

D2.2. Energy Communities barriers, needs and best practices analysis



Deliverable Information Sheet

Version

Grant Agreement Number	101076753
Project Acronym	LIFE21-CET-ENERCOM-COMANAGE
Project Title	Developing a transnational governance and holistic integrated services framework supporting the sustainability of European energy communities
Project Call	LIFE-2021-CET
Project Duration	36 months
Deliverable Number	D2.2
Deliverable Title	Energy Communities barriers, needs and best practices analysis
Deliverable Type	R - Document, Report
Deliverable Dissemination Level	PU - Public
Work Package	WP2
Lead Partner	ANESE
Authors	Agustín Villar (ANESE) Hugo Madureira (ANESE) Flavia Trovalusci (AISFOR) Marina Varvesi (AISFOR) Giorgio Scavino (ANCI LAZIO) Irina Theodorakopoulou (COOPABILITY)
Contributing Partners	ANESE ; AISFOR ; CO-OPABILITY ; METROPOLIS ; ECOSERVEIS ; ANCI LAZIO ; AMB ; KMA
Reviewers	Joana Mundó (ECOSERVEIS), Marcello Avanzini (ECOSERVEIS), Xavier Reig (ECOSERVEIS), Federica Giardina (ECOSERVEIS)

Official Due Date	30/04/23
Delivery Date	27/04/23
Resubmission Date	02/09/2024

History of changes

Version	Date	Comments	Main author(s)
1.0	15/03/2023	Draft of the first version	Agustín Villar (ANESE) Hugo Madureira (ANESE)
1.1	23/3/2023	Contribution	Irini Theodorakopoulou (COOPABILITY)
1.2	11/4/2023	Version for Peer review Check	Flavia Trovalusci (AISFOR)
2.0	21/04/2023	Integration of comments	Agustín Villar (ANESE) Hugo Madureira (ANESE)
2.1	24/4/2023	Review	Marcello Avanzini (Ecoserveis)
3	26/4/2023	Final version	Agustín Villar (ANESE) Hugo Madureira (ANESE)
3.1	27/04/2023	Review of the Final Version	Joana Mundó (Ecoserveis) Federica Giardina (Ecoserveis)
4	30/08/2024	Chapter 3 (Approach) revised according to comments from the Project Advisor	Agustín Villar (ANESE) Hugo Madureira (ANESE) Cristina Ramos (Ecoserveis)

List of Acronyms

BM	Business Model
BMC	Business Model Canvas
BoC	Board of Control
BoD	Board of Directors
CEC	Citizen Energy Community
CEP	Clean Energy Package
DSM	Demand Side Management
EC	Energy Communities
ECBM	Energy Community Business Model
ECGT	Energy Community Governance Toolkit
ESCO	Energy service companies
EU	European Union
GA	General Assembly
IDAE	Instituto para la Diversificación y Ahorro de la Energía
IEMD	Internal Electricity Market Directive
kW	Kilowatt
MW	Megawatt
OIS Hub	Operational Integrated Services Hub
P2P	Peer-to-peer
PA	Public Authority
REC	Renewable Energy Community

PV	Photovoltaic
RED II	Renewable Energy Directive Recast for 2030
SC	Supervisory Committee
TIAD	Testo Integrato per l'Autoconsumo Diffuso
V2B	Vehicle-to-Building
V2G	Vehicle-to-Grid

List of Tables

Table 1.	CEC vs. REC	14
Table 2.	Regulatory status of CECs and RECs in pilot countries	17
Table 3.	Barrier identification – literature review.....	22
Table 4.	Barrier identification - inputs from the interviews and COMANAGE consortium.....	24
Table 5.	Business model identification in OIS Hubs Countries Interviews	33
Table 6.	Financial instruments potentially usable by ECs	37
Table 7.	Energía del Prat – Spain.....	40
Table 8.	Osona model – Spain	41
Table 9.	Bioenergiedorf Jühnde eG – Germany	42
Table 10.	Eno Energy Cooperative – Finland.....	43
Table 11.	RevoluSolar – Brazil	44
Table 12.	Fetlar Wind – United Kingdom	45
Table 13.	Renewable Energy Project (PRIER) – Argentina	46
Table 14.	Hotoku Energy – Japan	47
Table 15.	Village Lighting Scheme (VLS) – Timor Leste	48

Table 16.	Best Practices Summary	49
Table 17.	Traditional agricultural cooperative characteristics	51
Table 18.	Interviews summary	67

List of Figures

Figure 1.	Categorization of selected barriers	25
Figure 2.	Emerging ownership models adopted by agricultural cooperatives - Source: Chaddad and Cook (2004, p. 352) ..	51
Figure 3.	Ownership models adopted by traditional agricultural cooperatives - Adapted from Chaddad & Iliopoulos (2013, p. 7)	53
Figure 4.	New internal governance models adopted by agricultural cooperatives - Adapted from Chaddad & Iliopoulos (2013, pp. 8-9)	54
Figure 5.	Sum-up of the three pilot's knowledge gaps & legal frameworks	59

Disclaimer

This document reflects the views of the author(s) and does not necessarily reflect the views or policy of the European Commission. Whilst efforts have been made to ensure the accuracy and completeness of this document, the European Commission is not responsible for any use that may be made of the information it contains nor for any errors or omissions, however caused. This document is produced under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

Table of Contents

Deliverable Information Sheet	1
History of changes	2
List of Acronyms	3
List of Tables	4
List of Figures	5
Disclaimer	5
Table of Contents.....	6
Executive summary	8
1.1. About the COMANAGE project.....	8
2. Background and Objectives.....	9
3. Approach	10
4. Introduction to EC.....	13
4.1. EU regulatory framework.....	13
4.2. Overview of regulatory framework on EC in the project pilots' countries	15
4.2.1. Spain (REC partially transposed and no transposition of CEC)	15
4.2.2. Italy (REC and CEC transposed)	16
4.2.3. Poland (CEC proposed and no transposition of REC)	17
5. Barriers and challenges of energy communities' projects.....	18
5.1. Summary of literature Review and interview inputs	18
5.2. Categorization of the identified barriers	24
6. Business models for EC initiatives	30
6.1. Public-private collaboration business models	34
6.1.1. Energía del Prat	34
6.1.2. CEL Management	35
6.1.3. Solurgy / El Padul.....	35
6.2. Potential financial schemes.....	36
7. Case studies in the EU and beyond.....	39
7.1. Selected Case Studies	39
7.2. Best Practice identification	49
7.3. Learning from organizational designs in other sectors	50

7.3.1. Innovations in the ownership structure	50
7.3.2. Innovations in the internal governance model	53
8. Learning and capacity Building needs - Analysis.....	56
8.1. Italy.....	56
8.2. Spain	57
8.3. Poland.....	58
8.4. Conclusion.....	59
9. Conclusions and recommendations to be considered for the ECGT.....	61
10. References	64
11. Annexes	66
11.1. Annex 1 – Interview summary.....	66
11.2. Annex 2 – Survey text.....	67
11.3. Interviewer guidelines.....	69
11.4. Dialogue Interview guide	70

Executive summary

1.1. About the COMANAGE project

Over the past years, several projects boosting energy communities have seen the light around the EU. The launch and implementation of these initiatives carried out -among others- by projects in which the members of the COMANAGE partnership participate, has made it evident that once started energy communities' projects often struggle to take-off. The COMANAGE proposal originates from this experience, with the aim of tackling and counteracting the main governance and management barriers - including a series of legal, administrative, financial, social, and organizational hurdles - faced by citizen-led and public-participated energy communities' projects.

It will do so by creating a methodological and operational **Energy Communities Governance Framework**, and by equipping public authorities involved in energy communities' projects with a set of integrated services, supporting mechanisms and tools aimed at facilitating the management and governance of energy communities and other forms of citizen-led energy initiatives, ensuring their growth and sustainability in the medium and long term: the **Energy Communities Governance Toolkit**.

The final goal of the project will be twofold: first, to ensure that energy communities' projects that have already been set-up can take-off and grow in the medium and long term. Second, to encourage and stimulate the uptake of new community-owned energy projects. With this goal in mind, the project will on one hand operationalize a transnational network of knowledge and competence providers; on the other, it will mobilize, engage, and operationalize key stakeholders around three Operative Integrated Services Hubs to be established in three Pilot Cases across the EU represented in the consortium by the Metropolitan Area of Barcelona in Spain (AMB), the Krakow Metropolis Association in Poland (KMA), the Lazio National Association of Italian municipalities in Italy (ANCI LAZIO).

2. Background and Objectives

Based on the results of the preliminary research and work already developed at proposal stage, this task has performed an in-depth analysis of the governance barriers, challenges, and opportunities that citizen-led and public-participated energy communities' projects - around the EU and within the COMANAGE pilot cases - are facing (including financial, legal, administrative, social, and organizational aspects). Best practices around and outside the EU have been identified. Synergies and replication of other awareness-based cooperative actions models outside the energy sector have also been identified. A variety of techniques have been employed, including desk research, dialogue interviews, focus groups, and workshops. A deep investigation of how an energy community works overtime, how is its governance structured, what are the cash flows, and what services are provided has been conducted, setting a solid understanding of the business models in use within the Operational Integrated Services (OIS) Hubs' areas/countries that will provide a robust base for further investigation to be carried on in later stages.

Learning and capacity building needs and methodologies has dealt with the identification of knowledge and capacity building gaps among public authorities' staff and energy communities' managers, and with the development of the COMANAGE learning and capacity building methodologies to be implemented at a later stage. The analysis of the learning needs has been carried out through surveys/questionnaires and dialogue interviews involving the COMANAGE metropolitan and regional governments' staff members, members and managers of cooperatives and energy communities' projects and the other key stakeholders mobilized around the local OIS Hubs (WP3). As a result, learning and capacity building needs for the management and governance of energy communities' projects have been identified, enabling the consortium to build the resources needed to fill in the gaps by creating bridges between institutional leadership and citizens. This task has also dealt with the development of the project learning methodologies, in particular establishing the methodology for the physical and online training to be delivered; establishing the methodology for Trainer to Trainer, experiential learning and mutual learning, and in particular the training of the Hub Managers and the stakeholders' mobilization and mutual learning; establishing the methodology for knowledge transfer from the OIS Hubs towards the Replicators through Peer Coaching.

Overall, the contents of this report illustrate the pilot cases' state of the art in the energy communities' field. It includes an analysis of barriers, obstacles, challenges, and needs related to the management and governance of energy communities within the OIS Hubs' areas/countries, as well as a study of the business models that enable public-private cooperation in energy communities and an analysis of the learning and capacity building needs identified.

3. Approach

This is a preliminary report, intended to lay a common foundation for most of the subsequent work to be developed within the COMANAGE project. It has four main components:

- *Barriers and challenges faced by Energy Communities (ECs).*
- *Capacity building needs, primarily within the Public Authority (PA) staff.*
- *Investigation of current practice in different countries – best practices.*
- *Different EC business models – description and brief characterization.*

There is a plethora of reports on Energy Community implementation barriers and challenges, but, especially in the context of the COMANAGE Hub countries, there is not much written on the continuity barriers and challenges that a successful EC must overcome in order to assure its long-term survival. Although all the barriers, needs, and best practices will be mentioned, the main focus of this report will be on the sustainability and continuity of the ECs, highlighting the governance and business model hinderances and the long-term strategies of public authorities that are most likely to succeed.

In preparing this report, all the available resources have been tapped into. Gaining access to the COMANAGE consortium partners own knowledge, both on aspects directly connected to Energy Communities and on other related aspects, was the intention of the focus group activity developed during the kick-off meeting in Barcelona with the consortium partners. This activity brought a preliminary qualitative understanding of the main barriers, challenges, and opportunities—organized into various categories—faced by Energy Communities in different countries, drawing on the participants' prior knowledge. The partners were divided into three groups (one per country, including the pilot partner and its knowledge support partner) to discuss these issues, guided by a semi-structured questionnaire. At the conclusion, the groups shared their findings, enabling the identification of common themes and key barriers, challenges, and opportunities related to the governance of energy communities in the pilot countries.

Based on the information gathered in the initial activity, abundant literature on the relevant topics has been analysed as part of the desk research process. This served to gain insight into the subject in a structured way, building upon the work of others to develop an adapted classification of the barriers and challenges that facilitates the analysis process.

An online workshop focussed on validating the main barriers identified and on discussing possible solutions was organised with the consortium partners to go into more detail of the main issues identified in the Kick off meeting and the literature review. This discussion also served as an introduction to the first common discussion on the EC governance and management toolkit composition.

Data that had been gathered in the literature review phase has been completed with more locally relevant information extracted from interviews that have been set-up with stakeholders, ranging from companies and PAs that foster the creation and activity of ECs to the civil society participants. In this regard, semi-structured interview guidelines were developed and supplemented with questions addressing the capacity-building needs identified by the interviewees,

intended for use in WP4 during the training design. The initial target was a sample of 20 interviewees, as research¹ suggests that 12 to 20 interviews are often sufficient to achieve representativeness in qualitative studies and to avoid saturation. The final number of interviews reached 23, comprising key stakeholders from the public sector and energy communities in the pilot countries (for more details, see Annex I).

This gives a very broad view of the Energy Community panorama in the OIS Hub countries, enabling a transversal understanding of the whole process of creation and operation of the ECs, and these interviews have also served to identify the knowledge gaps and capacity building needs of the majority, if not all, the involved parties. More in detail, the capacity building needs of the three countries, Italy, Spain, and Poland, were addressed as well through interviews and literature review of the past and ongoing experiences of Energy Communities in these countries. These interviews aimed at acknowledging how the lack of know-how in setting up, implementing, and expanding the communities is hindering their deployment, with an additional focus on Public Administration staff, and, thus, how tailored capacity-building programs can support the overcoming of several barriers.

World Café discussions were initially planned; however, after consulting with the pilot partners, it was decided to integrate them into the OIS Hub meetings to avoid overwhelming participants with too many sessions. The experienced pilots expressed concern that holding separate sessions might discourage participation in later stages. Additionally, the interviews, literature review, focus groups with partners were highly productive, revealing repetitive patterns that helped categorize barriers. As a result, the World Café tool was not used in this first phase of analysis, but the OIS Hub meetings validated the barriers, challenges, and opportunities identified in this task.

The Dialogue Interview technique has been used to get information from the stakeholders regarding the different business models. The different business models identified have been classified based on existing studies. The Business Model Canvas template has been used to prepare a brief description of each of the BMs, with view to preparing an in-depth study to be completed further on.

Through a process of desk research, several EC-related initiatives around the globe have been identified, these have been complemented with some other cases identified during the stakeholder interview process conducted during the initial phase of this work. In some instances, cases located outside the EU do not strictly conform to the definitions of REC or CEC, but in general these examples have been considered worthy of being included in the best practice recommendations for the points they do share in common. In the case of the USA the Energy Community definition is so intrinsically different from the European concept that an analysis is impossible in the context of a brief state-of-the-art comparison such as this one, and that is why no example was included.

On the other hand, to provide an in-depth overview on the possible business models, the final part of this deliverable casts light on emerging, innovative organizational models adopted by bottom-up initiatives in other sectors. Herein, as the main objective of COMANAGE is to tackle governance barriers for a long-term sustainable strategy, the agri-food sector has been taken as reference point, primarily because the agri-food sector during the last few decades, has been developing through agricultural cooperatives innovative models proving a higher sustainability and endurance. Beside this main aspect. Herein we list those that are clearly affecting the implementation of a sustainable business model: 1) the supply chain which shows features and complexity in term of coordination among different stakeholders in both sectors; 2) the progress done towards a higher sustainability aiming at reducing the impact produced by both sectors on

¹ Knott, E. Et al. (2022): Interviews in the social sciences. Nature Reviews Methods Primers volume 2, Article number: 73 (2022)

the environment; 3) the local communities involvement in decision-making processes; 4) the integration of renewable energy sources like solar panels or wind turbines and the implementation of a model focused on circular economy.

4. Introduction to EC

Energy Communities (ECs) are gaining increasing attention as a promising solution for decentralizing and democratizing energy production and management. An EC is a group of citizens, local authorities, and/or businesses who cooperate to produce, consume, and manage energy in a community-based approach, with the aim of achieving economic, social, and environmental benefits.

By empowering local communities to take control of their energy generation and consumption, energy communities can help to create more resilient and sustainable energy systems, reduce greenhouse gas emissions, and improve energy access and affordability for all. The overarching goal of energy communities is to promote sustainable and renewable energy services, reduce energy costs and improve access to clean energy sources. ECs could take many different forms, ranging from small, local initiatives to larger-scale, regional or even national projects. By pooling resources and sharing energy generation and distribution infrastructure, community members can collectively benefit from economies of scale and reduce their reliance on traditional energy providers.

4.1. EU regulatory framework

The regulatory framework for energy communities in Europe is governed by the Clean Energy Package (CEP)² adopted in 2019, which includes a range of measures to support and facilitate the development of energy communities.

The CEP is mainly composed of the Renewable Energy Directive (2018/2001/EU) (RED II) and the Internal Electricity Market Directive (2019/944/EU) (IEMD), which provide a legal basis for the creation and operation of energy communities in EU member states. Article 22 of the RED II introduces the “Renewable Energy Communities”, whereas article 16 of the IEMD introduces the “Citizen Energy Community”.

According to Article 2(16) of Directive (EU) 2018/2001 “*renewable energy community* means a legal entity:

- a. which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity;
- b. the shareholders or members of which are natural persons, SMEs (small and medium-size enterprise) or local authorities, including municipalities;
- c. the primary purpose of which is to provide environmental, economic, or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits”.

According to Article 2(11) of Directive (EU) 2019/944 “*citizen energy community* means a legal entity that:

- a. is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises;

² For more information about the *Clean Energy Package* visit: https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en

- b. has for its primary purpose to provide environmental, economic, or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and
- c. may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders”.

Each member state is responsible for transposing these directives into national law, resulting in varying levels of support and regulatory frameworks for energy communities across Europe. Some member states have additional regulations or incentives for EC, while others have yet to fully implement the directives.

Despite the two different definitions, the two types of energy communities share major commonalities:

- Require a legal entity as a community umbrella.
- Must be voluntary and open.
- Should be primarily value driven rather than focusing on financial profits.

Type	Activities	Markets	Participation	Geographical scope	Members	Effective control	Purpose
Citizen Energy Community (CEC)	Production, consumption, sale and storage of energy. Aggregation, recharging services and EE, Operation or management of distribution grids.	Focus on the electricity sector.	Open and voluntary participation.	Doesn't imply vicinity - no geographic restrictions.	Open to any actor.	Exercised by the partners or members. Decision-making powers are reserved to those who are not involved in large-scale economic activity and for whom the energy sector is not their main field of economic activity.	Environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits,
Renewable Energy Community (REC)	Production, consumption, sale and storage of energy.	Any market (electricity, thermal energy), as long as the energy comes from renewable sources.	Free entrance and exit.	Must be in the vicinity' of projects owned/developed by the community.	Restricted Membership – Natural persons, local authorities, MSMEs.	Exercised by members in the vicinity of the facility. The REC has autonomy from individual members and other traditional market actors participating in the community as members or shareholders.	

Table 1. CEC vs. REC

Also, despite the similarity of the two definitions, RECs and CECs have differences:

- CECs may produce energy even from non-renewable sources;
- RECs are subject to a proximity principle which limits the territorial extension of the community; a medium enterprise must not join a CEC, while it is eligible as a REC member (big undertakings are excluded from both);
- the participation in a REC must not be the primary commercial or professional activity of a private enterprise, while it appears to be allowed for the CEC.

The aim of COMANAGE is to comprehend the present state of Energy Communities concerning their regulatory, social, and economic aspects. The project consortium will make endeavours to create tools that ensure the long-term sustainability of ECs. For the purpose of the project, we understood the term “Energy Communities” as collective actions that encompass or closely align with the definition of RECs, in other words, projects that utilize renewable energy generation sources, situated in close proximity or within a locality and exhibits a significant degree of public sector

participation. Many European countries have started to transpose the CEP provisions into their national legislation, and some have already developed specific regulatory frameworks for energy communities. However, there are still variations in the implementation of EC regulations across different countries, and some countries are still in the process of developing their frameworks. Overall, the regulatory framework for ECs in Europe is still evolving, with ongoing discussions and proposals at the EU level to further support and incentivize their growth.

4.2. Overview of regulatory framework on EC in the project pilots' countries

Most of European Union (EU) countries have yet to fully implement the required definitions into national law, or in some cases, have not done so at all, despite the June 2021 deadline for transposition. This lack of adequate transposition may lead to legal and regulatory discrepancies between member states. Below an overview of the key regulatory advancements related to ECs within the project's pilot countries is presented.

4.2.1. Spain (REC partially transposed and no transposition of CEC)

Spain introduced the definition of RECs in Royal Decree-Law 23/2020³, which approves measures in the field of energy and in other areas for economic reactivation. They had also opened a consultation with specific questions on local energy communities. In the preamble of the Royal Decree, it is mentioned that the introduction of RECs is aimed at the participation of citizens and local authorities in renewable energy projects, which will allow a greater local acceptance of these energies and a greater participation of citizens in the energy transition. In this legal instrument, besides defining RECs and incorporating them as a new actor in the market, the law establishes that in competitive procedures, the particularities of RECs will be considered so that they can compete for access to the remuneration framework on an equal basis with other participants, all in accordance with community regulation. The definition of RECs is a copy-paste of the EU definition, without any elaboration on what each term means.

There is not concrete delimitation of the types of legal entities that could be used to develop RECs. Moreover, there are no powers given to a regulatory authority to oversee the definition. This could give rise to abuse and lack of trust/clarity in the concept by citizens. The [Spanish National Energy and Climate Plan](#) foresees several measures to foster energy communities. Energy communities are also mentioned in the Recovery, Transformation and Resilience Plan "España Puede"⁴, in its chapters on the Urban and Rural Agenda, and on the Fair and Inclusive Energy Transition. Also, they are mentioned in the National Long-term Strategy document [España 2050](#), in its Sustainability and Climate Change chapter. The National Institute for Energy Diversification and Savings⁵ (IDAE, a government agency) has published a guide on the development of Local Energy Communities. Although the definition of RECs was not completely transposed, numerous ECs were subject to regulation through the conditions and requirements of different grant programs designed to establish and develop such communities⁶. The latest addition to the + Seguridad Energética Plan⁷ measure, introduces the promotion of energy communities by establishing the legal status of RECs. This entails defining the administrative

³ The *Spanish Royal Decree – Law RDL 23/2020* is available in Spanish here: <https://www.boe.es/buscar/act.php?id=BOE-A-2020-6621>

⁴ For more information about the *Recovery, Transformation and Resilience Plan "España Puede"* visit: <https://www.fondoseuropeos.hacienda.gob.es/sitios/dgpmrr/es-es/Paginas/plan.aspx>

⁵ Instituto para la Diversificación y Ahorro de la Energía

⁶ The Spanish Order *TED/1446/2021* is available in Spanish here: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-21343

⁷ For more information about the Plan +SE visit: <https://www.miteco.gob.es/gl/ministerio/planes-estrategias/seguridad-energetica/default.aspx>

procedures required for their recognition, determining the rights and obligations of the communities and their members, and specifying support system design particularities. On April 21st, 2023, the Ministry for the Ecological Transition and Demographic Challenge (MITERD) released a public consultation regarding the draft text of a Royal Decree (RD) aimed at regulating the legal frameworks for Renewable Energy Communities (REC) and Citizen Energy Communities (CEC).

4.2.2. Italy (REC and CEC transposed)

Italy has transposed the REC definition in a first phase, through the enactment and conversion into law of DL 162/19⁸ (the so called *Decreto Milleproroghe*) and subsequently with DLgs 199/2021⁹ and the CEC definition with the DLgs 210/2021¹⁰. The RECs definition refers to most of the criteria contained in the RED II definition, including autonomy and effective control, which were not touched upon in previous legislation. It stands side-by-side with the collective self-consumption definition, presuming an inherent technology focus for RECs, which may limit their ability to operate across the energy system. The new legislation increased the previous cap on capacity, which now cannot exceed 1MW for each REC's plant. Also, the geographical proximity has been changed with the new legislation and has been defined as consumption points connected under the same medium voltage station. The CEC definition touches upon the open and voluntary membership and effective control, the different activities that they can undertake, while the law states that CECs can take any legal form, as long as it is clearly stated that the main aim of the community is to bring environmental, social and economic benefits at the local community where they operate, as financial profits cannot be the main aim of the community (article 14(6)). Interestingly, both REC and CEC provisions explicitly promote inclusiveness by mentioning the need to ensure participation is open to low-income or vulnerable households.

There is an expectation that the criteria that have been included in the decrees will be further specified in by-laws, for instance the requirement of proximity and the autonomy criteria. In this regard, on 4 January 2023, the ARERA resolution, known as TIAD (*Testo Integrato per l'Autoconsumo Diffuso* - Integrated Text for Diffuse Self-consumption), was adopted, in addition to the previous resolutions, promulgated in compliance with Decrees 199/21 and 210/21. The TIAD regulates the requirements, methods, and procedures for access to the provision of the service for diffuse self-consumption (collective self-consumption, renewable energy communities, citizens' energy communities and individual self-consumers), updating the relevant regulatory framework and simplifying certain procedures. This resolution, on the one hand, confirmed some of the previous provisions, such as the definitions of the different configurations for self-consumption as well as the right to choose one's own electricity supplier by all those involved, and on the other hand made some changes. The main changes concern the configurations for RECs, even existing ones, which are given the possibility to extend within a larger area (market zone for shared energy and area under the primary cabin for the valorisation of consumed energy) and the inclusion of plants with a power output of more than 200 kW. The TIAD will enter into force on 1 March 2023 or at the same time as the issuance of the Ministry of the Environment and Energy Security's decree containing the new incentives for widespread self-consumption, if later. The issuance of the latter decree and the subsequent update of the GSE Technical Rules will finally conclude the regulatory process.

⁸ The DL 162/19 is available in Italian here: <https://www.gazzettaufficiale.it/eli/id/2020/02/29/20A01353/sg>

⁹ The DLgs 199/2021 is available in Italian here: <https://www.gazzettaufficiale.it/eli/id/2021/11/30/21G00214/sg>

¹⁰ The DLgs 210/2021 is available in Italian here: <https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2021-11-08;210>

4.2.3. Poland (CEC proposed and no transposition of REC)

The legislative environment in Poland is still underdeveloped, and changes are being prepared to facilitate EC development. Poland has three types of broadly understood ECs: energy cooperatives, energy clusters, and collective renewable energy prosumers. Energy clusters are the most common, with 66 officially certified by the Ministry of Energy. The main shortcomings of the EC framework in Poland, in terms of implementing the Renewable Energy Directive II, are that energy clusters are not legal entities, large enterprises are allowed to participate in ECs and energy clusters, but they are not allowed to effectively control them¹¹.

The Government has proposed legislation on CECs, while it is also working on developing provisions for RECs. The transposition of the CEC in the proposed legislation technically covers the requisite for participation criteria. It details a standard of effective control, which will help establish legal clarity. However, there is an inherent geographical proximity requirement for CECs, which will significantly limit the scope where CECs can operate, potentially violating their rights to participate in activities that are covered by EU legislation. Additionally, in the directive geographical proximity is not a requirement for RECs, meaning that the proposed national legislation would be overly restrictive. The stated purpose of a CEC in the proposed legislation is also more restrictive and based on technical activities than the Electricity Directive, which is framed around social innovation. Given the expansive number of legal entities allowed to become CECs, the lack of an oversight or compliance mechanism creates a significant risk of abuse.

Poland's energy transformation strategy is envisioned in the Energy Policy of Poland with a horizon to 2040 (PEP2040) and the National Energy and Climate Plan with a horizon to 2030 (NECP). Both documents recognize the need to modernize electricity distribution systems, as the energy system will undergo decentralization, which seems to be of primary importance for the development of ECs in Poland¹².

	Type	 Spain	 Italy	 Poland
Regulatory status	Citizen Energy Community (CEC)	✗	✓	✗
	Renewable Energy Community (REC)	✓	✓	✗

Table 2. Regulatory status of CECs and RECs in pilot countries

¹¹ Deutsche Energie-Agentur (Publisher) (dena, 2022) "Best practices for energy communities in Poland and Germany"

¹² REScoop.eu published a tool to tracking and compared the progress of the development and implementation of the CEC and REC enabling frameworks in all 27 Member States.

5. Barriers and challenges of energy communities' projects

The objective of this section is to carry out an in-depth analysis to identify, describe and summarize the most common barriers faced by ECs projects during the different phases of their lifecycle: creation, implementation, and continuity.

Different methods or approaches can be used to assess the magnitude of the EC barriers: desk research, direct measurement using indicators, indirect measurement based on market observations and rankings based on expert opinion and/or stakeholder feedback through surveys, interviews, or workshops (expert/participative assessment). Desk research and, also, interviews and workshops with experts will be explored in some more details here.

Firstly, a literature review was done (explained in more detail below). At the same time a questionnaire was created to conduct interviews with various experts' representative of the OIS Hubs aiming to identify barriers and challenges related to the mid and long-term sustainability of ECs, including governance and management barriers, and knowledge and capacity-building gaps among public authorities' staff and energy communities' managers, to develop, in a second phase, several guidance tools, and also the COMANAGE learning methodology.

To coordinate the interviews, an interview contact file was created, to identify interviewers and interviewees, and the responsible partner. The interviews in Italy were carried out by AISFOR and ANCI LAZIO, in Spain by ANESE and ECO, and in Poland by KMA. A total of 22 interviews were carried out: 6 in Spain, 13 in Italy and 3 in Poland. The interviewees included different experts with diverse backgrounds, such as municipal technicians, university professors, citizens, and consultants, providing a wide range of perspectives. (For more detail see Annex 1)

5.1. Summary of literature Review and interview inputs

In academic and policy literature, there has been a lot of research done on actual and potential obstacles/barriers/challenges for ECs. According to the Oxford Learner's Dictionary¹³ a barrier is "*a problem, rule or situation that prevents somebody from doing something, or that makes something impossible*". Also, terms like constraint, hindrance, obstacle, and burden are used to describe barriers. In the course of an EC project's evolution, several barriers typically arise, stand in the way of the growth, functioning and sustainability of ECs.

With the aim of finding out which are the most common barriers to the development of ECs, in the following we will present an initial approximation on barriers that commonly ECs exhibit across European Union (EU) countries.

The initial approach or methodology utilised to comprehend the most frequent obstacles in ECs initiatives was to conduct a literature review. The subsequent list enumerates and gives a summary of the studies, papers, and reports whose utilization held the greatest significance according to the deliverable objectives.

¹³ Oxford University Press, 2022.

- **DECIDE (2021). Report D3.2 “Structured overview of existing and emerging business models, related contractual conditions and recommendations”:** drawing from the knowledge acquired through the DECIDE pilot projects and the collective experiences of DECIDE consortium (composed of different institutions representing Belgium, Germany, Austria, Estonia, Greece) along with the insights gained from public workshops organized by the DECIDE project in collaboration with other initiatives, several barriers to the efficient expansion and operation of energy communities and collective actions have been identified. These impediments primarily focus on business models.
- **New Clean Energy Communities in a Changing European Energy System – NEWCOMERS (2021). Deliverable 3.3 “Energy communities in different national settings – barriers, enablers, and best practices”:** the report is based on prior research and the national characteristics in the six studied NEWCOMERS countries: Germany, Italy, the Netherlands, Slovenia, Sweden, and the United Kingdom. Those six countries are compared with the aim to identify barriers and enablers for new clean energy communities to emerge in different national settings and to discuss the potentials for sharing insight. The focus for the analysis lies on socio-economic conditions, the technical system, the institutional setting, and actors on the electricity market.
- **SHAREs (2022). Report D3.2 “Handbook of identified barriers and enablers”:** it aims to identify a complete picture of obstacles in founding, preserving, and expanding ECs. To carry out that task, several methodological approaches were applied: interviewed to gather international hands-on experience with legal and socioeconomic restrictions, desk research and dialogues with policy developers. The literature review includes different papers, such as:
 - Vasco Brummer (2018) reviewed the experience of the UK, the USA and Germany to summarize the benefits and barriers for energy communities in those countries. The information about benefits and barriers is mainly collected through analysing existing peer-reviewed articles.
 - Khadem Sh. (2020) developed a report on community energy policy and barriers in the frames of Pan European Technology Energy Research Approach (PANTERA). The project covers the following countries: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia.
 - Friends of the Earth Europe (2021): provides analysis of barriers and threats for community energy project in Germany, France, the Netherlands, and Denmark. Main outcomes of the report are identified barriers and threats based on the analysis as well as solutions and recommendations for overcoming them.
 - Peeters L., (2021) review existing literature on local energy community (LEC) barriers and challenges, presenting successful cases of ECs in Europe and provide analysis of barriers and enablers in the context of realized projects. The barriers were grouped in three major categories: socio-economic, technical, and institutional and regulatory.
 - Lazdins, R (2021) review the scientific literature published during 2015-2021 to find solutions for PV energy communities. The analysis is based on 64 publications and focuses on several barriers for the energy communities: policy, trading model, economic assessment, business models, energy management, demand response, modelling tools and consumer adoption.
 - Aoidh A., Local Energy Community (LECo) policy paper identifying common barriers to community energy development through the Political, Economic, Social, Technological, Legislative and Environmental analysis, covering 5 European countries: Finland, Ireland, Norway, Sweden, and Germany.

The result was the development of a handbook of barriers and enablers (legal, regulatory, and socioeconomic) for the implementation/build-up/uptake of energy communities aims to support policy developers in making legal and regulatory frameworks more easily understood by ECs.

- **RESCOOP (2022). Assessment of Barriers and Drivers for Energy Communities: Literature Review:** to identify the most suitable methodologies for address barriers and drivers to ECs across EU Member States, a comprehensive study was conducted. This involved an exhaustive literature review and a series of interviews and surveys with a diverse range of subject matter experts. It should be noted that some of the academic works reviewed in this study have already been mentioned previously. Those that have not been mentioned so far are presented below.
 - Walker (2008) identifies different incentives and barriers for the development of community renewable energy projects in the UK.
 - Busch et al. (2021) investigate policy barriers or “challenges” and summarize these under different headings: directionality (i.e., breakdown of global targets), demand articulation (i.e., type of support that enables economic viability), (space for) experimentation and policy learning and coordination challenge.
 - Bauwens (2016): examine the changing role of ECs in the wind sector in Denmark, Germany, Belgium, and the UK by considering the energy system as a social-ecological system.

The report finally present a summarized list of barriers and drivers for ECs , grouped into four categories: business case and legal framework, market access and structure, informal institutions and conflicts and resources.

During the preparation of this report, it has been noted that not many documents focus on Spain, Italy, and Poland – COMANAGE pilot countries. Maybe the easiest explanation for this is that the ECs are still few and very recent in these countries, and the regulatory framework is right now only beginning to be clarified.

The main barriers that were identified have been compiled and presented in Table 3 in a regrouped form. The table includes various categories or typologies that are indicative (does not have a specific definition), enabling later analysis, evaluation, and comparison in an organized manner.

Category	Barrier	Source
Administrative	Support schemes for renewable energies do not have the right form, are too complex, change too often.	RESCOOP - Model Assessment of Potential and Barriers
	Licensing procedures are cumbersome and/or take long times with uncertain outcomes	RESCOOP - Model Assessment of Potential and Barriers
	Grid connection including complicated application procedures costs, time, and complexity.	SHARE D3.2
Economic/Financial	Uncertainties related to ownership of installations.	DECIDE D3.2
	High membership fee.	NEWCOMERS. DELIVERABLE 3.3
	Few Dominating market actors.	NEWCOMERS. DELIVERABLE 3.3
	Difficulty accessing financial capital due to poor definition of ECs.	RESCOOP - Model Assessment of Potential and Barriers
	Banks and other financial institutions do not lend to ECs or only at unfavourable conditions and/or not enough.	RESCOOP - Model Assessment of Potential and Barriers

D2.2. ENERGY COMMUNITIES' BARRIERS, NEEDS AND BEST PRACTICES ANALYSIS

	Lack of financial incentives due to non-cost reflective energy prices.	SHARE D3.2
	Lack of access to finance, grants, not fair and insufficient feed in tariffs.	SHARE D3.2
Governance	Multi-layer decision making and market power of incumbents.	DECIDE D3.2
	Long procedures/high quorum internal conflicts (heterogeneity).	RESCOOP - Model Assessment of Potential and Barriers
Knowledge/ Competences	Lack of knowledge, experience, and awareness to organise and build an initiative and to implement projects.	DECIDE D3.2
	Lack of Intermediaries - organisations or individuals that promote the exchange of best practices and information. They cooperate with local authorities and have access to wide ranging networks.	RESCOOP - Model Assessment of Potential and Barriers
	Members lack knowledge and expertise to develop more complex community energy projects.	RESCOOP - Model Assessment of Potential and Barriers
	Lack of competences/assets/capabilities.	RESCOOP - Model Assessment of Potential and Barriers
	Lack of knowledge (about technology, regulation, subsidies).	NEWCOMERS. DELIVERABLE 3.3
Political	Energy prices set by market mechanism, no correction for externalities.	NEWCOMERS. DELIVERABLE 3.3
	Time-consuming application for funding (especially due to lack of personnel and lack of qualification).	RESCOOP - Model Assessment of Potential and Barriers
	Fear of change or rejection of new things (risk aversion) in local politics and/or local administration.	RESCOOP - Model Assessment of Potential and Barriers
	Lack of access to politicians and policy makers.	NEWCOMERS. DELIVERABLE 3.3
	Bureaucracy and administration.	NEWCOMERS. DELIVERABLE 3.3; SHARE D3.2
	Burdensome bureaucracy and permitting.	RESCOOP - Model Assessment of Potential and Barriers.
	Non supportive energy agencies.	SHARE D3.2
	Lack of national strategies for ECs and targets.	SHARE D3.2
	Lack of institutional and political support.	SHARE D3.2
	Lack of clear policies and measures for ECs in the national legislation.	SHARE D3.2
	No incentives for DSOs to connect small operators to the grid.	NEWCOMERS. DELIVERABLE 3.3
Regulatory/Legal	Legal forms available hinder municipalities participation in ECs.	RESCOOP - Model Assessment of Potential and Barriers
	Problematic legal framework.	RESCOOP - Model Assessment of Potential and Barriers
	Definitions of RECs are unclear or change frequently.	RESCOOP - Model Assessment of Potential and Barriers
	There is no appropriate legal form for ECs.	RESCOOP - Model Assessment of Potential and Barriers

Social	Lack of time.	DECIDE D3.2
	Limited available land in more remote areas (e.g., islands) and land use conflicts (e.g., agriculture and tourism).	DECIDE D3.2
	Low disposable income.	NEWCOMERS. DELIVERABLE 3.3
	Resistance to RES Technology in territory.	RESCOOP - Model Assessment of Potential and Barriers
	Saturation effects: behavioural factors of individuals, but also of groups could slow down and prevent the development of renewable energies and ECs. The lack of expert knowledge, but also saturation effects, can be decisive factors.	RESCOOP - Model Assessment of Potential and Barriers
	Lack of understanding of the potential roles of the energy communities.	SHARE D3.2
	Lack of knowledge and trust.	SHARE D3.2
	Lack of experience with collective action and or EC.	SHARE D3.2
	EC is mostly prevalent in higher-income countries/regions.	SHARE D3.2
	Low environmental awareness, conflict between biodiversity protection and RES development.	SHARE D3.2
	Lack of trust in actors/processes.	RESCOOP - Model Assessment of Potential and Barriers.
Technological	Data access.	DECIDE D3.2
	Lack of smart metering and advanced data management systems.	SHARE D3.2

Table 3. Barrier identification – literature review

At the same time as the literature review was being carried out, two other approaches were being developed. During the kick-off meeting of the project held in Barcelona, examples of ECs from each of the countries within the OIS Hub were presented. A dynamic activity was conducted, where the consortium members identified the primary obstacles faced by these communities.

Also, at the start of this section, it was explained that over the course of February and March, several experts in energy communities from Spain, Italy, and Poland were interviewed. The purpose of these interviews was to gather practical knowledge and identify obstacles faced during various stages of EC development.

The main results of the inputs from the interviews and the COMANAGE consortium contributions are listed in Table 4.

Category	Barrier	Source
Administrative	Regional/national calls for proposals are not omni comprehensive.	Italy interviews
	Access to public grants lengthy and complicated.	Spain Interviews
	Legal form registration lengthy and complicated process, with a lot of red tape barriers and administrative requirements.	Spain Interviews

	Lack of universal, developed procedures, especially in the context of the last element of creating a cooperative.	Poland interviews
	Barriers and problems raised by the DSO: unavailable grid capacity or refusal to disclose the available capacities overall (DSO does not have or does not share data on connection points).	Spain Interviews
	Exaggerated response times of the DSOs to legalize self-consumption facilities.	Spain Interviews
Economic/Financial	No articulated product for CERs, it is a tailor-made and non-standardizable process.	Italy interviews
	Absence of certainty of the incentives.	Italy interviews
	When the main motivation for joining EC is economic, the grid price volatility and long-term tendency to lower could impact the EC business model and member benefits.	Italy, Spain Interviews
	Lack of awareness of what happens in the next phase (once EC were created)	Italy interviews
	Lack of knowledge on how to apply for funds for further investments.	Poland interviews
	Banks are still not involved in the funding process of an EC: only individual persons can ask for funding, not the EC.	Italy interviews
	Total dependency on external financing.	Italy interviews
	Funding difficulties: too much uncertainty about selling energy.	Italy interviews
	Lack of funding.	Italy, Spain, Poland interviews.
	Lack of financial entities buy-in into the EC model.	Spain Interviews
Governance	Discomfort of former members with no control of Limited liability company (LLCs).	KOM - Mureck
	Succession in leadership.	KOM - Mureck
	Dependency on external entities in the decision-making and management of the energy community.	KOM - San Giovanni a Teduccio
	Financing of full-time jobs (own team of experts).	Spain, Poland interviews
	Low participation. Frequent meetings between members. Decision power issues.	KOM - El Prat
Knowledge/Competences	Lack of competences: technical, social, legal/administrative on the part of the municipality staff, and on the part of the citizens.	Italy, Spain interviews
	Lack of know-how on ECs' concepts, e.g., shared energy and community engagement.	Italy, Spain interviews
	Lack of personnel and specific qualifications in the municipalities (need external agents to help them to develop the projects and carry out dissemination campaigns for citizens).	Italy, Spain interviews
Political	Main leader with lots of political power and influence.	KOM - El Prat
	Dependency on political situation of PA. What happens to the EC if there is a radical change in political will.	Spain Interviews
	Distrust, where the role of PA is lacking.	Italy interviews
	Local government/private entity involvement difficult: does not happen normally; local entity lacks figures to want to mediate with a private entity and vice versa.	Italy interviews
Regulatory/Legal	Lack of final transposition from EU directives. Slow legislative process: temporary frameworks, rules have changed over time	Italy, Spain, Poland interviews
	Lack of clear regulation - unclear impact of future changes or definitions.	

	Issues with cluster definition.	Poland interviews
	Transitional/waiting for final regulation: broader territorial scope, with goals that may change and in redistribution.	Italy interviews
	Contradiction regarding the legal form designated for the EC.	Italy interviews
	The introduction of EC in municipalities located in different autonomous communities, under distinct regulatory frameworks, impedes the swift adoption of the legal framework governing energy communities.	Spain Interviews
	Lack of frameworks (especially for private individuals who don't know where their investments are going to result into)	Italy interviews
Social	Little economic capacity of neighbours participating in the association.	KOM- San Giovanni a Teduccio
	Novelty - people don't know the model and don't "dare" participate without "guidance" or "being accompanied".	Spain Interviews
	No prior experience to cooperate, more individualistic.	Italy interviews
	Mistrust to implement an EC due to past bad experiences of collective actions in territory (cooperatives).	Spain Interviews
	Difficulty to engage two sectors: females and young adults.	Spain Interviews
Technological	Lack of digitalization.	Italy interviews
	Administrative management: difficult for smart management to be possible yet, as there is no effective smart grid because there is no regulatory structure for data management and cybersecurity, because the costs are high.	Italy interviews

Table 4. Barrier identification - inputs from the interviews and COMANAGE consortium

As both Table 3 and Table 4 show, certain barriers appear consistently in the analysis of different cases and experiences involving ECs. However, some of these barriers arise from unique characteristics and regulations established by different countries related to ECs. Among common barriers, one noteworthy constrain is **regulatory hurdles**, which stem from the absence of clear definitions for ECs in each country and their corresponding regulations. Another issue is administrative burdens, particularly those related to the establishment processes and grid connection of services offered by ECs. From an economic point of view, the general **lack of funding and the low involvement of relevant financial actors** constitute a robust barrier to the creation, implementation, and sustainability of ECs. Finally, from a social perspective, **bad experiences in collective actions, and lack of trust and generalized knowledge** are other factors that can jeopardize the continuity of an EC over time.

5.2. Categorization of the identified barriers

The literature review of selected academic papers and related project reports on factors hindering EC development, as well as the interviews and workshops that were carried out, revealed some country specific barriers, observable across the literature. Most of them are common or at least used to be common for most European countries, some are, however, country specific. In order to identify those barriers that have greater impact on, or pose a higher risk to, the sustainability of the ECs, mainly from the governance and management point of view, a structure has been created which allows the categorization of the barriers identified in one of six categories:

- **Political, Administrative, and Institutional support:** strategic actions of PA that may influence the development and/or implementation/build-up/uptake of energy communities. Example: lack of political support from local

representatives, non-supportive energy agencies, no RES support schemes, lack of national strategies for energy communities and targets.

- **Regulatory Framework and Legal Status:** factors pertaining to the legal and regulatory framework of the energy sector that affect implementation/build-up/uptake of EC. Example: lack of ability to operate in Peer-to-Peer (P2P) mode within electricity markets or lack of final transposition of EU directives.
- **Decision Making and Governance Structure:** factors that influence the continuity of the EC from the point of view of the legal form, member participation and control of the society. Example: low participation between members, dependency on external entities in the decision-making, discomfort of former members with no control of the EC.
- **Financial Scheme and Economic Sustainability of the Business Model:** factors that directly impact EC, influence the profitability of projects, and have resonating long term economic effects. Example: total dependency on external financing, lack of access to finance, grants, lack of financial incentives due to non-cost reflective energy prices, uncertainties related to ownership of installations.
- **Socio-economic Makeup of Partnership:** factors that influence developments of EC from society point of view, in general such as cultural trends, demographics, population analytics, acceptance of the technologies, etc. Example: community energy is mostly prevalent in the higher-income countries/regions (disposable income), conflict between biodiversity protection and RES development.
- **Others:** factors that influence the development of ECs which, due to their characteristics, cannot be included in the previous categories. For example: technological and environmental issues.

Upon grouping the barriers within the categories defined, those with the greatest significance or impact on the sustainability of the EC were singled out. To this end, an online workshop was held, where the members of the consortium validated the barriers with the highest impact on the OIS hub areas. It is important to clarify that the categories chosen to do not represent completely independent groups that could always be clearly delimited, and there may be some overlaps between them.



Figure 1. Categorization of selected barriers

- POLITICAL, ADMINISTRATIVE, AND INSTITUTIONAL SUPPORT:**

Bureaucracy and administration	Bureaucratic impediments and administrative obstacles are recurrently cited in various research related to ECs initiatives. Specifically, the implementation phase of new projects frequently encounters challenges arising from bureaucratic processes, including securing permits, grid connections, and attaining facility legalization. Lack of clear directives and regulation, responsibility of the PA, is at the root cause of the intricate and protracted nature of these procedures, that can prove overwhelming to community projects and may affect the sustainability of the EC. The huge administrative delays on the legalization of PV installations have a dual impact on financial sustainability of the business model, and also impact on the trust level of the associates. Related to incentives programmes for ECs, it is worth noting that tender procedures are almost always very complex.
Lack of PA involvement	Some interviews in Spain and Italy have highlighted the benefits of PA involvement in perceived levels of confidence and intrinsic reliability of the model. The participation of different stakeholders is enhanced by the tractor effect of PA involvement. The lack of involvement of the PA in EC projects leads to a general lower level of trust from all involved stakeholders.
Dependency of Political situation	Excessive dependency on the PAs leads to uncertainties in the face of changing political scenarios. The uncertainties about the fate of the EC in the event of a radical change in political will, can undermine the confidence of both partners and other relevant stakeholders, such as financiers. Boomerang effect: political change. Better to put more effort and implement a project in an area involving citizens/associations/businesses, than just relying on the administration (since if only the PA is committed, the risk of a not resilient REC increases).

- REGULATORY FRAMEWORK AND LEGAL STATUS:**

Lack of complete transposition of EU directives	Lack of complete transposition of relevant EU directives (IEMD and RED-II), due to slow legislative process results in long lasting temporary frameworks that fail to enhance confidence. Such lack of definition causes insecurity about legal forms or business models applicable/eligible. A substantial amount of the explanation of the differences between the countries studies resides in the legal framework ambiguity, or straight lack of normative development.
--	--

Lack of clear policies, regulation, and measures	Lack of clear policies, regulation, and measures for ECs – unclear impact of future changes or definitions. In Italy, the regulation allowed only users of the same low-voltage distribution grid to join the same EC, presently this has been extended to users of the same medium-voltage distribution grid. In Spain, the limit was first set on a 500m radius and now it has been changed to 2km. These changes in eligibility criteria strongly impact the Energy Community Business Model (ECBM), as well as their goals and objectives. There is no clear indication of the future tendency of these criteria. In Poland there are issues with unclear definition of “energy clusters” and how this match either one of the EC definitions proposed in the EU directives.
---	--

• **DECISION-MAKING AND GOVERNANCE STRUCTURE:**

Lack of knowledge and competences	• Lack of knowledge, experience, and awareness: technical, management, social, legal etc. to organise and build an initiative and to implement projects. • Lack of competences: high need of new professional figures, not only technical profiles but also third sector experts (consultants, ESCOs, etc), and legal-administrative: multi-disciplinary and interdisciplinary team. Lack of know-how in community engagement. • Lack of understanding of key concepts, e.g., shared energy consumption vs. EC. Chapter 8 has a detailed discussion and analysis of these issues
Lack of experience with collective action	No prior experience in cooperative models, more individualistic profiles: people often prefer individual self-consumption. There is a need to first develop the community concept. People lack the cooperative culture and don't know how to participate. Even when citizens have experience with collective actions, negative prior experiences (non-agricultural cooperative models) can lead to mistrust in the EC implementation.
Dependency on external entities	At the initial stages of their lifecycle, ECs tend to recur to external services for the decision-making & management of the energy community due to lack of time of the citizens and/or PA staff involved. This slows down their growth, delaying reaching the size that justifies financing of full-time jobs (own team of experts). Also, Novelty - people don't know the model and don't "dare" to participate without guidance. Some EC business models have this as a feature/driver instead of a barrier, and others recur to second-degree cooperatives to overcome this issue.

- FINANCIAL SCHEME AND ECONOMIC SUSTAINABILITY OF THE BUSINESS MODEL:

 Lack of financing	In general, limited access to financial capital is recognized as a significant obstacle for interested parties seeking to engage in collective action. Frequently, such parties are hampered by a lack of sufficient funds necessary for development. Investments are needed to produce sufficient renewable energy for an EC (as the number of future members is unknown, the global investment needed is not known beforehand), conversely, enough members are needed to repay the credit in the future. Since it is mandatory for an EC that the member must be free to join and leave at any time, this causes uncertainties on the side of the financiers. Lack of credit history: credit history enables financial entities to evaluate a customer's financial risk and management of their finances over time, which is crucial for providing financing. It also serves as a trust mechanism. However, for newly established ECs a vicious cycle is created where the lack of credit history makes it difficult for financial entities to assess creditworthiness, resulting in restricted access to financing for their activities. Furthermore, due to their unique characteristics, associations and cooperatives are often perceived as riskier by financial entities.
 Lack of financial entities buy-in into the EC model.	Public funding, comprising grants and program subsidies, represents the principal source of funding. Financial entities exhibit reluctance towards providing funding to ECs, due in part to the diversity of EC models, encompassing various actors, services, and legal forms. Moreover, financial institutions are not favourable towards the legal structures utilised by ECs (open and voluntary membership, for instance). They also lack knowledge on the operational functioning and the associated cash-flows, leading to an overestimation of the associated risks.
 Strictly economic motivation for joining EC.	When the main motivation for joining EC is strictly economic saving, the grid price volatility, and its long-term tendency to lower could impact the EC business model and member benefits.

- SOCIO-ECONOMIC MAKE-UP OF PARTNERSHIP:

 Difficulty to engage females and young adults	Very difficult to involve women. Typical profile is: ~50 y.o. white male, medium-high socio-economic level. Retirees from the energy sector, engineers or accountants are also very common. "Energy Freaks", environmental-aware citizens. Women and young adults are more difficult to engage, perhaps because the meetings are typically held at the end of the day, which is difficult to attend for families with young kids.
--	---

Lack of trust in actors/ processes	• Lack of trust in cooperative models due to insufficient knowledge. Negative experiences with other collective actions. • Lack of trust in governance processes: long procedures/high quorum required. • Lack of debate and consensus-achieving skills to handle Internal conflicts. • Unclear ownership of installations, benefits, and compromises.
---	---

• **OTHERS:**

Lack of standardized process.	No articulated model for RECs, it is a tailor-made and non-standardizable process. In the same way, once EC are created members perceive a lack of awareness of what happens in the next phase/future. This also impacts on the financial institutions view of the EC business as a whole. Unclear and incomplete regulation favours this status quo.
Lack of digitalization.	Lack of smart metering and advanced data management systems: smart meters have an interface through which the energy community can read out real-time data, but in some cases, ECs have to pay for the interfaces and communication infrastructure. This problem does not affect Spain due to the almost total penetration of smart meters. Interviews have shown this to be a concern in Italy and Poland.

6. Business models for EC initiatives

Energy Communities can perform both traditional activities (generation, supply, consumption, distribution) and engage in new business models. An increasing number of ECs provide additional services, such as: electro-mobility; energy efficiency and savings (i.e., buildings renewal, energy checking, consumption monitoring, heating, and air quality assessments); flexibility of uses, energy storage and smart grid integration; energy monitoring and grid management; financial services; consultation services to develop community initiatives (de Lotto et al., 2022).

Although the Business Model (BM) concept has been extensively used for a relatively long time now, there is still no consensus on its definition. In general, it can be said that a *“Business Model describes the logic behind a business operation describing how organizations can create, deliver and capture value”* (Reis et al., 2021). The Business Model Canvas (BMC) is a systematic approach that allows the definition, creation and comparison of existing business models. It is the most widely used BM analysis tool nowadays, and it sits at the base of the framework that has been chosen to help categorize the different business models. Literature for Energy Communities Business Models (ECBM) is scarce, but a quite comprehensive review can be found in the paper of Reis et al. (2021) published in Renewable and Sustainable Energy Reviews. Although the definition of “Energy Community” adopted by the aforementioned authors is more permissive than the definition we have adopted in this report, their work is nevertheless useful for understanding and classifying the a priori hugely diversified ECBMs. Eight ECBM Archetypes are identified by Reis et al. (2021).

- *Energy cooperatives*

According to the authors, “energy communities organized as energy cooperatives are by far the most common in Europe”. In this model, citizens join to raise the funding for owning energy generation systems. Membership is open and voluntary, and control is typically democratic, usually “one participant one vote”. Energy cooperatives can be set-up as companies (for-profit entities), as retail cooperatives with medium- or large-size PV or wind power plants, competing with other market players. They can also be set-up as local not-for-profit cooperatives, supplying local regions with shared self-consumption and sale of surplus energy. It is worthy to note that in some countries this kind of cooperatives can assume the role of low-voltage DSO, while under other regulations they are prevented from taking on this role.

- *Community prosumerism*

These are typically communities created by prosumers that play the roles of decisionmakers, investors and customers, joining to benefit from advantageous financing conditions in the acquisition of assets – as bulk purchasers – to gain dimension that allows participation in flexibility markets, to benefit from collective Energy Efficiency initiatives or to participate in Local Energy Markets. Under this BM, the EC acquires collective or individual generation and storage systems and establishes long-term PPAs with the energy suppliers. The energy suppliers become responsible for buying the surplus generation and supplying the extra power that may be required. The aggregation of the demand and surpluses achieved by joining in communities gives the prosumers additional power to negotiate better conditions with energy suppliers, which is one of the main benefits of this BM.

- *Local Energy Markets*

Local Energy Markets are typically developed by prosumerism-driven communities that have as a goal the maximization of their energy self-sufficiency. These can be place-based, if all participants are located within the same low-voltage distribution grid, or they can take the form of virtual power plants or prosumer-community groups. At present, regulation limits the implementation of virtual power plants in the EU, although there are some initiatives currently in motion. Place-based LEMs can be more attractive to this BM, since both the IEMD and the RED-II directives exempt energy transactions within the same distribution grid from paying right-of-use to the unused upstream distribution and transmission networks, which means prosumers can trade their surpluses with other participants at more advantageous conditions.

- *Community Collective Generation*

This business model is based on shared PV generation and storage systems installed in rooftops or in the vicinity of the consumption sites, with the output power being shared among several customers. The investment is usually shared between the consumers, which are also decision makers and investors. The distribution of the energy generated as well as results from the sale of surpluses depend on rules that are established in collaboration between all the project participants.

- *Third Party Sponsored Communities*

There are several entities that, having recognized the potential of ECBM, are interested in supporting and investing in the sector. For example, utilities and technology companies may be willing to provide technical advice and financial support in order to expand their customer and services portfolios. These entities usually retain the assets ownership, being responsible for the project governance and investment decisions. In this case, these entities are the main decision-makers but cooperate with local communities to develop suitable energy supply solutions, and the community is usually involved in the decision-making through its representatives. The investors are paid-back through the establishment of long-term PPAs with the customers, and these benefit from renewable and usually cheaper energy. Non-profit local PAs and social entrepreneurs may take the place of utilities and technology companies in this model, to alleviate specific social problems, with all the profits generated being fully reinvested in the community.

- *Community Flexibility Aggregation*

Communities interested in using collective Demand Side Management (DSM) strategies to provide demand flexibility to grid operators through aggregation can also use more sophisticated and technology-dependent BMs. Small consumers face difficulties in accessing flexibility markets, due to high costs and minimum volume requirements. Energy communities are expected to make residential demand flexibility commercially attractive and European directives encourage aggregation. The flexibility provided by multiple small participants is pooled together, achieving the volume required to take part in the balancing, reserve, and ancillary markets.

DSM programs can be dispatchable or non-dispatchable. Dispatchable programs imply that an external operator directly controls the customers appliances through direct load control. In non-dispatchable or price-based programs, dynamic pricing signals are generated to influence customers' demand profiles.

- *Community ESCO*

Energy communities may establish partnerships with external companies to jointly create and operate community Energy Services Companies (ESCOs) destined to provide Energy Efficiency (EE) services and / or renewable energy supply. Those energy communities that show a particular will to reduce their energy demand by means of energy efficiency are

especially well-suited to implement this ECBM. The ESCO model differs from the traditional energy consultant or technology supplier in that ESCOs can finance systems, and their remuneration is at least partly based on the energy savings achieved by the customers. Several servitization schemes can be used within this model, for example solar-as-a-service with the community ESCO financing the PV panels and assuming the responsibility for the installation, maintenance, and upstream supply; or heat-as-a-service, with the community ESCO owning the infrastructure – district heating or combined heat and power - and offering energy performance contracts for internal temperature comfort. In both cases, the community ESCO can also provide energy efficient systems – air conditioners, water heaters, etc. – and building retrofit solutions as well as the generation systems. In these ECBMs, the assets, structures and the decision power are held by the investing companies. However, as the projects are customized and dependent on local conditions, members of the community are deeply involved in the decision-making processes.

- *E-mobility Cooperatives*

Both CEC and REC encourage EV as mobility solutions, providing fossil fuel free transportation services, and as extra sources of flexibility. ECBMs based on e-mobility can provide green mobility solutions through cooperatives that provide community public transportation, car-sharing or car-pooling services, while also exploiting their assets as flexibility resources. With Vehicle-to-Grid (V2G) and Vehicle-to-Building (V2B) technologies, car batteries can be used as storage resources to offset energy bills, either by peak-shaving strategies or by providing flexibility services. Also, if these companies own power generation assets, battery storage helps maximize self-consumption. Community participants may be involved as shareholders, decision-makers, and mobility customers.

Given the above classification, from the stakeholder interviews that were conducted a total of 9 ECBMs have been identified, as illustrated in Table 5. It is important to note that the cases studied do not always conform to an exact ECBM archetype, or sometimes conform to a hybrid of more than one ECBM archetype. In these cases, notes are added in parenthesis.

Country	Energy Community Name	BM	Number of members	PA Role	Financing	Legal form	Technology	Governance
Spain	Energía Bonita - La Palma (Canarias)	Energy Cooperative (local, non-profit shared self-consumption and sale of surplus)	86	Cession of public rooftops Support (staff) Grants	Mandatory contribution of 100€ Yearly payment to reserve power Grants and subsidies	Cooperative	PV Minihidraulic (possibly)	One member one vote
Spain	Comunidad Energética de la Poble de Segur	Energy Cooperative (local, non-profit shared self-consumption and sale of surplus)	10 (goal 400)	Cession of public rooftop Grants Support for constituting a cooperative	Mandatory contribution of 100€ Grants and subsidies	Cooperative	PV	One member one vote
Spain	El Prat	Energy cooperative + flexibility services + demand management services + energy efficiency	400 in waiting list	Initial financing Grants Participation	40% PA 40% SMEs 20% Consumer Association (w/ PA grant)	Not-for-profit LLC	PV	40% Municipality 40% SMEs 20% Consumer Association

		services + community PPA						
Spain	El Padul	Community Prosumerism	28 (goal 280)	Support (information and dissemination) Cession of public rooftops	Still not clear – PA is facing initial costs of consultants + EC formation	Association	PV	One member one vote
Italy	Energy Community of Antrodoco	Community Collective Generation	150	General coordination	10€ as tuition fee for each member	Association	PV	Public led (One member one vote)
Italy	Energy Community of Ventotene	Community Prosumerism / Community Collective Generation	24	The municipality is a member and counts as another citizen member	20€ as a tuition fee for each member	Association	PV	Citizen centered (One member one vote)
Italy	Energy Community of Castel Sant'Angelo	TBC	300	Coordination for the request for funds at the national level	To be defined	Association	PV	Public led (One member one vote)
Italy	Energy Community of Monterotondo	Community Prosumerism	n.a.	It was formalized with a municipal resolution	PPPs approach	Association	PV	Public led (One member one vote)

Table 5. Business model identification in OIS Hubs Countries Interviews

From the interviews and the bibliography revision it is clear that multiple ECBMs are possible. The variation is due, in part, to the lack of specific regulation, and in part to incoherences in the regulation across different EU countries. As such, regulatory status across the project's pilot countries has resulted in discrepancies in the development of ECs. Most EC projects have emerged after 2018, which coincides with the formal recognition of the energy community concept in European legislation. However, there are also EC projects with a longer history, as observed in other European countries. Specifically, Spain and Italy have a higher number of established ECs compared to Poland¹⁴, where the concept is still in its early stages. However, through literature review and expert and energy community interviews, several relevant characteristic features have been identified:

- Most projects are locally focused and bear more resemblance to the REC concept.
- There is significant involvement from the public sector in these projects, either as a partner/REC member, by providing space/land, by undertaking dissemination and support tasks or by developing support schemes.
- Renewable energy sources, particularly photovoltaic solar energy (self-consumption prevails) are the main energy sources used across different projects.
- EC projects are designed to be scalable, providing opportunities to learn from initial experiences.
- Although the legal forms chosen to set up ECs depend in part on each country, most projects are set up as cooperatives or associations, as these are the legal vehicles that more easily fit with the characteristics required for energy communities by European directives – free and voluntary participation especially.

¹⁴ EC EU repository.

- Most emerge from public support schemes, either through grant programmes, or National Support Schemes such as feed-in tariffs.
- The most common BMs, from the interview sample, are Energy Cooperatives, Community Prosumerism and Community Collective Generation¹⁵
- Many ECs are legally constituted but not yet implemented, due to one or more of the following reasons: pending technical viability and detailed project, pending access to finance, pending definitive regulatory framework, pending bureaucratic burdens in legalizing facilities or implementing shared consumption through the grid.

This work reflects the specific sample accessible through the interview process, and as such there is no guarantee of total completeness. It gives nonetheless a valuable insight into the actual state of the sector in each of the pilot Hubs countries', and as the work moves on, it will constitute a valid starting point for a more in-depth analysis.

6.1. Public-private collaboration business models

During the stakeholder interviews process to prepare this report, a number of business models that explore different configurations of public-private collaborations have been identified. In this chapter the main aspects of some of them will be briefly described in terms of its principal characteristics.

6.1.1. Energía del Prat

This is a top-down approach to EC, in which the PA assumes and maintains strong leadership throughout the development of the project. Corporate structure is unusual, as it is an LLC participated by the municipality with a share of 40%, another 40% share is owned by private companies and businesses, and the final 20% share corresponds to a user association. These quotas are not modifiable, not even in the likely event of a capital increase, and so the EC is not subject to having the citizen and municipal participations diluted and the leading role of the PA is assured.

Financial actors tend to dislike legal entities such as cooperatives or associations regarding long-term credit concession, because of the potential volatility of their membership on one side and of liability issues. Legal entities such as Ltd or LLC are generally preferred. Ltd societies present a number of constraints that make them unfit for EC, and the issue with LLC is that, under Spanish law, changing the corporate structure of an LLC (SL in Spanish law) requires a change in the public registration, which is both not very agile and quite expensive. This effectively prevents the "free and voluntary" participation of citizens if applied to an EC. On the other hand, in the case of an association citizens are free to join or leave it at any time, without any mandatory costs. So, the seemingly over-complex scheme proposed for Energía del Prat achieves multiple beneficial results which would be nearly impossible to guarantee otherwise:

- "Credit-friendly" legal entity
- Free and voluntary citizen participation
- Open to private companies and businesses participation
- Fixed capital composition, shielding the EC from "capital dilution" in the event of capital increases

¹⁵ Many of the cases identified in Spain and Italy belonging to this BM do not fully qualify as ECs according to the IEMD or RED-II directives, since they lack a legal entity.

As for the business model, it is presently centred around PV self-consumption schemes, but wider scopes of action are foreseen. In fact, an experiment with heat pump servitization is being prepared, and as soon as the regulatory framework allows it a CEC-like branch, with a not-for-profit utility, is likely going to be put in place. The long-term view of the business is that due to increased decentralised renewable energy penetration in the mix, especially solar PV, the price of energy during the central hours of the day will tend to approach zero, undermining the self-consumption-only business models. As such a gradual shift towards offering other services such as energy services or shared mobility services is expected.

For now, since the EC is not a utility it is not allowed to charge per kWh, so detailed and variable (on a daily and hourly basis) coefficients are used to assign the share of locally produced energy to each of the participants. The EC then charges each participant depending on the respective coefficients. The citizens have free choice of the utility they prefer to work with.

6.1.2. CEL Management

CEL Management is a company that promotes, helps to set-up, and manages local energy communities in small municipalities (Castilla-La Mancha and Extremadura provinces) with strong involvement from the Local Authorities. Their business model consists in helping the Local Authorities set up an "energy consumer cooperative", access to which is granted to all local consumers in exchange for a symbolic fee (2€). Financing is secured through a mix of grants and private funding. The municipality mayor is the president of the cooperative, which has no employees. The PV installation is executed on public buildings roofs, which are ceded at no cost by the municipality. The company, together with the local authorities, sets up a series of public dissemination events, where it presents the business model and its advantages to the local citizens. The company provides all the necessary support, information, and templates, and once the Energy Community is established, they sign a contract through which the company becomes responsible for the management of the Community in exchange for a negotiated administration fee.

CEL Management then negotiates with a utility the prices of self-consumption, make-up energy and surplus energy. It is an indispensable condition that all the members of the EC have their energy supply contracted through the same utility that the EC has negotiated with. The utility charges the total consumption amount to the end users and then returns the value corresponding to locally produced energy (self-consumed + surplus) to CEL management. This amount is then used to pay back the installation, and to pay for insurance, maintenance, and the administration service. Users get one single discounted invoice from the utility, which then settles the balance with the EC.

6.1.3. Solurgy / El Padul

Solurgy is a PV installer and consultant company that also promotes and manages ECs (Andalucía province). The business model is centred on shared self-consumption, with a strong involvement of public authorities. The El Padul municipality hired Solurgy to impart several public presentations, raising awareness and interest among the citizens. The *modus operandi* is very similar to the one presented in the previous point, but the legal entity they chose to incorporate the EC is an association instead of a Cooperative. Not-for-profit association has been chosen because eligible legal entities for ECs are still not regulated and an association can be easily turned into another figure. Governance is one-member one-vote. Another difference is that after all the informative sessions the mayor stimulates the creation of a group of citizens, which the company then guides through all the steps to become an Energy Community. The PA is part of the EC, and present in all stages of operation, since inception to the installation phase in which it cedes rooftops and municipal spaces, but in this case the approach is more truly bottom-up.

Until now, the members are free to choose their utility, but a collective purchase agreement with a single utility is being considered.

6.2. Potential financial schemes

Depending on their business model EC can take many forms, sizes and a wide set of activities operating in a different environment. Hence, each EC is unique and so will be their financing needs (COMPILE 2021, Financing Guide). As exhibited in the section that analyses the primary barriers for ECs, limited access to financial capital is recognized as a significant obstacle for interested parties seeking to engage in collective action. Financial institutions exhibit reluctance towards providing funding to ECs, given the diverse range BMs that encompass various actors, services, and legal forms. Additionally, financial institutions are not favourable towards the legal structures used by ECs, such as open and voluntary membership.

Given these circumstances, **the first way for ECs to finance their projects is by raising funds from their members.** However, this approach has limitations as the ECs growth potential is tied to the capacity of its members. Aware of these constraints, as previously noted in this report, **ECs primarily rely on public funding in the form of grants and subsidy programs as their alternative source of financing.**

Despite these challenges, **ECs seek private financing alternatives, such as equity and debt.** The equity option involves approaching individuals or financial institutions to invest directly in exchange for a series of shares in the company. However, this approach may affect the autonomy of the ECs. The acquisition of debt through an equity loan is another option, but it may jeopardize the ECs assets if they fail to repay the debt. Table 6 provides an overview of the diverse private and public financing instruments that may be potentially used by ECs.

Instrument		Type	Brief Description
Private	Equity Finance	Share offer and Self-financing (Equity capital)	Share offer is offering a share of the EC's capital to its members. To become a member of the EC, thus, is necessary to own a share of the cooperative. Self-financing occurs when capital is raised by coop members, rather than private investors. In many ECs, members who invest equity in the project are given a single vote regardless of their investment size, which improves governance transparency.
		Private equity funds	Pooled investment vehicles where an adviser uses the money pooled to make investments on behalf of the fund. Usually take a controlling interest in a project to increase its value. ECs could maintain their autonomy when using this financing instrument by enlisting investors as silent partners that plays an inactive role in decision-making process.
	Debt Finance	Leasing	Contract outlining the terms under which a firm or an individual can obtain the use of a certain fixed assets for which it must pay a series of contractual, periodic, tax-deductible payments. At the end of the contract term, the user may gain ownership of the good by paying fixed quota that is settled before the contract is signed. Leasing contracts are also used for small operations.
		Loans	Financing in debt which usually requires guarantees and the payment of interests. Different types of financing can be identified based on the lending institution, requirements, and the nature of the project: bank loans, ethical loans, social loans, soft loans, green and sustainability loans.

		Green Bonds	Fixed income instruments used to finance projects that provide environmental benefits. Represent a debt instrument, whereby the bondholder is typically obligated to make interest payments and repay the principal amount upon the bond's maturity date. While bonds may be challenging for individual ECs to access due to their smaller size and higher investor risk, financial institutions can aggregate smaller loans granted to individual ECs and issue their own bonds.
	Mezzanine instruments	Mezzanine financing	Refers to quasi equity financing. It is a type of financing situated between debt and equity financing (hybrid financing). It usually comes in the form of subordinated loans that can be turned into ownership in the project if the debt isn't repaid. This type of financing is often used by financial cooperatives to lend money to companies for projects.
	Alternative Investment Funds	Crowdfunding /Crowdlending	Refers to a financing method wherein organizations, small and medium-sized enterprises (SMEs), projects, or individuals obtain financial resources directly from a large group of individuals, or the "crowd," without seeking the assistance of a conventional financial institution. Crowdfunding enables fundraisers to gather funds from numerous individuals via online platforms, thus facilitating the financing of projects and businesses. Typically, start-up companies employ crowdfunding, and several types of crowdfunding exist, including equity crowdfunding, rewards-based crowdfunding, donation-based crowdfunding, profit sharing, and hybrid models.
Public	Grants and loans	EU regional funds	Specific public funds in the form of grants and loans that are available based on the specific objectives to be pursued and can provide an interesting solution to risk-averse EC throughout the EU. For example: Recovery and Resilience Facility; Cohesion Policies Funds, Just Transition Mechanism Modernisation Fund
	National Support schemes	Feed In tariff	Policy tool designed to promote investment in RES, and which usually entails guaranteeing producers an above-market price for what they deliver to the grid (usually support the development of small-scale RES projects in early project phases when production is often not economically feasible).
		Revolving fund	Capital pool dedicated to funding projects that plan to generate cost savings, a portion of which are then used to repay the initial investment and to replenish the fund (for example: emerging government schemes which combine the flexibility of traditional loans with the security of a government grant).
Private/Public	Others	Guarantees	Insurance policy for the activity that the EC wishes to undertake, providing a commitment from a supporting organization to cover the debt in case of inability to repay. This is particularly relevant when borrowing significant amounts of money or when undertaking activities with negative cash balances or risky. There are two types of guarantees: direct and indirect. A direct guarantee involves a bank or other financial institution providing insurance directly to the lender, while an indirect guarantee involves a trusted institution providing the guarantee to the lender on behalf of the borrower. In either case, collateral in the form of a payment or deposit may be required. Although most guarantees are provided by financial institutions or governments, cooperatives may also provide guarantees for other cooperatives.

Table 6. Financial instruments potentially usable by ECs

It is important to highlight that, despite their existence, only a short number of those financing instruments are accessible for ECs in both public and private financing mechanisms. This summary provides an initial approach to the current

financial schemes available for ECs. Further investigation will examine these schemes more comprehensively and will concentrate on the specific requirements of the Pilot Hubs.

7. Case studies in the EU and beyond

The aim of this chapter is not to make a full-blown best-practice study on its own, but instead to build on the considerable wealth of up-to-date studies, parsing the most relevant contents and adding some relevant content from other sources, including the present work. Relevant sources of information on European best practices were the Interreg [“Empowering Citizens for Energy Communities” Nov-2022 Report](#) and the [Compile H2020 project “Best Practice Guide”](#), published in Apr-2021 as part of the “Energy Community Toolkit”. From the best practices identified in each of these reports, the ones that were more relevant to the topic of this study have been selected, in base of the level of public/private cooperation, fitting the REC definition, having a prolonged existence, or having a particularly innovative governance structure or business model.

Outside the EU, the main source for information on EC-related best practices was found on the “IRENA Coalition for Action (2021). Community Energy Toolkit: Best practices for broadening the ownership of renewables”. Although this report refers to “community energy”, the selected examples are deemed relevant for comparison and for extracting applicable best practices.

In addition to the previously mentioned cases, some initiatives worthy of mention coming from the stakeholder interviews conducted previously in this study have been added.

7.1. Selected Case Studies

Energía del Prat – Spain



Background: El Prat de Llobregat is a municipality located in the Province of Barcelona, in Catalonia, Spain. It has a population of over 64.000 inhabitants. The Energía del Prat EC initiative rises from the public administration (top-down approach). Driving the project from the entity already dealing with energy affairs within the municipality (Aguas del Prat) didn't warrant the needed citizen participation and made private companies' participation difficult as well. In order to coordinate all the municipal initiatives (solar PV self-consumption for the municipal services ceding surplus to citizenship, shared mobility services, municipal OSS for citizen energy transition), the municipality has created an EC that fits both the CEC and REC definitions, through a not-for-profit Limited Liability Society, with a specific and guaranteed participation structure - 40% Municipality, 40% open participation for private companies and small businesses, 20% for a user association funded by the municipality. This structure is guaranteed not to change, even in the event of a capital ampliation. What this achieves is open and voluntary citizen participation – all eligible citizens are guaranteed the right to join and leave the user association without having to buy or sell their share. The municipality funds the association 100%. A space for private investment is also provided, and the municipality and citizen participation roles are guaranteed not to be diluted in the likely scenario of capital increase.

The more lengthy and complex procedures caused by the fact that this initiative is spawned from the public sector are compensated by the added confidence in the altruistic goals of the project, which make it easier to involve third parties

– example of this is the relative ease with which the compromise of securing privately owned rooftops to install up to 1350 kW of PV has been achieved, in a period of under 15 days.

As for the governance structure, a board of administrators is foreseen, with 2 representatives of the municipality, 1 representative of the C1 partners – businesses with HQ in El Prat – 1 representative of the C2 partners – partners with HQ outside El Prat but with consumption facilities located in El Prat – and 1 representative of the user association, that has vetoing rights. The C1/C2 differentiation was made to encourage companies with important assets in the municipality to participate, irrespectively of where their fiscal HQ is located. These companies can then cede rooftops for PV installation, although to do this they need not be associates – the model chosen is the cession of the rights of use of the rooftops for a period of 25 years in exchange for a percentage of the energy produced, and priority in accessing the rest of the energy produced, at a convened price (lower than utility tariffs).

The allocation of the energy produced is made after a matching study has been conducted and based on the hourly and daily allocation of a certain peak power, because at this point the EC is not constituted as an utility and as such it cannot sell energy based on kWh consumption. Future expansion plans foresee the implementation of a not-for-profit utility, mainly to streamline and speed up the processing of shared self-consumption installations legalization.

When looking for financing, it is expected that the fact of being constituted as a Limited Liability Company, with the accompanying societal structure stability, and considerable social capital, will enable lower risk assessments and more agile responses from the financial entities. Even so, the uncertainties and delays in the legalization of energy self-consumption schemes on the part of DSOs make it difficult to take risks such as hiring dedicated personnel to the EC. Prudence is therefore the operative word, and hiring personnel to work for the EC is something that will only be standard practice when the EC has a stable source of income.

Key features: This model of public-private collaboration avoids the cooperative and association legal forms, which are less preferred by the financing entities, while at the same time it effectively assuring the free and voluntary citizen participation without incurring in the nightmare of changing the corporate structure of the LLC each time someone joins or leaves the EC. It safeguards the leading role of the PA, shielding the EC from possible governance changes driven by capital increases.

Table 7. Energía del Prat – Spain

Not-for-profit consumption cooperative – Osona Model – Spain



Background: The Osona Local Energy Agency was created within the Energy Department of the Osona County Council in Catalonia - bringing together 50 municipalities and a population of approximately 150,000 inhabitants. The Agency's main objective is to advise and collaborate in the energy accounting of the local councils of the region, working to improve energy efficiency, encourage energy saving and promote renewable energies. It currently has a signed agreement with 48 town councils in the region.

The Local Energy Agency works in several strategic areas, including energy accounting and contracting optimisation, monitoring and remote management of public facilities (more than 120 facilities), identification of renewable projects and their financing, and the promotion of energy communities. In this last aspect, the Agency has taken a proactive role in the creation and proliferation of energy communities in the region, creating its own "Osona Model" of energy community per municipality in the form of a non-profit consumer cooperative.

The most distinctive features of the model include a sense of community and belonging, participation in the direct environment, local control and governance of assets, and volunteerism. To ensure the medium-term survival of the energy communities, the Local Energy Agency helped create the second-tier cooperative "Osona Energia Sccl", which provides technical, legal and administrative support to the different ECs created in the region, with the aim of pooling services and taking advantage of economies of scale through the establishment of replicable models.

The initiatives arise from citizen interest, channelled through the Local Energy Agency. The Agency has launched the process of creating these energy communities through public information sessions, talks and dissemination days. It has also developed various documents that simplify the creation and implementation of ECs, such as creation and implementation guides, cooperative training sessions, model statutes, assignment of public roofs, tools for calculating economic viability, among others.

As a result of the promotion of the Local Energy Agency, there are currently more than 21 energy communities in Osona, 3 in creation and 4 under evaluation. An installed photovoltaic power of 9,600 kWp, 22 electric vehicle charging points and 2 electric vehicles are expected. Under this model, municipalities are key to the success of the projects, but they are not part of the energy communities, partly to avoid political cycles. Its role, apart from support and promotion, is based on the concession of public roofs through a public tender procedure. In order to participate, members have to make a contribution to the cooperative's share capital.

Key features: The indirect role of the PA as a driving force and tractor of ECs in the region is highlighted, generating its own replicable model in different municipalities and a structure (second degree cooperative) that provides economic, technical, operative support. Another feature of the PA's involvement has been the provision of training and content generation for citizens, aimed at simplifying their participation in the ECs.

Table 8. Osona model – Spain

Bioenergiedorf Jühnde eG – Germany



Background: Bioenergiedorf Jühnde eG is a cooperative situated in the small town of Jühnde, in Germany. It was founded in 2000 as an initiative of the University of Göttingen to create a pilot model of a "bioenergy village" that could be replicated in other localities in the country. The local bioenergy system combines electricity generation with a heating network, and started operating in 2005, four years after its establishment.

The cooperative has approximately 1,090 members, mainly citizens of Jühnde (around 75% of the town is involved in the project). The University of Göttingen played a prominent role in promoting the initiative and provided support in the development of the project. The German Agency for Renewable Resources (FNR) funded the project and encouraged similar initiatives throughout the country. Other public actors and the EU LEADER+ programme also contributed to the development of rural areas. Also, the mayor of the village was an active participant, getting involved and convincing other citizens.

The model implemented is similar to the REC definition, as it is a local-scale EC where facilities and members are in close proximity. Furthermore, its bottom-up approach means that it is an initiative driven by local citizens and the university. The EC is multi-component/activity, as it generates electricity through various sources (biogas 700 kW with solar and wind, 5 MWh per year), produces heat through biomass and incorporates shared electric mobility services. The governance structure follows a cooperative regime, where each member buys shares in the EC to join and has the option to be supplied with electricity and heat produced in the EC.

Key features: the role of proximity and social cohesion in the project's inception and its contribution to strengthening the sense of community in Jühnde. The mayor's involvement in motivating citizens has also been a significant factor in the project's success. Additionally, the multi-service offering is a noteworthy aspect that contributes to the sustainability of the community energy project.

Table 9. Bioenergiedorf Jühnde eG – Germany

Eno Energy Cooperative – Finland	
Background: Eno Energy Cooperative is a community-based enterprise located in North Karelia, Finland. It was established in 1999 by 12 local forest owners. At that time, there was no proper market for energy wood and the cooperative created that for Eno district. The initiative was well-received as the municipality wanted to profile itself as a clean and environment-friendly place. Currently the co-operative is owned by 54 local forest owners and the aim is to generate heating energy by providing wood chips for the 3 district heating plants. Members provide about 20-30% of energy wood, and the rest is acquired from different suppliers nearby, e.g., from the fellings of forests owned by the city of Joensuu. The raw materials used are small diameter trees by manual felling (15%), by multi-tree processing (70%) and logging residues (15%) from clear cut areas. Local approach is central in the operations, in terms of its members, energy wood procurement and other related services. Municipality building and private customers have saved without taxes about 2 million € for 15 years compared to light fuel oil. Besides affordable price of heat, local benefits include net carbon dioxide emissions being reduced because imported oil is replaced by renewable forest chips (5 million kg annually) and local networks are created. The actions employ between 7-10 persons/year. The cooperative produces 15,500 MWh energy annually which corresponds to the energy consumption of c. 800 detached houses. The cooperative received 20-30% investment support from regional state administrative authority: Centre for Economic Development, Transport, and the Environment. Key features: The fact that it exploits local renewable resources to the benefit of the local community, the role of the PA helping finance citizen initiatives, and its exceptional longevity make it a relevant example.	

Table 10. Eno Energy Cooperative – Finland

RevoluSolar – Brazil	
Background: In 2015, the first photovoltaic community was founded in the Babilônia favela in Rio de Janeiro, with the aim of promoting the sustainable development of low-income communities through solar energy. With 38 kWp installed and nearly 84.000 kWh generated, this EC has trained 48 electricians and PV installers and is currently educating 230 “favela” children on sustainability matters. Through collective volunteer work and involving community leaders and electricians, the RevoluSolar project was born, this community not only generates energy, but also informs and educates the local population about the benefits, social, economic, and environmental aspects of the use of solar energy. RevoluSolar promotes sustainable development through solar energy on 3 fronts: sustainable energy programme, professional training in electricity and solar installations and environmental education for children and young people. RevoluSolar’s methodology is called "Solar Cycle". The installations are carried out, operated, and maintained by professionals trained by RevoluSolar. And this training, combined with children's education, promotes the involvement of the local population in all phases of the project. RevoluSolar’s action fronts are aligned with the Sustainable Development Goals (SDGs) of the UN. Key features: this project is all about social impact: fighting energy poverty, building capacity among adults, and contributing to sustainability education for children.	

Table 11. RevoluSolar – Brazil

Fetlar Wind – United Kingdom	
Background: Fetlar Wind was set up by the community in Fetlar to take forward a modest renewables project for the island. It has four directors and a company secretary, of whom all but one are currently based in Fetlar. They bring a range of skills and experience to the project from both the private and third sectors. They are supported by the Fetlar Development Worker, who has assisted with project coordination. Fetlar Wind Ltd is constituted as a Community Benefit Society (sometimes referred to as a BenCom). This is a form of co-operative and as such is regulated by the Financial Conduct Authority (FCA). Fetlar Wind Ltd installed 2 x 25Kw C&F wind turbines on the Setter croft in Fetlar. These will generate estimate approx. 197Mwh per annum. Saving around 85 tonnes of CO2. The aim is to use as much of the energy generated as possible locally, to supply connected properties. The board is elected by the members at the Annual General Meeting (AGM) with each shareholder having one vote regardless of the number of shares they hold. Any surplus generated will be donated to a local registered charity, Fetlar Developments Ltd, to advance various community projects. Key features: Off-grid insular community, microgrid with private wire distribution for electricity and thermal storage for wet heating systems connected. Managing the hot water tanks temperature allows storing surplus generated energy for consumption during peak hours or when production is low, increasing local power usage.	

Table 12. Fetlar Wind – United Kingdom

Renewable Energy Project (PRIER) – Argentina 
Background: The Renewable Energy Project - PRIER (2016) is a pioneering pilot project for electricity generation using photovoltaic panels in Argentina. It is located in the city of Armstrong in the Province of Santa Fe. The project's aim is to implement, commission, and evaluate a distributed generation experience of renewable energy as a complement to the smart grid's development in the city. The underlying idea behind this concept is to shift from a model of a few large energy generators to one with a greater presence of many small generation sources installed closer to the consumption sites. Specifically, 50 rooftop solar panels and their respective smart meters were installed on homes, businesses, and institutions in the city. At the same time, a solar plant was installed in the industrial area (200 kW - 1 hectare) that contributes energy to the city's general grid. A total of 98 people and institutions participated in the project. The National Agency for Scientific and Technological Promotion, the Armstrong Electric Cooperative, the National Technological University, and the National Institute of Industrial Technology invested in the project. The project was designed around a citizen participation strategy to accompany its implementation. The objective is to promote social learning and generate a critical mass on the issues of distributed generation with renewable energies through interviews, technical talks, and focus groups. The participation strategy was planned in two main stages: one of information gathering and installation of the theme and another of collective work and co-production. An important aspect to highlight was the signing of a "Citizens' Pact" with the members of the pilot project. They committed to developing renewable energies in situ, moving towards a solidary, participatory, and equitable model, reinvesting the savings generated by the pilot project in solidarity to expand the project in the network, and strengthening the cooperative management of the city's public services. The Electric Cooperative, as the promoting institution, the Municipality of Armstrong, the Deliberative Council, local institutions, NGOs, businessmen, traders, and independent citizens played an active role in the process, getting involved and encouraging the PRIER process. Key features: First participatory experience within the city, aiming to engage local households and institutions in the discussion of urban public issues. It was met with great acceptance, as households and institutions made their roofs available in a disinterested manner. The alliance of various local actors, including the municipality, social and economic organizations, the electric cooperative, and academic institutions, resulted in a fruitful exchange of knowledge and learning. Power generation for self-consumption with government support for equipment acquisition. A notable achievement of this project was the production and development of a simple and accessible language, aimed at generating informed dialogues throughout the process, thus advancing towards the construction of a local critical mass that can sustain and expand the project. This experience is deemed suitable for replicability among cities that aim to advance in actions related to the use of renewable energy.

Table 13. Renewable Energy Project (PRIER) – Argentina

Hotoku Energy – Japan 
Background: The Hotoku Energy case is based on the efforts of the city of Odawara, Japan, to cultivate renewable energy in the aftermath of the Great East Japan Earthquake and the Fukushima nuclear catastrophe in 2011. By securing grants from the Ministry of Environment, the city established Hotoku Energy, an energy firm with the objective of developing solar energy projects. This initiative was supported by 24 local companies, a bank loan, and funding from the Japan Green Fund. Hotoku Energy has since prospered, having created a number of successful solar projects. In 2016, the company joined forces with Shonan Power and local gas suppliers to establish an energy consortium aimed at selling locally generated solar power. This collaboration resulted in local renewable electricity accounting for approximately 23% of total power generation in 2020. Furthermore, Shonan Power offers retail electricity packages that enable customers to contribute 1% of their bills to support community initiatives. This business model has proven to be exceedingly effective, leading to the transfer of shares from ENERES, the majority owner of Shonan Power, to consortium partners and other local organizations. It has also engendered a common aspiration for renewable energy production and consumption in the local community. Additionally, the model has given rise to the city's own local energy firm and the implementation of other services, such as an electric vehicle sharing program. Key features: The formation of Hotoku Energy was aided by strong leadership and communication. The mayor of Odawara City initiated discussions with interested parties after the Fukushima disaster. The support of local small and medium enterprises was crucial in financing Hotoku Energy. ENERES transferred ownership of Shonan Power to local entities, realizing the importance of community involvement. The CEOs of the consortium partners and community leaders played a key role in facilitating discussions and collaboration. This led to the creation of a shared vision for renewable energy production and consumption in the community.

Table 14. Hotoku Energy – Japan

Village Lighting Scheme (VLS) – Timor Leste	
Background: Since 2010, the Government of Timor-Leste (East Timor) has undertaken an expansion of the grid, achieving an electrification rate that has risen from 24% at independence in 2002 to 86% in 2018. However, East Timor is a mountainous area, where many households (over 35,000) are off grid, relying on inefficient candles and paraffin lamps after dark. In 2003, a group of members of the Australian organisation Renew (formerly Alternative Technology Association) began installing solar photovoltaics on critical infrastructure in East Timor. After receiving requests for modern domestic lighting, renew collaborated with local organisations and the government in 2007 to develop the Village Lighting Scheme (VLS). The VLS is a community-managed energy programme administered at the village level. Households in the community agree to contribute to a maintenance fund that is used to pay a local technician, purchase spare parts and build up capital for the replacement of components at the end of their useful life. In addition, the community nominates candidates who will receive technical training in a mobile training unit at a Timorese vocational school and then install 30 watt (W) solar panels in households. After ten years of operation, the VLS has reached 2,133 households in seven districts of the country. However, operational success depended largely on the communities' trust in the energy committees set up to oversee the programme. Renew also faced challenges in growing the programme further unless it could identify a local entity to take over the programme. Consequently, in 2018 Renew began modifying VLS to focus on a local model run by social enterprises using domestic energy finance. This modification aims to create the economies of scale needed to support full-time technical employment and local enthusiasm to drive the programme forward.	
Key features: local model run by social enterprises using domestic energy finance to create economies of scale and support full-time technical employment and local enthusiasm. The initiative is being led by PA, who will transfer control of the community to its citizens.	

Table 15. Village Lighting Scheme (VLS) – Timor Leste

7.2. Best Practice identification

Best practices refer to activities that yield positive and specific outcomes that are sustainable and can be replicated in similar conditions by others. According to UNESCO (MOST1 program – Management Of Social Transformations) best practices in general should be: Innovative – developing new or creative solutions; Effective – showing positive and tangible impact; Sustainable – due to its social, economic and environmental characteristics, it is long-lasting and produces long-term effects; Replicable – serving as a model to develop policies, initiatives and actions in other places. Sharing best practices is a common way of exchanging knowledge and experiences, and it has a positive impact on the dissemination of successful solutions.

Based on Chapter 7.1 we summarize on Table 16 the best practices identified.

EC Name	Country	Best Practices
Energía del Prat		Legal form (LLC+Association) fills all the EC requirements, safeguards PA leading role, helps secure funding, shields EC structure from capital increases, simplifies municipality participation as a member.
Osona Model		Indirect role of the PA as a driving force and tractor of ECs in the region; own replicable model in different municipalities; second degree cooperative that provides economic, technical, operative support; provision of training and content generation for citizens.
Bioenergiedorf Jühnde eG		Role of proximity and social cohesion; contribution to strengthening the sense of community in Jühnde. Mayor's involvement in motivating citizens; multi-service offering contributes to the sustainability of the community energy project
Eno Energy Cooperative		Exploits local renewable resources to benefit local community; role of PA helping finance; exceptional longevity
RevoluSolar		Project all about social impact: fighting energy poverty, building capacity among adults and contributing to sustainability education for children
Fetlar Wind		Off-grid microgrid with private wire distribution for electricity and thermal storage for wet heating systems connected. Hot water tanks storage for surplus generated energy, increasing local power usage
Renewable Energy Project (PRIER)		Households and institutions made their roofs available in a disinterested manner; Power generation for self-consumption with government support for equipment acquisition; production and development of a simple and accessible material; replicability among cities in actions related to the use of renewable energy; "Citizens' Pact" (reinvesting the savings generated by the pilot project in solidarity to expand the project).
Hotoku Energy		Strong leadership and communication; support of local small and medium enterprises; transferred ownership of EC facilities to local entities; creation of a shared vision for renewable energy production and consumption in the community.
Village Lighting Scheme (VLS)		Local model run by social enterprises using domestic energy finance to create economies of scale and support full-time technical employment and local enthusiasm. The initiative is being led by PA, who will transfer control of the community to its citizens.

Table 16. Best Practices Summary

7.3. Learning from organizational designs in other sectors

Within the context of Energy Communities, the business model and the organizational structure in the EU is rapidly changing and approaching different types of organizational design to adjust to the fast-changing reality. In this sense, local energy initiatives have a lot to learn from cross-industry knowledge transfer that can lead to innovative organizational models. The agri-food sector can provide interesting and valuable lessons learnt on how to implement sustainable practices and processes in the long-term in the energy sector as per the features the two sectors have in common.

In all countries with an advanced agri-food system, agricultural cooperatives play a major role in producing and bringing food to consumers' tables (Bijman et al., 2012). During the last 35-40 years, in addition to the traditional agricultural cooperative, we have witnessed the emergence of numerous organizational innovations that have resulted in many new models of collective entrepreneurship in agriculture around the globe (Chaddad and Cook, 2004). In order to understand these new models, we have to contrast them to the traditional cooperative model but, also, to Investor-Oriented Firms (IOFs). Such comparisons are facilitated if we look at the three basic questions of organizational design: Who owns? Who controls? Who benefits?

Traditional agricultural cooperatives, usually composed by farms and food businesses, are user-owned, user-controlled, and user-benefitted, and whose goal is to achieve the objectives set by their members through democratic processes (Cook and Iliopoulos, 2016). On the other hand, IOFs are investor-owned, controlled, and benefitted businesses whose main objective is to create value for their investors-owners. This is a major difference that has numerous and significant consequences for both the owners and the society at large.

While until, approximately, forty years ago agricultural cooperatives were, more or less, following the same organizational design, recently we observe additional models emerging in different countries (Cook and Chaddad, 2004). The need for such organizational innovations arguably came from the combination of increasing competitive pressures and intra-cooperative constraints that necessitated the reinvention of cooperatives in order to survive (Iliopoulos, 2014). The need for injecting significant amounts of risk capital that members have little or no incentive to provide and/or the need to improve the efficiency of internal governance led to experimentation with new ownership and governance attributes (Cook and Iliopoulos, 2016). The associated organizational innovations concern primarily two aspects of organizational design, namely, the ownership structure and the governance model adopted, which we examine next.

7.3.1. Innovations in the ownership structure

Based on the definition and allocation of ownership rights, a traditional agricultural cooperative is a farmer organization with the following characteristics:

Ownership	◆ <i>Open, Producers</i>
Control	◆ <i>One-member, One-vote</i> ◆ <i>District/At large</i>

Benefits	◆ <i>Proportional to patronage</i>
Primary Risk Capital Generation	◆ <i>Earnings, Retains</i>
Supply Control	◆ <i>Limited</i> ◆ <i>No delivery obligation</i>
Equity Investment	◆ <i>Illiquid, Exit constraints</i> ◆ <i>Non-transferable</i> ◆ <i>Non-appreciable</i> ◆ <i>Redeemable</i>

Table 17. Traditional agricultural cooperative characteristics

The emerging cooperative models modified one or more of these ownership attributes in order to provide members with incentives to invest in their cooperative and improving the efficiency of decision making in business issues (Iliopoulos, 2014). Chaddad and Cook (2004) identify emerging ownership models adopted by agricultural cooperatives in various countries (Figure 2).

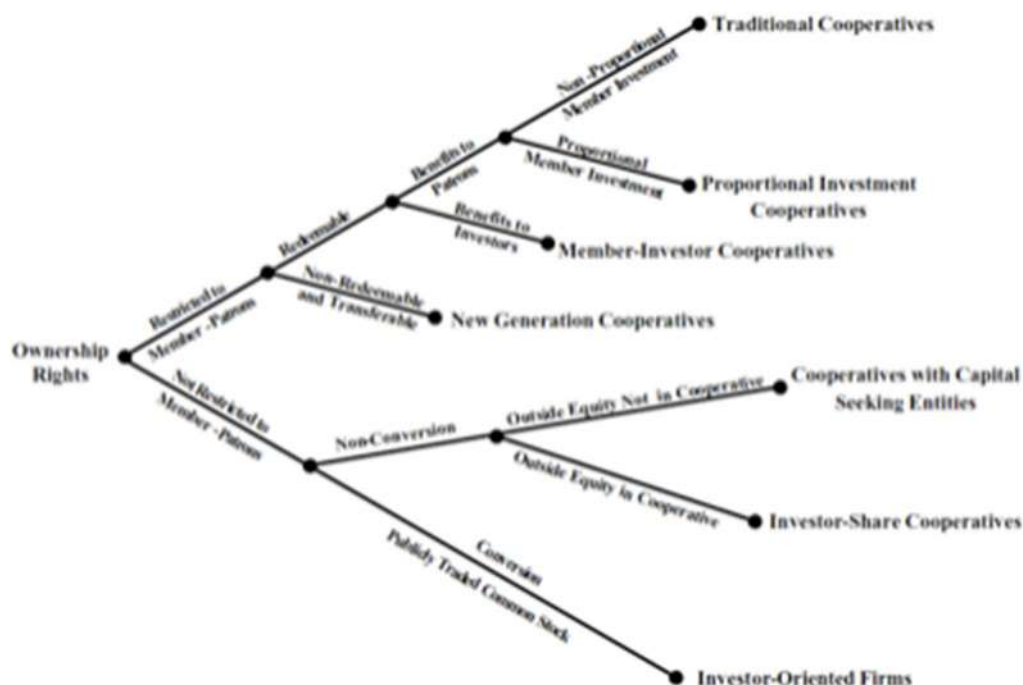


Figure 2. Emerging ownership models adopted by agricultural cooperatives - Source: Chaddad and Cook (2004, p. 352)

In Figure 2's upward-egressing branch, three innovative models are outlined, each with ownership rights limited to member-patrons: the proportional investment cooperative, the member-investor cooperative, and the new generation cooperative.

The proportional investment cooperative model limits ownership rights to members, making them non-transferable, non-appreciable, and redeemable. However, members are expected to invest in the cooperative in proportion to their patronage. To ensure proportionality of internally generated capital, proportional investment cooperatives adopt capital management policies such as separate capital pools and base capital plans.

In member-investor cooperatives, returns to members are distributed based on their shareholdings in addition to their patronage. This can be achieved through dividend distribution proportionate to shares and/or appreciation of cooperative shares.

The new generation cooperative model, on the other hand, grants ownership rights in the form of tradable and appreciable delivery rights exclusively to current member-patrons. In addition, member-patrons are required to acquire delivery rights based on their expected patronage, aligning usage and capital investment perfectly.

In Figure 2's downward-egressing branch, ownership rights are not limited to member-patrons, allowing the cooperative to acquire risk capital from non-member sources. However, this may result in members having to share profits and control rights with outside investors who may not necessarily be patrons of the cooperative, leading to potential conflicts of interest. Conflicting goals may arise between maximizing returns for investors and member-patrons.

The more radical model in this branch is the conversion to an Investor-Owned Firm (IOF), which serves as an exit strategy for cooperatives that choose not to continue operating as a user-owned and controlled organization. Alternatively, cooperatives may acquire risk capital from outside investors through capital-seeking entities or investor shares. In the first model, investors acquire ownership rights in a separate legal entity that is wholly or partially owned by the cooperative. In other words, outside investor capital is not directly introduced into the cooperative firm, but rather into trust companies, strategic alliances, or subsidiaries.

In investor-share cooperatives, investors receive ownership rights in the cooperative in addition to the traditional cooperative ownership rights held by member-patrons. This means that the cooperative issues multiple classes of shares assigned to different "owner" groups.

In the last decades, we have also witnessed experimentation with hybrid ownership models (Iliopoulos, 2014). For example, in the USA and Europe, during the 1990s and early 2000s, numerous multi-stakeholder cooperatives emerged (e.g., Lund and Novkovic, 2023; Gonzalez, 2017; Schermer, 2015). Such cooperatives are owned by both local farmers and the consumers of their products. Such models may provide additional inspiration to local energy initiatives, but also serve as potentially replicable organizational models.

7.3.2. Innovations in the internal governance model

Agricultural cooperatives have traditionally followed one of the following internal governance models; the traditional and the extended traditional governance models as it is possible to see in the Figure 3 that follows.



Figure 3. Ownership models adopted by traditional agricultural cooperatives - Adapted from Chaddad & Iliopoulos (2013, p. 7)

In the traditional governance model, the higher decision-making body is the General Assembly of members (GA), which elects a board of directors (BoD) and, if the cooperative law makes it mandatory, a Supervisory Committee (SC). The BoD is usually responsible for designing the long-term strategy of the cooperative and making all strategic decisions. In this model, one board member, most commonly the Chairperson, also acts as the general manager of the cooperative, responsible for day-to-day operations. The extended traditional model is the same as the traditional one, except that the BoD hires and supervise professional management to run the cooperative. The extended traditional model is the governance model most widely used by agricultural cooperatives around the world (Chaddad and Iliopoulos, 2013).

The last two decades, agricultural cooperatives have experimented with alternative governance models (Chaddad and Iliopoulos, *ibid*). Two of these models, the managerial and corporate ones, are depicted in Figure 4 below.

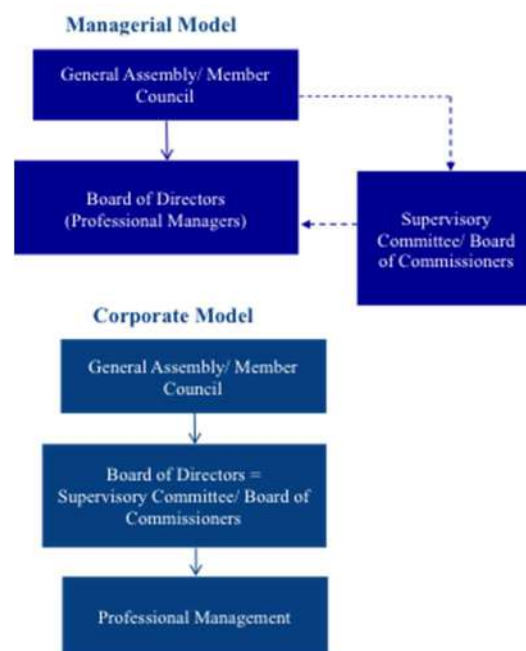


Figure 4. New internal governance models adopted by agricultural cooperatives - Adapted from Chaddad & Iliopoulos (2013, pp. 8-9)

The managerial model of cooperative governance streamlines the decision-making process by merging the Board of Directors (BoD) with the professional management team, effectively eliminating one layer of governance. In this model, only external professionals who are not member-patrons of the cooperative are appointed to the BoD, which holds the responsibility for decision management functions. This means that both formal and real authority are vested in the hands of professional managers in the managerial model. While ultimate control rights for major decisions still rest with the General Assembly (GA), day-to-day operational and strategic decisions are delegated to the professional managers. The Supervisory Committee (SC) or the Board of Control (BoC) in larger cooperatives exercises ex post control over the decisions made by the BoD.

On the other hand, the corporate model of cooperative governance consolidates the BoD with the SC or BoC. In this model, both members and non-members, usually experts, participate in the expanded BoD, but the bylaws may specify that two-thirds of BoD members must also be member-patrons of the cooperative. In this case, professional managers hold both formal and real authority. The majority of decisions are delegated to managers, and the BoD's role is primarily focused on decision control.

The above-described innovations in the ownership and internal governance models adopted by agricultural cooperatives and other farmer-owned producer groups around the world provide inspiration and knowledge to local energy initiatives (e.g., energy cooperatives), on the organizational design attributes they need to consider when co-creating the organizational design of their organizations. For example, the common complaint of people involved in local energy communities is about the difficulties they face in securing enough capital for requisite investments. We know from the evolution of agribusiness cooperatives over the last forty years that, at least in some cases, the cooperative needs to consider member-users also as investors, whose capital contribution should be compensated properly. In this way, member-patrons have an incentive to contribute risk capital for constructing infrastructures and growing the business.

Therefore, it may be advisable for energy communities and cooperatives to consider all the roles assumed by their members (both individuals and organizations) and treat each role separately but in an integrated fashion.

Similarly, energy communities need to adopt internal governance models that facilitate efficient decision-making, while ensuring that control of the initiative stays in the hands of member-patrons. Although this is a very complex task, they can receive inspiration by paying closer attention to the changes in the traditional governance model introduced by agricultural cooperatives, particularly in northern Europe. While copy-and-paste replications are not advisable, still there is a lot to be gained from looking at how agricultural cooperatives have evolved along their life cycle over the past decades.

8. Learning and capacity Building needs - Analysis

8.1. Italy

Energy communities (ECs) are becoming increasingly popular in Italy as a way for communities to transition to renewable energy sources and reduce their carbon footprint. Moreover, as explained in Chapter 4, Italian ECs are still developing. The temporary phase of the legislative framework and the topic's novelty hindered these communities' full deployment. Thus, the challenges that are still facing Italian ECs regard still the setting-up and implementation phases of the communities, and, due to the innovative subject, lack of know-how regarding those phases is spread across public and private sectors, as well as citizens.

One major issue is the lack of an expert figure in public administration (PA) who is knowledgeable about ECs. This lack of expertise can lead to the outsourcing of tasks related to setting up a community, engaging citizens, and setting up renewable energy plants. It also results in difficulties in accessing funds and a lack of involvement of all the PA staff members in community building. Moreover, the knowledge gap recognized within the Public Administration (PA) affects the formation and engagement of ECs. The PA lacks internal knowledge on how to set up a community, engage citizens, and set up renewable energy plants. The lack of an expert figure in public administration regarding ECs, personnel, and specific qualifications in the municipalities, as well as the technical support needed to reduce the level of complexity and support the municipalities, are, thus, elements hindering the development of ECs in Italy. One of the suggested solutions is the need for the PA to engage in capacity-building activities and training, including interdisciplinary and multidisciplinary figures, strategic vision for specific RECs, and communication and negotiation skills and techniques.

However, another issue is, indeed, the lack of online courses for ECs. Although there are webinars and small lectures available online, they typically last a few hours, which may not be sufficient to provide a comprehensive understanding of the technical aspects of setting up and managing an EC. Live and experiential training methods, such as learning by doing, could be the most effective way of training the staff on the mechanisms that make the community work and how to relate to the other members who make up the community. Online courses, webinars, and short lectures could also be helpful, especially on technical, social, and economic aspects related to the strengthening and concrete development of ECs.

Moreover, the technical feasibility and implementation of ECs require a long-term management plan that includes maintenance and management responsibilities. The lack of startup funding for energy plants and technical-economic feasibility studies is also an issue that needs to be addressed. To bridge the knowledge gap, there is a need for training and education on the technical aspects of collecting and analysing large amounts of data. The dialogue between good practices in Europe would also be useful to share knowledge and expertise.

Lastly, another main challenge faced by ECs is the lack of know-how on funding for startup costs and technical-economic feasibility studies. This can slow down or even prevent the development of ECs, especially for local public administrations that may not have the resources to invest in such projects. To address this challenge, it is important to explore and build capacity on alternative funding sources such as grants, loans, or crowdfunding. In some cases, it may be possible to partner with private companies or investors who are interested in supporting sustainable energy projects. Additionally, seeking government subsidies or tax incentives for renewable energy projects can be helpful.

In conclusion, Energy Communities in Italy are a promising way for communities to transition to renewable energy and reduce their carbon footprint. However, there are still significant challenges that need to be addressed for their full deployment. These challenges include the lack of expertise within public administration, the need for capacity-building activities and training, the lack of online courses for ECs, the long-term management plan, and the lack of funding for startup costs and feasibility studies. Addressing these challenges will require a collaborative effort from various stakeholders, including public administration, private sector, citizens, and international organizations. By investing in education, technical support, and alternative funding sources, Italian ECs can overcome these challenges and achieve their full potential, contributing to a more sustainable future for all.

8.2. Spain

In Spain, Energy Communities have gained attention as an alternative model to traditional centralized energy production and consumption. However, to fully realize the potential of ECs in Spain, a favourable legal framework is required, and the current ones are the Law 24/2013 of the Electricity Sector and the Royal Decree 244/2019, paving the way for the development of ECs in Spain, providing the legal basis for self-consumption and the sale of excess electricity to the grid. In addition to the national legal framework, Spain has also implemented regional regulations that establish specific requirements and procedures for ECs.

However, there are several barriers and knowledge gaps that need to be addressed to successfully implement energy communities. The barriers include administrative hurdles, mistrust of collective actions, financing difficulties, grid capacity issues, and lack of knowledge and uncertainties from financial institutions.

Registration as a cooperative in Spain is a lengthy and complicated process, with a lot of red tape barriers and administrative requirements. This administrative burden can discourage potential energy communities from forming. Additionally, there is mistrust in implementing an energy community due to past bad experiences of collective actions in the territory, specifically with cooperatives. This mistrust can hinder the development of energy communities, and there is a preference for collective self-consumption as it does not require legal status and is easier to involve public authorities without governance and management schemes.

The introduction of energy communities in municipalities located in different autonomous communities, under distinct regulatory frameworks, can impede the swift adoption of the legal framework governing energy communities. Moreover, the lack of formal knowledge on the part of the PA staff apart from the individual knowledge of each staff member creates a barrier to successful implementation.

Financing models are not clear, and access to public grants can be lengthy and complicated, making it challenging for energy communities to secure funding. Furthermore, barriers and problems being raised by the utility, such as unavailable grid capacity and refusal to disclose the available capacities overall, create additional difficulties for energy communities.

There is a knowledge gap at the municipality and citizen levels regarding energy communities and their services. The lack of technical and general knowledge on the part of the local authorities, staff, and citizens is a significant barrier to the successful implementation of energy communities. There is a need for external agents to help municipalities develop projects and carry out dissemination campaigns for citizens. Formal capacitation on all topics related to energy communities is also necessary to ensure that knowledge is homogenous and dispersed.

At the technical feasibility and implementation level, there is a small population with a great technical knowledge deficit. There is a need to build capacity for future direct employees and associates in general. Municipality-level training of PA staff is necessary, and citizen-level information is essential to build confidence and participation. Financial institutions

also need to understand what a local energy community is and the risks it presents. Without understanding the business model, financing becomes more difficult to obtain for energy communities. Energy communities also need to know how to extend the initial group of 10-12 people, usually very active, and involve the community in general. The implementation of shared consumption and billing is also a challenge that energy communities need to address.

In conclusion, while Energy Communities hold great potential for Spain's energy transition, there are several barriers and challenges that need to be overcome for their successful implementation. The national and regional legal frameworks have laid the groundwork for self-consumption and the sale of excess electricity to the grid. However, administrative hurdles, mistrust of collective actions, financing difficulties, grid capacity issues, and lack of knowledge and uncertainties from financial institutions present significant barriers to the establishment and growth of energy communities. To address these barriers, there is a need for capacitation, dissemination campaigns, and technical capacity building at the municipality and citizen levels, as well as greater understanding and support from financial institutions. If these challenges are successfully addressed, energy communities could play a significant role in Spain's transition towards a more sustainable and decentralized energy system.

8.3. Poland

The lack of knowledge and experience among local authorities' employees is a major barrier to developing and sustaining community-based energy initiatives in Poland and other countries. Without the proper knowledge and expertise, local authorities are unable to effectively promote energy communities and support their development. This lack of knowledge is particularly acute in the citizen engagement field, which leads to limited promotion of energy communities.

Additionally, Poland's legislative framework does not promote distributed renewable energy systems, such as renewable energy communities, and funding schemes. This means that there is no legal framework in place to support the development of energy communities, and funding for such projects can be difficult to obtain. Furthermore, with no legal backup, renewable energy projects are often viewed as risky, and there are no guarantees of profitability, making it difficult to access grants and explore innovative business models.

To overcome these challenges, there is a need for increased access to knowledge and information about energy communities. This includes access to laws and their interpretations, as well as lobbying for energy policies that promote local energy communities. In addition, an efficient work administration tool or platform is needed to analyse energy consumption, exchange information, and create agreements and documents. This tool should also contain a database of best practices and processes for overcoming barriers.

Another significant issue is the lack of practical information on how to build and manage energy communities. This lack of knowledge is particularly evident in the area of balancing and settling energy, as there is no contact or cooperation with energy producers and grid owners. Private energy cooperatives are also often unwilling to share their knowledge and experience, making it difficult for new communities to learn from others who have already been successful. It was, in fact, highlighted that there is a need for experience and case studies from those who have been operating energy communities successfully for a long time.

To address this knowledge gap, there is a need for more practical training and skills development for those involved in energy communities. This training should go beyond theoretical knowledge and provide practical skills that can be applied in real-world situations. While some workshops and lectures are available in Poland, they are often stationary and held outside of the workplace, making it difficult for employees to attend.

In conclusion, the transformation of energy systems requires a combination of top-down and bottom-up approaches, with citizens playing an active role. To effectively promote and support the development of energy communities, local authorities and coordinators need access to knowledge and tools, and policy changes are necessary to promote renewable energy systems. By addressing these challenges, Poland can play a crucial role in transforming its energy mix and maintaining its membership in the EU and international agreements.

8.4. Conclusion

In conclusion, Energy Communities are a promising alternative to traditional energy production and consumption, with the potential to reduce carbon footprint and increase sustainability. However, challenges related to knowledge gaps and legal frameworks need to be addressed to achieve their full potential, as summarized in the figure below. Summarizing the beforementioned findings obtained through interviews with stakeholders from the three different countries, it can be noticed how essential capacity building programs are in spreading innovation, in this specific case Energy Communities. Lack of technical social, legal/administrative competences have been acknowledged from the literature and confirmed by the interviewees, with a further focus on the lack of personnel and specific qualifications in the municipalities' staff.

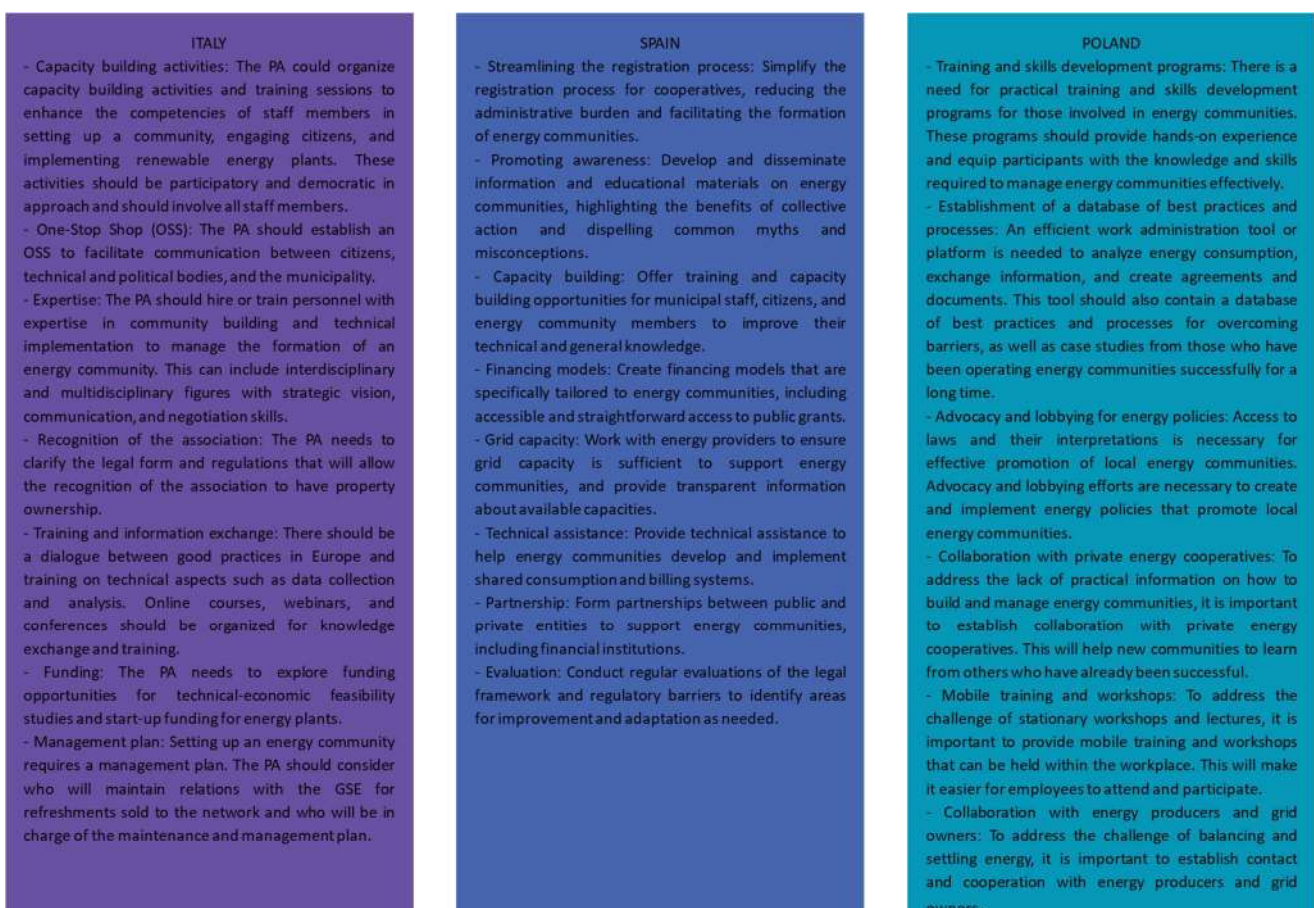


Figure 5. Sum-up of the three pilot's knowledge gaps & legal frameworks

In Italy, the challenges are related to the lack of expertise within public administration, the need for capacity-building activities and training, the lack of online courses for ECs, the long-term management plan, and the lack of funding for startup costs and feasibility studies. Addressing these challenges will require a collaborative effort from various stakeholders. In Spain, a favourable legal framework has been established, but barriers and knowledge gaps still need to be addressed. These include administrative hurdles, mistrust of collective actions, financing difficulties, grid capacity issues, and lack of knowledge and uncertainties from financial institutions. While the legal framework for energy communities in Poland is in place, there is a knowledge gap regarding the technical aspects of setting up and managing an energy community. This knowledge gap extends to both the public and private sectors, including municipalities, investors, and citizens. There is a need for capacity-building activities and training programs that focus on the technical, economic, and social aspects of energy communities. Additionally, there is a lack of funding sources for startup costs and feasibility studies, which can slow down the development of energy communities. Addressing these knowledge gaps and providing support for the development of energy communities can help Poland transition to a more sustainable future.

To overcome these challenges, it is necessary to invest in education, technical support, and alternative funding sources, as well as to create a supporting legal framework and address administrative barriers. By doing so, Energy Communities can fully realize their potential and contribute to a more sustainable future for all.

9. Conclusions and recommendations to be considered for the ECGT

In a context of high pressure on the European energy sector, that has been increasingly challenged over the last decades and that still suffers peaks of strain motivated by global events, such as the invasion of Ukraine, increasing the resilience and economic and environmental sustainability of the European energy supply system is of paramount importance. As a clear contributor to the decentralising and democratising of energy production and management, and a very well-suited vehicle for distributed renewable energy generation and other energy-efficiency related activities, Energy Communities are increasingly being proposed as part of the solution. In the last few years, a great effort has been conducted to increase the number of EC initiatives, understanding, and trying to overcome the barriers to their creation and implementation. This has resulted in a high number of new EC being created all over the EU. However, jump-starting a whole economic sector in a context of absence of complete and effective regulation, unadjusted national legal frameworks and even uncertainty as to the interpretation of the base concepts is complex and time consuming, which makes it very important to know the most successful initiatives in as much detail as possible. Particularly, it has been noted that the ECs created under the protection of foster-plans would prove to have a low survival rate once the initiatives that spawned them were over. The motivation of this study is then in the first instance to try to understand the root causes of the failure of the ECs to thrive in the absence of outside stimuli, on second instance to characterize these barriers and needs so as to allow solutions and mitigation plans to be developed, and finally to gain some insight on the different structural characteristics of ECs, such as their Business Plans, their corporate structure and their governance models so as to be able to derive the context-dependent optima with the final goal of their long-term subsistence.

In line with these objectives, the present work started by looking at the state-of-the-art of the implementation of Energy Communities in the EU, in terms of barriers and capacity building needs through literature review and desk research. After this, a series of interviews with different stakeholders has enabled a better understanding of the challenges and specificities of the EC sector within the three demo OIS Hub countries: Italy, Poland, and Spain. The same interviews were also used to get a clear picture of the knowledge gaps and capacity building needs within each of the demo OIS Hubs PA staff, and also in the population in general. In some of the interviews the *Dialogue Interview* techniques have been used, and from these interviews apart from the barriers and needs identification also some very valuable information on the Business Model has been extracted. Finally, a review of the EC situation in the world, inside and outside of the EU, has been carried out in order to identify best practices that can potentially be translated into tools and recommendations applicable to the demo OIS Hubs.

In Italy the transposition of the definitions of REC and CEC has been in place since 2021, but the definition of some specific criteria not included in the decrees has been completed only in January 2023, through the publication of the TIAD, thus ending a period of temporary dispositions and uncertainties.

In Spain, the definition of RECs is exactly the same as the one of the EU definitions, without any elaboration on what each term means. There is no concrete delimitation of the types of legal entities that could be used to develop RECs; moreover, there are no powers given to a regulatory authority to oversee the definition, which could give rise to abuse and lack of trust in the concept by citizens. Numerous ECs were subject to regulation through the conditions and requirements of different grant programs designed to establish and develop such communities. On the 21st of April 2023, the Ministry for the Ecological Transition and Demographic Challenge (MITERD) released a public consultation regarding the draft text of

a Royal Decree (RD) aimed at regulating the legal frameworks for Renewable Energy Communities (REC) and Citizen Energy Communities (CEC). The REC and CEC requisites are in principle aligned with what was expected and with what has been common practice in the sector and would complete the missing definitions in a way that would allow a notable diminution of the regulatory uncertainties tied to new EC initiatives.

The legislative environment in Poland is still underdeveloped for ECs, with proposed changes to facilitate their development. Currently, there are three types of ECs, with energy clusters being the most common. However, they are not legal entities and generally are formed by large companies (large enterprises are not allowed to effectively control them), which creates shortcomings in implementing the Renewable Energy Directive II.

According to literature review and work carried out by the consortium, barriers to the continuity of ECs have been classified into 6 categories. From all the identified barriers, those deemed to have greatest significance or impact on the sustainability of the EC have been singled out.

From all the barriers cited, the ones relating to the **"Regulatory framework and legal status"**, **"Financial scheme and economic sustainability of the Business Model"** and **"Decision-making and governance structure"** have been identified as the most concerning, together with **"Bureaucracy and administration"** under the **"Political, Administrative and Institutional support"** category.

In Italy and Poland **"Lack of digitalisation"** under the category **"Others"** has also been identified as a strong barrier.

In Italy, the challenges are related to the lack of expertise within public administration, the need for capacity-building activities and training, the lack of online courses for ECs, the long-term management plan, and the lack of funding for startup costs and feasibility studies. Addressing these challenges will require a collaborative effort from various stakeholders. In Spain, a favourable legal framework has been established, but barriers and knowledge gaps still need to be addressed. These include administrative hurdles, mistrust of collective actions, financing difficulties, grid capacity issues, and lack of knowledge and uncertainties from financial institutions. While the legal framework for energy communities in Poland is in place, there is a knowledge gap regarding the technical aspects of setting up and managing an energy community. This knowledge gap extends to both the public and private sectors, including municipalities, investors, and citizens. There is a need for capacity-building activities and training programs that focus on the technical, economic, and social aspects of energy communities.

Starting with a proposed classification of ECBMs into one of 8 archetypes, the ECs whose members have been interviewed were placed into the categories of "Energy Cooperative", "Community Prosumerism" and "Community Collective Generation". It is worthy to note that in Italy the ECs are either in the "Community Prosumerism" or "Community Collective Generation" categories, whereas in Spain "Energy Cooperative" is the main BM. This indicates that the regulatory framework has a huge influence in the BM, perhaps being the single most influential factor. It can also be noted that there is significant involvement from the public sector in these projects, renewable energy sources are the main energy sources used, cooperative or association are the legal forms that more easily fit with the characteristics required by the European Directives (especially "free and voluntary" participation) and finally that most ECs emerge from public support schemes.

Financial instruments potentially available to ECs have been listed and summarised, and the impact of the level of public involvement on public/private collaboration ECBMs has been verified through a more detailed analysis of three ECBMs with very different levels of public involvement. Next steps regarding the development of applicable / recommended

ECBMs will take on from this point and deepen the formal analysis of the ECBMs on one side, and the possible dependencies between financing options and ECBM choices.

International cases have been selected to be as close as possible to the REC definition, and have shown that ECs, particularly RECs are well suited to a wide range of objectives, from the social impact of the Brazilian “RevoluSolar” and the East-Timorese “VLS” to the more environment and economical oriented “Hotoku Energy” in Japan or “Eno Energy Cooperative” in Finland. Each of the selected cases highlights at least one interesting feature that can be replicated in future EC projects.

As well as looking overseas for inspirational projects and models, it is worthy to look into other sectors where initiatives that share similitudes to the ECs have evolved over a much larger period of time. Particularly, in the case of agricultural cooperatives, these consist of user-led initiatives, controlled by the users to their own benefit, much like the EC model. In this case, a sort of “cross-industry knowledge transfer” is proposed, as innovations in both the ownership structure and the governance models of agricultural cooperatives are presented. Determining what and how much of these innovative models can be transferred into the EC model is an important part of the work that is still to be done in the next steps.

10. References

Aoidh A., et al., PESTLE analysis of Barriers to Community Energy Development, LECO policy paper, Northern Periphery and Arctic Programme 2014-2020

Arnould, J. and D. Quiroz (2022, September), Energy communities in the EU: Opportunities and barriers to financing, Amsterdam, The Netherlands: Profundo

Brummer, V., Community energy – benefits and barriers: A comparative literature review of Community Energy in the UK, Germany and the USA, the benefits it provides for society and the barriers it faces (2018), Renewable and Sustainable Energy Reviews, Elsevier, vol. 94(C), pages 187-196 Friends of the Earth Europe, Barriers and threats to the people-owned energy revolution (2021)

De Lotto, R., Micciché, C., Venco, E. M., Bonaiti, A., & De Napoli, R. (2022). Energy Communities: Technical, Legislative, Organizational, and Planning Features. *Energies*, 15(5), 1731.

Deutsche Energie-Agentur (Publisher) (dena, 2022) “Best practices for energy communities in Poland and Germany”.

Empowering Citizens for Energy Communities: A Policy Brief from the Policy Learning Platform on Low-carbon economy (2022). Interreg Europe.

Handbook of identified barriers and enablers. Deliverable D3.2. developed as part of the SHAREs project funded under EU H2020 grant agreement 101033722, April 2022.

IRENA Coalition for Action (2021), Community Energy Toolkit: Best practices for broadening the ownership of renewables, International Renewable Energy Agency, Abu Dhabi.

Khadem Sh., Nouri A., Papadimitriou Ch., Efthymiou V., Report on community energy policy and barriers (2021), Deliverable D3.3, Pan European Technology Energy Research Approach.

Knott, E. Et al. (2022): Interviews in the social sciences. *Nature Reviews Methods Primers* volume 2, Article number: 73

Lazdins, R., Mutule, A., Žalostība, D., PV Energy Communities—Challenges and Barriers from a Consumer Perspective: A Literature Review (2021). *Energies*. 14. 4873. 10.3390/en14164873.

Palm, J. (2021). Energy communities in different national settings – barriers, enablers and best practices, Deliverable D3.3 developed as part of the NEWCOMERS project, funded under EU H2020 grant agreement 837752, May 2021.

Peeters L., Protopapadaki C., Vandamme L., Most Prominent barriers and best practices (2021), LECSea Project, European Regional development Fund.

Programa Internacional de Cooperación Urbana Unión Europea – América Latina y el Caribe – “Energía Limpia – Caso: Energía Distribuida Armstrong” (2020), available at: https://iuc.eu/fileadmin/user_upload/Regions/iuc_lac/user_upload/Armstrong_-_Energ%C3%ADa_Distribuida_.pdf

Reis, I. F., Gonçalves, I., Lopes, M. A., & Antunes, C. H. (2021). Business models for energy communities: A review of key issues and trends. *Renewable and Sustainable Energy Reviews*, 144, 111013.

Renewable Energy Directive 2018/2001/ EU DIRECTIVE (EU) 2019/944 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on common rules for the internal market for electricity

REScoop- ECOLOG Institute for Social-Ecological Research and Education(2022).Model Assessment of Potential and Barriers to the Development of Renewable Energy Communities at the National Level. Lars Holstenkamp, Christian Kriel

Rescoop.eu (2021) Best Practice Guide D4.1 – COOLKIT Compile H2020 project.

REScoop.eu (2021), COMPILE. Financing Guide.

Schmuck P., Karpenstein-Machan M., Wüste A. (2013). Applying the Sustainability Science Principles of the Göttingen Approach to Initiate Renewable Energy Solutions in Three German Districts. En: Ruppert H., Kappas M., Ibendorf J. (eds.) *Sustainable Bioenergy Production - An Integrated Approach*. Springer, Dordrecht.

Spanish Royal Decree of Law – Real Decreto-ley 23/2020

11. Annexes

11.1. Annex 1 – Interview summary

Country	Entity	Role(s)	Type	Interview date	Conducted by
Spain	Energía Bonita - La Palma (Canarias)	Civil society - Co founder and Board Member	EC	01/02/2023	ANESE
Spain	Director - km0 energía	Technical Consultant	Third-party consultant	14/02/2023	ANESE
	Participant - "Comunidad Energética de la Poble de Segur"	Civil society - Co founder and Board Member	EC		
Spain	CEL Management (Promoter and Manager of Local ECs) Abenójar Energy Community	General Manager Financial Manager Sales Manager Back Office Manager	Third-party promoter	24/02/2023	ANESE
Spain	Energy Community Technician - Osona Energy Local Agency	Technical Municipality	PA	27/02/2023	ANESE
Spain	El Prat Energy Community	Technical Municipality	EC	27/02/2023	ANESE
Spain	El Padul Energy Community Solurgy	El Padul Mayor Technical Consultant	EC	14/03/2023	ANESE
Italy	Postdoc Research Fellow, Trieste University, Social and Political Science	Technical	Expert	02/02/2023	AISFOR
Italy	Consultant/Junior Officer, ènostra, energy cooperative	Technical	EC	06/02/2023	AISFOR
Italy	Chair of Federconsumatori Lazio	Technical	Expert	08/02/2023	AISFOR
Italy	Professor in Law, Camerino University	Technical	Expert	13/02/2023	AISFOR
Italy	Coordinator, Joint Office for Environmental Sustainability	Technical	PA	09/02/2023	AISFOR
Italy	Researcher, RSE Research on the Energy System	Technical	Expert	20/02/2023	AISFOR
Italy	Member of the Energy Community of Antrodoco	Technical	EC	06/02/2023	ANCI LAZIO
Italy	Energy Community of Ventotene Project Manager	Technical	EC	07/02/2023	ANCI LAZIO
Italy	Municipality of Antrodoco	Municipal councilor	EC	06/02/2023	ANCI LAZIO
Italy	Municipality of Castel Sant'Angelo	Mayor	EC	03/03/2023	ANCI LAZIO
Italy	Board Manager member of "ANCITEL ENERGIA E AMBIENTE"	Board Manager member	PA	21/02/2023	ANCI LAZIO

Italy	Municipality of Monterotondo	delegate to Energy of Municipality of Monterotondo	EC	02/03/2023	ANCI LAZIO
Italy	Renewable Energy Community of Ventotene	President	EC	03/03/2023	ANCI LAZIO
Poland	Skawina Municipality	Municipality	PA	08/03/2023	KMA
Poland	Wieliczka municipality	Municipality	PA	08/03/2023	KMA
Poland	Chairman of the Board - Instytut Projektów i Analiz (IPA)	Technical	Expert	10/03/2023	KMA

Table 18. Interviews summary

11.2. Annex 2 – Survey text

Survey

Part 1: Information on the Interviewee

- Name:
- Country:
- Position – Name of the Organization:
- Role (technical, civil society, municipality):
- Email:
- Date of the interview (dd/mm/yyyy):

Part 2: Questions

For further information on the questions, a **guide** of the survey is provided in the file called “Interviewer Guidelines Survey”.

1st Step: Community Building

- GENERAL
 - How did the interest in this area start?
 - Who have you partnered with in this phase? How?
 - If you are a member of a community, what legal form (e.g., cooperatives) was chosen for the realization of the energy community? And are there any management structure set up for collaboration?
- BARRIERS
 - What are the regulatory, social, etc. barriers encountered in the *setting-up* of the energy community?
- KNOWLEDGE GAP
 - If you are a member of the Public Authority staff/Local Authorities, how have you acquired enough knowledge on the subject? If not, what knowledge do you lack and would you like to acquire it?

- If you are NOT a member of the Public Authority staff/Local Authorities, how have you acquired enough knowledge on the subject? If not, what knowledge do you lack and would you like to acquire it?
- If you are NOT a member of the PA staff/Local Authorities, did you get support from the latter? If yes, how?

2nd Step: Technical Feasibility and Implementation

- GENERAL
 - Who have you partnered with? How?
 - Is any support (capacity and funds) foreseen at the national/regional level for EC?
 - How the areas for the project location were identified?
 - How was the ownership of the entity/project defined?
 - Was it straightforward to access the incentives, if available?
- BARRIERS
 - What are the regulatory, social, etc. barriers encountered in the *implementation* of the energy community?
- KNOWLEDGE GAP
 - If you are a member of the Public Authority staff/Local Authorities, how have you acquired enough knowledge on the subject? If not, what knowledge do you lack and would you like to acquire it?
 - If you are NOT a member of the Public Authority staff/Local Authorities, how have you acquired enough knowledge on the subject? If not, what knowledge do you lack and would you like to acquire it?
 - If you are NOT a member of the PA staff/Local Authorities, did you get support from the latter? If yes, how?
 - According to you, what would be the most efficient way to receive the training? What is the most efficient tool to learn, according to you?
 - Are there any trainings available in your country? If yes, what type?

3rd Step: Future Operation and Expansion of the Community (only for ECs that are currently operating)

- GENERAL
 - How long has your EC been in operation?
 - Is your EC expanding / shrinking or stable in dimension?
 - What is the main barrier encountered in the *operation and expansion* of the EC?
 - What do you do to actively assure the EC's continuity / expansion / sustainability?
 - Do you rely on any external partners?
- POLITICAL & ADMINISTRATIVE & INSTITUTIONAL SUPPORT
 - How can PA staff support the continued operation of an EC?
 - How do you interact with your reference municipality? (Reference persons, frequency of meetings, contact means)
- REGULATORY FRAMEWORK & LEGAL STATUS

- Does your project have a high dependency on political power? If yes, how do you manage to minimize the risk?
- How have you organised the governance of the EC once created?
- DECISION-MAKING AND GOVERNANCE STRUCTURE
 - How do you define and pursue your strategic objectives as an EC? (e.g., annual general assemblies, monthly meetings, strategic guided sessions, etc.)
 - How do you manage the internal conflicts within the EC and the exiting and admittance of members?
- FINANCIAL SCHEME & ECONOMIC SUSTAINABILITY OF THE BUSINESS MODEL
 - Have you identified any potential financial concerns in the project? If yes, how do you plan to tackle them?
 - Once a new opportunity has been identified, how is it treated inside the EC?
- SOCIO-ECONOMIC MAKE-UP OF PARTNERSHIP
 - Would you say your EC is homogenous or heterogenous regarding its socio-economic composition (income and education levels, economic activities, etc.)
 - In your opinion, the specific socio-economic composition of your EC is more a barrier or a booster to its continuity in time?

11.3. Interviewer guidelines

Interviewer Guidelines

1st and 2nd steps

Those two steps have the purpose of collecting information on the barriers that are hindering ECs' deployment in the setting-up and implementation phases, as well as understanding the knowledge gaps and what is the more suitable methodology to address them. Three are the identified macro-categories.

GENERAL: These are generic questions focused on characterizing the EC.

BARRIERS: a list of barriers is expected, better if with proposed solutions and suggestions on how to address them.

KNOWLEDGE GAP: as mentioned at the beginning of the survey, one of the aims of the latter is to understand the knowledge gaps among Public Authorities staff, as well as stakeholders and citizens around energy communities' project. Thus, this section has the purpose what are the skills needed to set-up and implement ECs', and suggestions on the purposes.

3rd step

The 3rd step questionnaire is divided into 6 sections (one general section and one section for each of the barrier types identified).

GENERAL: These are generic questions focused on characterizing the EC.

POLITICAL & ADMINISTRATIVE & INSTITUTIONAL SUPPORT: Strategic actions of the government (local, regional, national ...) that may influence the development of economy or a certain sector and/or implementation/build-up/uptake of energy communities.

Example: Lack of political support in local representatives, non-supportive energy agencies, no RES support schemes, lack of national strategies for energy communities and targets | Losing "political heroes" who had the idea & the vision (elections, someone retires, moves away...)

REGULATORY FRAMEWORK & LEGAL STATUS: Factors that affect legal and regulatory framework of the energy sector and implementation/build-up/uptake of energy communities.

Example: Administrative burdens related to the framework for the self-consumption of electricity from renewable sources and the renewable community | Centralized energy production systems and few dominating actors | Lack of final transposition from EU directives

DECISION-MAKING AND GOVERNANCE STRUCTURE: Factors that influence the continuity of the EC, from the point of view of the legal form, member participation and control of the society.

Example: Low participation. Frequent meetings between member | Dependency on external entities in the decision-making | Discomfort of former members with no control of LLCs.

FINANCIAL SCHEME & ECONOMIC SUSTAINABILITY OF THE BUSINESS MODEL: Factors that directly impact Energy Community/consumers and have resonating long term economic effects.

Example: Total dependency on external financing | Lack of access to finance, grants, not fair and insufficient feed in tariffs | Lack of financial incentives due to non-cost reflective energy prices | Uncertainties related to ownership of installations

SOCIO-ECONOMIC MAKE-UP OF PARTNERSHIP: Factors that influence developments of EC from society point of view, in general such as cultural trends, demographics, population analytics acceptance of the technologies, etc.

Example: Low disposable income | Lack of knowledge (about technology, regulation, subsidies) | Community energy is mostly prevalent in the higher-income countries/regions (disposable income) | Low environmental awareness, conflict between biodiversity protection and RES development | Lack of understanding of the potential roles of the energy communities

11.4. Dialogue Interview guide

Questions

- Key partners:

Who are the members of the EC? Are you part of the EC or are you an external actor?

- Key activities:

What services or products does the EC offer?

- Resources:

What resources do you have (internal/external)?

- Value proposition:

What are the benefits/objectives (economic, social, environmental, empowerment, etc.) you are pursuing?

- Relationship with customers/channels:

How do the associates relate with each other?

- Memberships/Customers:

Do you have customers outside the EC? Yes, who?

Who are your partners?

What is your governance model like? Who owns the project: the citizens, the municipality or a third-party partner? Type of legal entity.

- Economic Model:

- EC costs:

- What are the costs, how are they financed (financial mechanisms used: external financing, subsidies, financing from the energy community itself)?

- EC income: entrance fee, maintenance fee, membership fee, flexibility, PPA's with government, etc.

- What is the role of the public sector?

- What does it do? Transfer of land/cover, financing, tax relief, consultancy, etc.
- How do they interrelate?

- Contractual forms with external partners/agents