single member can install. Nothing similar can be found in the Netherlands. Hopefully, this limitation will be overcome by the upcoming updated Italian regulatory framework, introducing the possibility for including new members in the ECs.

A second crucial difference between the two case studies lies in the connection between the community and the national grid. Indeed, in the Netherlands (as for *Schoonschip*), the community smart grid has the chance to have a single connection to the national energy grid. In contrast, in Italy (as for the *Marsciano Community*), each building is connected to the national grid and exchanges energy. Members of the same community can only draw power from the grid for instant self-consumption. Therefore, the "shared energy"—i.e., the incentivized energy—is, at each time step, the minimum between the amount produced and fed into the grid by renewable energy systems and the sum of the electricity drawn by the community members from the grid. Nevertheless, among the numerous ECs in the

Netherlands, only approximately 16 have this legal exemption—the Experiment Electricity Act—and, thus, have their own "project-net", while the majority of them do not have one direct connection to the national grid. For the majority of the Dutch ECs, instead, the "Dutch postal code scheme" has played a key role, as it provided a strong financial incentive to create a local community and collectively invest in renewable energy nearby (the postal code), while financially benefiting from their share in the community. At the country level, this administrative/legal enabler had a higher impact than the physical requirement of having one project–net connection.

Accordingly, from an economic point of view, the Netherlands has appropriate financial incentives (see the previous description) that act as critical drivers of ECs development. EC members can select the most convenient approach among different acknowledged incentive schemes that provide relevant economic benefits. On the other hand, Italy still has few financial incentives that need to be clearly defined. Indeed, the current configuration of incentives is not definitive and the actual economic benefit is not acknowledged. Nevertheless, this aspect will by favored by the energy crisis associated with the recent Russo-Ukrainian war.

Another significant difference concerns the energy community members, their roles, and their type. Both *Schoonship* and *Marsciano Community* are examples of bottom-up established communities. Still, in the first one, the residents pushed to adopt this framework to enhance the neighborhood's sustainability. In the *Marsciano Community*, the promoter is a "professional" working on building energy efficiency. The first bottom-up approach requires the higher engagement of the society and results in a large-scale EC (46 members). This goal is partly achieved through the greater awareness of Dutch citizens regarding the benefits of energy communities, which has been gained over time. On the other hand, the promoter of the Italian case study (a private entity) carried out a one-year-long promotional campaign for the initiative, resulting in a smaller community (four members). Finally, *Schoonschip* is a fully residential community of energy "prosumers". On the contrary, *Marsciano Community* only has one prosumer and collects different end-users, which should be more efficient in terms of energy balance among the community members. Table 4 summarizes the main similarities and differences between the two case studies and countries. This section is not mandatory, but can be added to the manuscript if the discussion is unusually long or complex.

Table 4. Comparison between the two case studies and countries.

***Schoonschip*—The Netherlands**	***Marsciano Community*—Italy**
Similarities	
• Bottom-up communities. • Community members organized an awareness campaign for the citizens, enhancing their knowledge about energy communities. • Same EU regulation that provides the role of energy communities as the tools to make green energy affordable for all classes of people.	
Differences	
• Better development of the regulatory framework. • Single connection of the community smart grid to the national energy grid. • No regulatory limitations for installable renewable energy power. • Presence of more "prosumers". • Less efficient energy balance among the members (residential end-uses). • Clear definition and convenience of the incentives.	• Delay of the regulatory framework and policies. • Connection of each building to the national grid. • Limit for incentivized renewable energy power (that has been improved with the updated regulation). • Presence (often) of only one "prosumer". • More efficient energy balance among the members (different end-uses). • Unclear indications for incentives convenience.

5.2. Lessons to Be Learned in Italy

Based on the successful example of the Netherlands and the *Schoonschip* community, general guidelines can be established to boost Italian engagement in ECs. Indeed, the direct comparison between the previously described realities allows us to define five prominent keystones to be tackled adequately by laggard countries, such as Italy:

– *Improve law making and readability*: Italy suffers from a deficient legislation framework at the policy level. Therefore, future policies should aim to define the required legislation and adequate implementation guidelines and strategies as soon as possible.
– *Increase profitability*: in parallel with legislation, Italy and similar laggard countries should establish inviting financial incentives and affordable energy tariffs to encourage citizens to invest and participate in energy communities.
– *Minimize limitations on systems & grid*: adopting the Dutch approach to enable the development of smart grids for a community, could improve the robustness of the energy grid and increase the quota of energy that can be generated and self-consumed from renewable energy—indeed, there is a limit to how much energy the electricity network can handle and process directly.
– *Leverage sustainability*: policymakers should further push ECs as an innovative approach to sustainability. Indeed, the transition from fossil fuels to electricity as an end-use energy source could be easily explained as a step forward to a more sustainable environment.
– *Raise people's awareness and social engagement*: a key feature of *Schoonschip* was the existence of an active and participative social community. Indeed, building upon an existent social community could maximize EC development, leveraging citizens' awareness and engagement [9]. In this view, laggard countries, such as Italy, which still lack widespread awareness and engagement, should develop dedicated strategies to build social communities as a foundation of energy communities. To this aim, dedicated communication campaigns and information desks at the national and, especially, local levels should be launched to make citizens aware and engage them in the energy transition process.

5.3. Lesson to Be Learned in The Netherlands

Although ECs are more diffused and rooted in the Netherlands, insights can still be gathered from the comparison with other countries for the improvement of their operation and effectiveness. Additionally, pioneer countries are facing issues that could help improve the faster growth of ECs in other countries, by skipping the same issues thanks to the lesson learned in pioneer countries:

– *Increase flexibility*: the focus of Dutch policymaking over recent years has predominantly been on incentivizing investments in renewable energy production. Even though this had a positive effect—also on the growth of energy communities—one of the downsides is that the Dutch Electricity grid runs into its limits, as a result of the growing electrification and increased volatility from renewable energy sources, which limits the opportunity to further increase renewable production. Therefore, it is recommended to shift focus in policymaking and regulations from a sole focus on the growth of renewable energy production towards a focus on smarter growth, in which flexibility plays an important role.
– *Improve market access*: energy communities with flexibility assets face challenges in obtaining access to relevant energy trade markets. For example, the flex-capacity from smart-grid-ready heat pumps in residential communities could be used for balancing and (local) congestion markets. However, energy communities are required to meet high capacity requirements to gain access to these markets, which in practice is difficult to achieve. The additional profits from this market trade could improve both the business case for energy communities and therefore the acceptance and support for these investments within the community.

– *Tailored tax policies*: the cost structure of the energy bill for consumers and energy communities in the Netherlands is not favorable for flexibility trade. The majority of the energy bill consists of fixed taxes and standing fees per kWh consumed, and thereby, does not reflect the real value of flexibility. New regulations and laws are currently in development in which tax policies and financial incentives are not in scope, even though they play a crucial role and should be considered an integral part of the solution. Additionally, the previously mentioned "net metering" scheme is limiting the potential value of flexibility, even though it has been an important incentive for the growth of renewable energy production. A focus on smarter regulations and policies that both stimulate the growth of renewable energy and overcome the limitation of the electricity grid will become a critical success factor for the years to come.
– *Improvement of users' heterogeneity inside the community*: the Italian case study considers different types of end-users (e.g., residential, commercial, etc.), while *Schoonschip* involves only residential users. In this view, *Schoonschip* community is based on similar requirements for all the community members and similar trends of energy consumption. The involvement of different types of users could improve the flexibility and self-consumption within the community.

6. Conclusions

In recent years, the urgent need for an adequate energy transition to renewable energy sources has emerged. In this context, energy communities (ECs) could represent a valuable solution among the strategies adopted for a low-carbon economy.

EC European regulations, however, strictly depend on local energy policies and management protocols that, provided their fragmentation, eventually produced different levels of implementation throughout the continent. In this work, we analyze the current situation and identify two European countries as representatives of EC laggards (Italy) and early adopters (the Netherlands), the first type being less advanced than the second. Furthermore, this work analyzes and compares these countries based on their regulatory framework, as well as their economic and technical protocols, aiming to identify differences in ECs implementation and classify them in terms of benefits/shortcomings. In doing so, we produce a precise comparison between the selected countries, which represents the main limitation of the present study and the European approach to energy policies, in general. However, discussing ECs on the local level allows us to focus on local fragmentations and differences, identify their effects, and possibly define optimized best practices to be applied at a larger scale in similar contexts.

Results highlight several lessons to be learned from pioneer countries that could be used as practical implementation strategies for Italy and other laggards for the uptake of RECs. More in detail, crucial steps for paving the way to ECs development are:

– the improvement of law making and its understandability and readability;
– the proliferation of economic benefits;
– the reduction of the existing limitations on systems & grid;
– the adequate dissemination of the concept of sustainability;
– the development of dedicated awareness campaigns to boost social awareness.

These keystones play a crucial role in the diffusion and implementation of energy communities and should be appropriately addressed by policymakers to bridge the gap with and follow the lead of the pioneers. Indeed, simply addressing technical constraints in legislation, economic incentives, and technical barriers could be less effective than combining these actions with a proper information campaign focusing on EC benefits for the individual and the environment to develop the necessary social engagement crucial to sustainability. Similarly, pioneers could take the cue from relevant experiences in laggard communities and optimize the obtained results. Based on the *Marsciano Community* experience, for example, the benefit of including different energy users within an EC is apparent, particularly regarding energy access and availability. Moreover, generally relevant lessons can be learned from the pioneering Dutch experience regarding the need for increased flexibility, improved market access for energy communities, and the development of the most proper tax policies.

Accordingly, the outcomes of this study represent valuable insights for policymakers and experts—including professionals and companies—who support the energy transition through energy communities. Indeed, the presented investigation paves the way toward a more conscious understanding of the main barriers these stakeholders will face and should overcome during the definition of the related policies and the concrete development of ECs. Furthermore, this study could also convince final users, such as family householders, to adopt this innovative approach. Finally, it may represent a reliable reference guide on ECs, their benefits and limitations, and their day-to-day management.

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