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INTEGRATING COMMUNITY POWER IN ENERGY ISLANDS

Deliverable 2.3: Regulatory frameworks for energy communities in the pilot site countries Croatia, Spain, Greece, Portugal and Slovenia

Shaping EU framework transposition and project implementation

Delivery Date: October 2020

Title	Document Version
D2.3: Regulatory frameworks for energy communities in the pilot site countries Croatia, Spain, Greece, Portugal and Slovenia	1.0

Project Number	Project Acronym	Project Title
H2020-824424	COMPILE	Integrating community power in energy islands – COMPILE

Contractual Delivery Date	Actual Delivery Date	Deliverable Type*-Security**
31 October 2020	30 October 2020	R-PU

*Type: P: Prototype; R: Report; D: Demonstrator; O: Other.

**Security Class: PU: Public; PP: Restricted to other programme participants (including the Commission); RE: Restricted to a group defined by the consortium (including the Commission); CO: Confidential, only for members of the consortium (including the Commission).

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Abstract

Emerging energy communities in most cases act in the context of an ongoing transposition of the EU Clean Energy Package. The deliverable aims on the one hand at assessing the current legal and regulatory framework conditions for energy communities in the pilot countries of the COMPILE project. On the other hand, experiences made with the current frameworks in the pilot countries as well as the role of different types of actors are discussed. Finally, it provides overall lessons for implementing energy communities in the respective countries complemented by general lessons on organisational setups and needed framework conditions. Thereby, the deliverable also aims at providing insights and recommendations for further policy and regulatory processes.

Keywords

Energy communities, Clean Energy Package, regulatory framework, actors, organisational models.

Revision	Date	Description	Author (Organisation)
V0.0	08.01.2020	New document/draft structure	Dorian Frieden, Andreas Tuerk (JR)
V0.1	12.10.2020	Contributions	Melani Furlan, Lin Herenčić, Boris Pavlin (ZEZ), Nasos Vasilakis (ICCS), Alexandros Chronis (RAF), Rita Marouço, Niccolo Primo, Ana Rita Antunes (COOP), Aurelio Lázaro Chueca (ETRA)
V0.2	13.10.2020	First draft	Dorian Frieden, Andreas Tuerk (JR)
V0.3	19.10.2020	Review Contributions	Jure Ratej (ETRL), Borut Jereb, Gregor Gonstinčar (PETR) Stanislas d'Herbemont (RESC)
V0.4	23.10.2020	Second draft	Dorian Frieden, Andreas Tuerk (JR)
V0.5	29.10.2020	Final contributions	Esteban Pastor Calatayud (ETRA)
V0.6	29.10.2020	Final draft	Dorian Frieden, Andreas Tuerk (JR)
V1.0	30.10.2020	Final version	Marjana Harej (UL), Tomi Medved (IRI UL)

This project has received funding from the
European Union's Horizon 2020 Research and Innovation Programme
under Grant Agreement № 824424.
More information available at https://www.compile-project.eu/

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EXECUTIVE SUMMARY

This deliverable consists of three main pillars:

- A **stock-taking of the current European and national legal and regulatory frameworks** for energy communities (or, where not yet in place, collective self-consumption schemes) and their implications for the implementation of the COMPILE pilot projects.
- A **description of the actual organisational models**, i.e. the roles of actors and their interaction in the COMPILE pilot sites, as well as general discussions on the potential role of specific types of actors in energy communities.
- **Conclusions and recommendations** on the further transposition of the Clean Energy Package, organisational models, and the potential role of specific types of actors. These are based on the current experiences in COMPILE as well as on an exchange with project external actors on the current legal developments and practical experiences.

The first pillar includes a detailed assessment of the EU directives relevant to energy communities and their national transposition in the COMPILE pilot countries. This stocktaking aimed to compare how different EU member states are implementing the EU framework and to gain insights for further shaping of the national frameworks. In the second pillar, the role of different types of actors in the pilot energy communities was described and assessed (e.g. citizens, cooperatives, municipalities, DSOs, suppliers). Finally, the pilot projects provided important insights into the national transposition of the Clean Energy package or the lack thereof, that can be used by national policymakers and stakeholders across the EU. Also, insights for the implementation of future energy communities are provided based on the experiences made so far.

The transposition process of the Clean Energy Package is at strongly differing stages in the COMPILE pilot countries. The pilot in Croatia is still importantly constrained by the lack of a legal framework for energy communities. Spain as well as Slovenia have an advanced collective self-consumption scheme in place. Portugal implemented a framework for renewable energy communities, currently limited to electricity that is also still part of self-consumption legislation. The options for possible activities under the Portuguese framework will enter into force stepwise and may be adapted over time depending on the made experiences. Greece has the most advanced framework in place and addresses aspects such as energy poverty and governance details to an important extent. However, some constraints apply in this framework, such as the need for all energy community participants to be customers of the same electricity supplier.

To facilitate the implementation of energy communities, related legal areas such as financing and taxation (e.g. crowdfunding in Croatia and Greece), and administrative hurdles need to be addressed and harmonized. This also includes permission procedures in the housing sector for the installation of devices and the majority requirements of, e.g., apartment owners for such investments. Besides, accompanying measures will be needed to support the establishment of energy communities. These are particularly foreseen for RECs in the REDII and include information measures, the facilitation of administrative procedures (“one-stop shops”), active support for the formation of energy communities, and the alignment of support schemes to RECs. In most cases, these measures are not yet fully in place.

The Clean Energy Package is not the starting point of (local) energy initiatives. Existing initiatives and models may continue or be developed further. For instance, energy cooperatives partly exist for a long time, as is the case in the Spanish pilot of COMPILE. Regarding the role of other types of actors, municipalities may be an important driver or partner and can benefit from energy communities to

reach their goals. DSOs are in a specific situation as their services, in particular for metering and netting of the energy flows, are fundamental in most countries. Even though they will in most cases not have an active role in terms of participation, their activities and related regulations may be game-changers for the implementation of energy communities and CSC. These concerns for instance the installation of smart meters and the provision of measurement data in a suitable resolution. At the same time, DSOs may benefit from services provided by energy communities.

Also, organisational aspects that refer to the practical implementation rather than to legal and regulatory questions are of high relevance. For instance, the engagement of local citizens partly proves to be difficult, in particular in the current context of the Corona crisis.

The transposition of the Clean Energy Package into national law is by far not yet finished. Even if deadlines for the transposition are met, full implementation may include a stepwise implementation, learning, and potential adaptation over a longer timeframe as is specifically foreseen in Portugal. The COMPILE pilot countries show an important range of provisions regarding major technical elements of the EU framework such a localisation of CSC systems and RECs, proximity, effective control and others. While the process of transposition is still fully going on in most countries, aspects aiming at broad access to information, administrative facilitation, open participation and other facilitating features are mostly not yet addressed. These are, however, equally highlighted by the EU framework and can be expected to be highly relevant for a broad rollout of local initiatives and citizen participation in the energy sectors. In the longer run, fully embedding energy communities in the market may also allow benefitting from their potential to a much higher extent. This would include the integration of CSC schemes and energy communities in local markets for flexibility/ancillary services, which are not yet in place in all member states.

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1 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

Within the COMPILE project, pilot energy communities are developed in five EU member states, mostly in a context of an ongoing transposition process of the Clean Energy for All Europeans Package (Clean Energy Package) which defines energy communities. This deliverable consists of three main pillars:

- A **stock-taking of the current European and national legal and regulatory frameworks** for energy communities (or, where not yet in place, collective self-consumption schemes) and their implications for the implementation of the COMPILE pilot projects.
- A **description of the actual organisational models**, i.e. the roles of actors and their interaction in the COMPILE pilot sites, as well as general discussions on the potential role of specific types of actors in energy communties, in particular municipalities and cooperatives.
- **Conclusions and recommendations** on the further transposition of the Clean Energy Package, organisational models, and the potential role of specific types of actors. These are based on the current experiences in COMPILE as well as on an exchange with project external actors on the current legal developments and practical experiences.

The first pillar includes a detailed asessment of the EU directives relevant to energy communities and their national transposition in the COMPILE pilot countries. Aim of this stocktaking was to compare how different EU member states are implemeting the EU framework and to gain insights for further shaping of the national frameworks. In the second pillar, the role of different types of actors in the pilot energy communities is described and asessed (e.g. citizens, cooperatives, municipalities, DSOs, suppliers). Finally the pilot projects provided important insights into the national transposition of the Clean Energy package or the lack thereof, that can be used by national policymakers and stakeholders across the EU. In addition, insights for the implementation of future energy communities are provided based on the experiences made so far.

The document summarises the outcomes of the activities of Task 2.2 Regulatory and organisational aspects. The work of task 2.2 is connected to Task 2.1 Use cases definition and requirements, the results of which were presented in the deliverable 2.1 LES: Operational requirements, use cases and KPIs. Task 2.2 provided inputs to the definition of use cases while a range of use cases as well as barriers identified in D2.1 are subject to the report at hand as further shown in the next section. Besides contributions of the different project partners responsible for this deliverable, further project partners and representatives of external initiatives provided inputs and insights on the status quo of their initiatives. We would like to thank all contributors for the received support.

1.2 SCOPE OF THE DOCUMENT

This deliverable offers an overview of the current legal and regulatory frameworks for energy communities both on the EU level as well as in the COMPILE pilot countries Croatia, Greece, Portugal, Slovenia and Spain. Furthermore, the current set-up of the pilots (actors and their roles, general-purpose, organisation), experiences with the national frameworks, as well as enabling factors and barriers are discussed. Lessons learned from these cases as well as from project external initiatives feed into a general discussion of the role that municipalities and cooperatives can take in energy communites. Finally, a discussion and conclusions on the required frameworks and thus the further transposition process on the national level are provided.

They discussed barriers for the pilot projects relate to an earlier general assessment of potential obstacles provided in deliverable D2.1 of COMPILE. Table 1 presents an overview of these barriers

(based on Table 13, p40, of D2.1). These refer to both organisational and regulatory obstacles which are now discussed in more detail in the present report (in the table the symbol "✓" means low or potential obstacle while the symbol "✓✓" means high or moderate obstacle. Empty cells mean that the obstacle is not considered as an obstacle to achieving the pilot site goals).

Table 1: Obstacles that prevent the pilot sites to achieve their goals

OBSTACLES		LUČE	KRIŽEVCI	CREVILLENT	RAFINA	LISBON
Increase self-sufficiency	Organisational	✓✓	✓✓			
	Regulatory	✓✓	✓✓	✓		✓✓
Increase RES production	Organisational		✓✓			✓✓
	Regulatory	✓	✓✓	✓✓		✓✓
Improve operation of LES	Organisational					
	Regulatory	✓✓		✓✓		
Reduce costs of LES	Organisational					✓✓
	Regulatory	✓✓				
Have an active community	Organisational		✓✓			
	Regulatory					✓✓
Mobilize investments for RES	Organisational					
	Regulatory	✓	✓✓	✓✓		
Grow a structured community	Organisational		✓✓		✓	
	Regulatory		✓✓			✓✓
Grow a community to test new technologies	Organisational		✓✓		✓	
	Regulatory				✓	

Potential barriers and enabling factors are of major relevance for the use cases of the different pilot sites. The following table presents the secondary use cases as presented in deliverable D2.1. While the legal, regulatory, and organisational aspects in the present deliverable may have an impact on all use cases, the secondary use cases highlighted in bold are most directly affected and discussed in the following table.

Table 2: Implementation of Secondary Use Cases in pilot sites

UC name (shortened)	LUC	KRI	CRE	RAF	LIS
2UC-1.1 Increase local production: planning	✓	✓	✓	✓	✓
2UC-1.2 Increase local production: deployment	✓	✓	✓	✓	✓
2UC-2.1 Reduce energy consumption		✓			
2UC-3.1 Grid investments: planning	✓	✓	✓	✓	✓
2UC-3.2 Grid investments: deployment	✓	✓	✓	✓	✓
2UC-4.1 Grid operation: achieve supervision and control of micro-grid	✓		✓		
2UC-5.1 Production/consumption optimisation on micro-grid level	✓		✓		
2UC-5.2 Production/consumption optimisation on prosumer level	✓	✓			
2UC-5.3 Reduce LES operation costs: introduce services for external actors	✓				
2UC-6.1 Increase citizens awareness	✓	✓	✓	✓	✓
2UC-6.2 Increase citizen participation	✓	✓	✓	✓	✓
2UC-7.1 Create an energy community	✓	✓	✓	✓	✓
2UC-7.2 Establish a legal structure	✓	✓		✓	
2UC-7.3 Establish a democratic governance	✓	✓	✓	✓	✓

UC name (shortened)	LUC	KRI	CRE	RAF	LIS
2UC-7.4 Create a structured community		✓			
2UC-7.5 Mature a structured community			✓		
2UC-8.1 Provision of financial sources for investments/community activities	✓	✓	✓	✓	✓
2UC-9.1 Enhance relationships to grid actors	✓	✓	✓	✓	✓
2UC-9.2 Enhance relationships to energy market actors	✓	✓	✓		✓
2UC-9.3 Enhance relationships to local government	✓	✓	✓	✓	✓
2UC-10.1 Promote additional energy services: tackling energy poverty	✓	✓	✓	✓	✓
2UC-10.2 Co-benefits for citizens	✓	✓	✓	✓	✓
2UC-11.1 Replication of EnC procedures in large- and small-scale scenarios				✓	✓
2UC-11.2 Replication of innovative EnC procedures in emerging economies					

Deliverable D2.1 equally presented a list of major types of actors involved in the pilot projects. The following table presents a reduced overview of the major actors referred to in the following table (based on D2.3, p 51). The abbreviations are used for overview tables in the country sections.

Table 3: List of actors involved in EnC activities

Abbr.	Name	Description
AGGR	Aggregator	Aggregates services provided by Final Customers and offer them to grid/energy actors
BO	BEMS Operator	A natural or legal person that operates the Building Energy Management System
DSO or DSO-E	External distribution system operator	Operates the external distribution grid (to which the local distribution grid is connected)
DSO-L	Local DSO	Operates the local distribution grid (microgrid), under control of the EnC
EnC	Energy Community	Legal entity (CEC or REC) representing the citizens collectively acting to provide and purchase services from the other actors of the energy system
ESP	Energy Supplier	A legal person that sells/buys energy to/from Final Customers
FC	Final Customer	A natural or legal person that purchases energy for its own use, sells self-generated electricity or participates in flexibility or energy efficiency schemes (provided that those activities do not constitute its primary commercial or professional activity)
LAU	Local Authority	Municipality, regional authority
LESO	LES Operator	operates the production/consumption in LES, under control of EnC

1.3 STRUCTURE OF THE DOCUMENT

The document is structured in 10 chapters. First, as a background, the European framework for energy communities as part of the Clean Energy Package is presented in chapter 2. This is followed by five country chapters (chapters 3 to 7), providing the status quo of the legal and regulatory frameworks on the national level (subsections x.1), the set-up and policy-related goals of the pilots (subsections x.2), as well as lessons learned based on the experiences made so far (subsections x.3). The chapter on Greece also includes a section on general considerations on the role of different types of actors and a broader discussion of made experiences as part of section 4.2. The country

chapters are followed by a general discussion on the role that municipalities and cooperatives can take in energy communities, based on experiences of the COMPILE pilots, as well as additional initiatives (chapter 8). Chapter 9 discusses major lines of the current transposition status of the Clean Energy Package. Finally, chapter 10 provides for synthesis and conclusions on nationally required frameworks and potential organisational models.

2 EUROPEAN FRAMEWORK: CLEAN ENERGY FOR ALL EUROPEANS PACKAGE

This chapter provides an overview of the European framework for energy communities, thereby explaining the concepts that are discussed in the country chapters. In several EU member states, including Spain, Croatia, and Slovenia, which are part of this deliverable, the European provisions on energy communities are not yet transposed, or only to a limited extent. Therefore, the pilot projects in these countries currently operate as collective self-consumption schemes. These are equally defined on European level and therefore described below as well. Spain and Slovenia, however, have advanced schemes in place, allowing, for instance, for the use of the public grid. The chapter is primarily a synthesis of the report "Collective self-consumption and energy communities: Overview of emerging regulatory approaches in Europe", equally published in the context of the COMPILE project in June 2019 [1].

With the "Clean Energy for all Europeans" package (in the following "Clean Energy Package"), the European Union (EU) introduced new provisions on the energy market design and frameworks for new energy initiatives. Specifically, the recasts of the renewable energy directive (REDII) [2] and the electricity market directive (EMD) [3] provide basic definitions and requirements for the activities of individual and collective self-consumption as well as for two types of energy communities. "Renewable energy communities" (defined in the REDII) and "citizen energy communities" (defined in the EMD) allow citizens to collectively organise their participation in the energy system. These new concepts open the way for new types of energy initiatives aiming at, in particular, the empowerment of smaller actors in the energy market as well as an increased decentralised renewable energy production and consumption (prosumption). The mandatory transposition into national law provides significant room for nationally specific provisions. While the EMD (and thus provisions on citizen energy communities) has to be transposed into national law by the end of 2020, a framework for renewable energy communities as well as for self-consumption (as part of the REDII) has to be established by mid-2021.

2.1 THE DIFFERENT NATURE OF SELF-CONSUMPTION AND ENERGY COMMUNITIES

In the following, the three concepts of collective self-consumption, renewable energy communities and citizen energy communities are explained and defined according to the relevant EU directives. At the outset, it is important to note the relationship (i.e. distinctions and similarities) between these concepts. A major characteristic of collective self-consumption schemes is that they constitute a specific activity while not explicitly focusing on the organisational format. In contrast, energy communities focus much more on organisational and market aspects. Nevertheless, activities such as energy generation, distribution, supply, and consumption are specifically included as possible activities in the energy community definitions. Consequently, self-consumption may well occur as a specific activity in the context of an energy community.

2.2 DEFINITION OF COLLECTIVE SELF-CONSUMPTION (JOINTLY ACTING RENEWABLES SELF-CONSUMERS)

Collective self-consumption (CSC) is addressed in article 21 of the REDII and referred to as "jointly acting renewables self-consumers". The REDII defines "self-consumers" as follows:

Renewables self-consumer: "a final customer […] who generates renewable electricity for its own consumption, and who may store or sell self-generated renewable electricity, provided that, for anon-household renewables self-consumer, those activities do not constitute its primary commercial or professional activity".

Jointly acting renewables self-consumers: a group of at least two cooperating "renewables self-consumers […] who are located in the same building or multi-apartment block". In the following, due to its common use and for simplicity reasons, **we maintain the term collective self-consumption (CSC) for "jointly acting renewables self-consumers".**

Currently, some EU MS already allow CSC on building scale, others are extending it to block scale.

- **CSC on a building scale**: In this case, for instance, inhabitants of one multi-apartment building share produced renewable electricity. Also, connected installations such as a storage system can be shared.
- **CSC on a block scale**: Here the area is enlarged to more than one building (including neighbouring buildings via direct lines) and correspondingly more actors are involved.

According to the REDII, besides electricity generation, the two types of renewables self-consumers should be able to operate electricity storage systems without underlying double charges, including network charges. The self-consumer's installation may be owned or managed by a third party according to the consumer's instructions. For electricity fed into the grid, (jointly acting) renewables self-consumers shall be granted non-discriminatory access to relevant existing support schemes as well as to all electricity market segments.

2.3 ENERGY COMMUNITIES: GENERAL CHARACTERISTICS

The Clean Energy Package contains two definitions of energy communities: The concept of citizen energy communities (CEC), which is contained in the EMD, and Renewable Energy Communities (REC), which is contained in the REDII. The Clean Energy Package frames energy communities as a non-commercial type of market actor. This is one of the reasons why member states are required to ensure a level playing field to allow energy communities the operation across the market without discrimination. This requirement is specifically embedded in both directives. Table 4 provides an overview of the definition, actors, purpose and potential fields of activity of the two types of energy communities. These serve as the basis for the transposition of new EU rules into national legislation. Note that the term "Local energy community" was abandoned during the legislative process.

Table 4: Comparison of the "Renewable Energy" and "Citizen Energy" Community concepts according to the REDII and the EMD

Article 2(16) Recast Renewable Energy Directive "Renewable Energy Community"	**Article 2(11) Recast Electricity Market Directive "Citizen Energy Community"**
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 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. The REDII further states that RECs shall be entitled to produce, consume, store and sell renewable energy, including through renewables power purchase agreements.	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**; (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.

Despite their differences, the two types of energy communities have 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.
- Require specific governance (e.g. "effective control" by certain participants).
- Should be collective actions.

While the right to manage distribution networks is specifically included as optional for CECs, the REDII only states that "renewable energy communities are not subject to discriminatory treatment about their activities, rights and obligations as […] distribution system operators…".

According to the EMD, **citizen energy communities** constitute a new type of market entity due to their membership structure, governance requirements and purpose where the purpose is framed around the provision of services/benefits for members or the local community – as opposed to profits (as shown in the definitions above). The definition is therefore an acknowledgment that CECs' organizational structure can be used by citizens, small businesses and local authorities to participate across the energy sector. According to the scope of the EMD, CECs refer to electricity only but are not limited to renewable electricity.

The overarching emphasis of the CECs definition is on a specific way to organize an activity – not the activity itself. However, the Definition of CECs also identifies different types of activities that CECs could engage in, although the definition is not limited to specific activities. The identification of these activities in the CEC definition intends to acknowledge activities that CECs may engage in. Furthermore, the listing of activities in the definition does not imply that a CEC is meant to perform an integrated set of activities, even though integrated activities may be foreseen.

In general, **renewable energy communities** follow the same logic. However, they have more stringent governance requirements, are technology-specific around renewable energy sources, and are rooted in local communities. There is also a stronger obligation for member states to incentivize the development of RECs, not just provide a level playing field in the energy market (contrasted with CECs). Renewables self-consumption is just one potential activity of a renewable energy community among other activities it could undertake (e.g. sale of energy to the market).

Major characteristics differentiating the two concepts are:

- **For citizen energy communities:**
  - No geographic limitation (i.e. no proximity of the "effective control" to the energy project required). Also open to cross-border participation.
  - Large and medium-sized enterprises are excluded from effective control.
  - Electricity only (according to the scope of the EMD).
  - Technology neutral (not necessarily renewable energy).
  - The major purpose of enabling frameworks: create a level playing field for the CECs as a new market actor.
- **For Renewable Energy Communities:**
  - Proximity requirement (to be defined in national law).
  - Limited membership (shareholders or members do not include large companies).
  - Open to all sources of renewable energy (e.g. also heat), but renewable energy only.
  - A major purpose of enabling frameworks: to promote the development and growth of RECs as a way to expand the share of renewable energy at the national level.

It is important to mention that these two types of organizational formats do not exclude additional alternatives defined on the national level and that they allow for different legal forms of organization. While the REDII leaves this open, the recast of the EMD explicitly states that "the definition of citizen energy communities does not prevent the existence of other citizen initiatives such as those stemming from private law agreements." Therefore, if member states choose to do so, they can allow market actors not foreseen in the directive to establish, own and manage local energy systems. Indeed, this is also foreseen for industrial and commercial enterprises under Article 38 of the recast of the EMD on closed distribution systems.

Also, the recast of the EMD states that "it should be possible for member states to choose any form of entity for citizen energy communities, for example, an association, a cooperative, a partnership, a non-profit organization or SME". The legal format of an energy community is thus to be defined on a national level. The REDII additionally aims, besides the deployment of renewable energy sources, to raise public acceptance and the engagement of local citizens and authorities in renewable energy projects. Consequently, the membership in the communities is more limited – it excludes large professional entities, while the control is to be retained by those community members that are located in the proximity of the renewables projects.

2.4 SPECIFIC TERMS USED FOR ENERGY COMMUNITIES AND SELF-CONSUMPTION

The following provides more detailed explanations of major concepts used in the context of energy communities and self-consumption in the REDII and the recast EMD.

Activities: The used wording in the two directives partly differs. For instance, in the EMD, **"supply"** is defined as "the sale, including resale, of electricity to customers". However, although the REDII

adopts the definitions of the EMD, the term **"sale"** is used rather than "supply". Also, specific ways of sale are referred to in the REDII. For renewables self-consumers, next to the sale through renewables power purchase agreements, peer-to-peer trading arrangements are stated, while Article 22 on RECs does not specifically refer to peer-to-peer trading. We, however, assume that all activities referred to for renewables self-consumers equally apply to RECs and CECs because renewables self-consumption may well be carried out in the framework of an energy community.

A feature that appears in all three concepts is energy "**sharing"**, departing fundamentally from the traditional supply. Even though this concept is not specifically defined, Article 16 of the recast of the EMD on CECs mentions, for instance, the possibility "to share electricity produced using generation assets within the citizen energy community among their members or shareholders based on market principles, […] , even over the public network, provided that both metering points belong to the community"**.** For RECs, the REDII states that "Renewable energy communities should be able to share between themselves energy that is produced by their community-owned installations". Similarly, the REDII states for CSC that "member states shall ensure that renewables self-consumers located in the same building, including multi-apartment blocks […] are permitted to arrange to share of renewable energy that is produced on their site or sites between themselves".

The term **"generation"** is defined in the recast of the EMD as **"production of electricity".** Again, the two directives use both terms, generation and production. According to the nature of the directive, the REDII refers to renewable energy while the recast of the EMD refers to electricity only.

Besides, the recast of the EMD provides the following definitions that equally apply to the REDII:

"Distribution": the transport of electricity on high-voltage, medium-voltage and low-voltage distribution systems with a view to its delivery to customers, but does not include supply;

"Aggregation": a function taken by a natural or legal person that combines multiple customer loads or generated electricity for sale, for purchase or auction in any electricity market;

"Producer": a natural or legal person generating electricity.

"Peer-to-peer trading" is defined by the REDII as "the sale of renewable energy between market participants" by specific means including "the automated execution and settlement of the transaction". This may occur "either directly between market participants or indirectly through a certified third-party market participant, such as an aggregator".

2.5 GOVERNANCE AND OWNERSHIP OF ENERGY COMMUNITIES

The REDII states that the specific characteristics of local renewable energy communities in terms of size, ownership structure and the number of projects can hamper their competition on an equal footing with large-scale players, namely competitors with larger projects or portfolios. Also, the EMD mentions the need for citizen energy communities to be allowed to operate on the market on a level playing field and decision-making powers should be limited to those members or shareholders that are not engaged in large-scale commercial activity and for which the energy sector does not constitute a primary area or economic activity.

Therefore, several provisions and concepts are introduced to allow energy communities to compete on an equal footing with other market participants. While the eligibility of shareholders and members are set in the directives for both, RECs and CECs, the concepts of effective control, the proximity of effective control and autonomy that are part of the REC definition are left to the MS to be specified. The concepts are interrelated, while the openness of the concepts allows MS to

consider national circumstances and approaches and to best fit them into their national legal systems.

Shareholders or members: Only for RECs limitations apply, excluding large enterprises. For renewables self-consumption, as it represents an activity rather than an organizational form, this criterion is not of relevance.

Effective control and autonomy**:** The recast of the EMD includes a definition of "control" referring to the possibility of "exercising decisive influence on an undertaking, in particular by (a) ownership or the right to use all or part of the assets of an undertaking; (b) rights or contracts which confer decisive influence on the composition, voting or decisions of the organs of an undertaking". The "effective control" of CECs is explicitly limited to natural persons, small and micro enterprises, as well as local authorities for which "the energy sector does not constitute a primary area of economic activity" (the latter limitation refers to "decision-making powers"). For RECs, the exclusion of large enterprises as shareholders or members equally implies exclusion from the "effective control". In addition, the majority of voting rights should be held by "shareholders or members that are located in the **proximity** of the renewable energy projects". Furthermore, RECs are required to be "**autonomous"**. As described in the recitals of the REDII, this means that RECs "should be capable of remaining autonomous from individual members and […] traditional market actors that participate in the community as members or shareholders, or who cooperate through other means such as investment."

Table 5 provides a summary of the potential activities as well as the eligible entities that may act as shareholders or members and that may carry out effective control in self-consumption schemes as well as energy communities.

Table 5: Activities and actors foreseen for renewables self-consumption (RSC, including individual and collective self-consumption) and the two types of energy communities under the REDII and recast of the EMD

	REDII		EMD
Activity	RSC	REC	CEC
Production (REDII: renewables) / Generation (EMD: electricity)	✓	✓	✓
Consumption	✓	✓	✓
Storage	✓	✓	✓
Sale (RSC: excess electricity), e.g. via:	✓	✓	(✓)
- Renewables PPAs	✓	✓	(✓)
- Electricity suppliers	✓	✓	(✓)
- Peer-to-peer trading	✓	(✓)	(✓)
Sharing	✓	✓	✓
Supply		✓+	✓
Aggregation (RSC: "through aggregators")	(✓)	✓+	✓
Energy Efficiency Services			✓
EV charging services			✓
Other energy services (RED: "commercial")		✓+	✓
Shareholders or members			
Natural persons	n.a.	✓	✓
Small and Medium Enterprises (SMEs)	n.a.	✓	✓
Large enterprises	n.a.	X	✓
Local authorities incl. municipalities	n.a.	✓	✓
Effective control (RED: proximity requirement, EMD: membership, in general, is restricted, energy sector no primary area of economic activity)			
Natural persons	n.a.	✓	✓
Micro enterprises	n.a.	✓	✓
Small enterprises	n.a.	✓	✓
Medium enterprises	n.a.	✓	X§
Large enterprises	n.a.	X	X
Local authorities incl. municipalities	n.a.	✓	✓

+ Reference to "*the provisions relevant for such activities*"

(✓) Not explicitly stated but assumed to apply

§ However, the CEC as such can be organized as an SME (EMD, recital 44)

3 CROATIA

3.1 THE LEGAL AND REGULATORY FRAMEWORK IN CROATIA

3.1.1 General status of legal and regulatory framework for energy communities and collective self-consumption

The term Energy Community is still not transposed in the national regulatory framework. It is planned to be transposed in 2021. The development of the regulatory framework for aggregators, energy communities (participation in local energy production, distribution, storage and supply, and provision of energy services and aggregation services) and energy production for own use, by the provisions of the EMD and the Regulation on the internal electricity market (recast), as well as with the REDII still has to be conducted in Croatia.

Citizen energy communities in a broader sense are not yet corresponding to the EU definitions. However, related concepts are possible through the legal form of a cooperative. There are few energy cooperatives in Croatia, but mostly in pilot/testing phases and the concept is not proven in a large scale. Some of the potential issues are administrative procedures, lack of trust of the citizens, cost of deposits for the establishment of the energy cooperative as well as an unsupportive taxation system.

Since Croatia became a member of the European Union in July 2013, new legislation to incorporate the EU Third Energy Package was adopted: the Energy Act [4], the Energy Activities Regulations Act [5] and the Electricity Market Act [6]. These acts incorporate respective EU directives (Directive 2009/72/EC, 2009/28/EC and 2005/89/EC) and were all last amended in 2018 to further align Croatian laws with EU legislation.

The general guidelines of the policy regarding the electricity sector are set out in the Strategy of Energy Development of the Republic of Croatia until 2030 with an outlook to 2050 (which was adopted by the Croatian Parliament in February 2020). The idea behind this strategy is to “ensure a transition to a new period of energy policy, providing accessible, safe and high-quality energy supply without burdening the state budget by subsidies and incentives, which proved troublesome in the past”. The Strategy is to offer “a wide spectrum of energy policy initiatives to enhance the security of supply, gradually reduce energy losses and increase energy efficiency, reduce fossil fuels dependency, boost domestic production and use renewable energy sources”.

The Integrated National Energy and Climate Plan (NECP) of the Republic of Croatia until 2030 [7], was adopted in December 2019. The key objectives outlined in the NECP are the reduction in greenhouse gas emissions for the year 2030, an increased share of RES in the gross final energy consumption and energy efficiency, expressed as consumption of primary energy and direct consumption of energy.

As stated in the NECP, “Energy communities will be promoted under the RES-1 measure, and the regulatory framework necessary for their functioning under the RES-4 measure.”

RES-1 measure “Information, education and capacity building for RES use” is an informational measure, where one of the envisioned activities is “capacity building and enhancement for all market players (active customers, energy communities, renewable energy communities, energy suppliers, aggregators, system operators, installers)”.

RES-4 measure “Developing a regulatory framework for RES use” is envisioned to complement the existing legal solutions by the development of a regulatory framework for active customers,

aggregators, energy communities, renewable energy communities (participation in local energy production, distribution, storage and supply and provision of energy and aggregation services) and energy production for own needs, following the relevant EU provisions. If necessary, an action plan will be established for the development of energy communities. RES-4 is a regulatory measure, which is supposed to be implemented in 2021-2022.

The Draft of the Low-carbon Development Strategy of the Republic of Croatia until 2030 with an outlook to 2050, was prepared in 2017 and refers to the sectors of energy, industry, transport, general consumption, agriculture, waste and land use. The final adoption of the draft has been postponed to align it with the Energy Development Strategy. It was submitted for public debate in February 2020.

The abovementioned strategic documents demonstrate that the national energy policy is becoming committed to renewable energy sources as a main driver of the power sector expansion in the future.

3.1.2 Specific provisions

Definition of local area

Since the development of the regulatory framework for energy communities is yet to be conducted in Croatia, there is no legal definition of "local area". Cooperatives (as one potential legal form for energy communities) are not bound by geographical proximity.

However, local action groups in Croatia use the following features when defining a local area, in accordance with LEADER methodology and guidelines published by the European Network for Rural Development: (1) Between 5.000 and 100.000 inhabitants, (2) Homogeneous unit, (3) No predefined boundary, (4) Coherence and critical mass, (5) Small dimension, (6) Common tradition and identity, (7) Common needs and expectations.

Generation, supply and system operation

The Croatian energy law regulates six electricity activities: generation, transmission, distribution, supply, retail, and electricity market organisation. Traditionally, all activities were performed exclusively by the Croatian national electricity utility, HEP Grupa (HEP Group). However, through the process of liberalisation and opening of the electricity sector to market competition, certain activities became market activities, while others remained as HEP's exclusive activity.

Generation, retail and supply of electricity (except when performed as a public service) are performed as market activities (the price and quantity of delivered power are freely negotiated).

Transmission and distribution of electricity, electricity market organisation and electricity supply (when performed as a public service) are regulated activities and are performed as public service obligations.

In August 2019, there were 57 registered electricity generation undertakings, 14 suppliers and 34 retail undertakings. Although the number of registered electricity undertakings has been growing continuously since Croatia joined the EU, the HEP Group still holds a dominant position on the Croatian electricity market.

The Croatian Energy Regulatory Agency (HERA) is obliged to apply regulations to protect market competitiveness relating to energy activities and offering technical assistance to the Croatian Competition Agency. According to the Electricity Market Law, the Croatian Energy Market Operator

(HROTE) is responsible for organising the electricity market in accordance with the Electricity Market Rules [8].

A market participant in the Croatian electricity market is any producer, supplier, trader or eligible customer. A producer, supplier and trader must have a license for performing energy activity, issued by HERA. Energy cooperatives can participate in energy markets if they obtain a relevant license (they are considered legal persons).

A producer is an energy entity with a license to produce electricity, an energy entity producing electricity for its own needs and an energy entity having generation facilities of up to one MW. There are two types of producers in Croatia: an **eligible producer** and an **independent producer**. An eligible producer is a producer, which can obtain the status through the production of electricity from renewables and cogeneration. The Energy Act, the Law on renewable energy and high-efficiency cogeneration and secondary legislation regulate incentivizing such electricity production as well as the purchase/sale of electricity produced from the renewables and cogeneration.

Until the first of January 2019, each supplier was obligated to off-take a share of electricity produced from renewable energy sources and cogeneration by incentivized eligible producers. The required share is prescribed by the Croatian Government ordinance.

Producers, traders and suppliers may buy or sell the electricity to another producer, trader, or supplier, power exchange, or Croatian Transmission System Operator or HEP to provide ancillary services, providing balancing services, compensation plan exchanges and to cover losses in the transmission or distribution network, or in a way that is imported or exported over Croatian borders.

The Act on Renewable Energy Sources and High-Efficiency Cogeneration [9] define the term **"end customer with own production"**, which can be referred to as prosumer. Individual prosumers can sell their surplus energy to energy suppliers, but not to other consumers. Thus, peer-to-peer trading and power purchase agreements as foreseen in the EU framework for CSC schemes and energy communities are not yet possible.

The RES Act explicitly regulates the sale of a surplus of self-generated energy in a prosumer model. Conditions which a prosumer must fulfill to be able to obtain remuneration for the sale of surplus electricity are the following: (i) obtaining the status of the eligible electricity producer, (ii) acquiring a right of a permanent connection to the grid, (iii) total connection capacity not exceeding 500 kW, (iv) outward connection capacity not exceeding the inward connection capacity, (v) a prosumer can only use one metering point for injecting and receiving electricity from the grid and (vi) keeping data of electricity produced and delivered.

Energy sharing and metering

In Croatia, the roll-out of smart meters is at its beginning, the plan is to install smart meters for over 95% of the customers by 2030. The data collected from the meters will be stored in the database of the DSO HEP. The right to access the data will be with the user, DSO, supplier, retailer, and Electricity market operator (HROTE). However, the data stored at the DSO will not be suitable for use under peer-to-peer electricity trading because it is stored usually only once a day, sometimes even less frequently. Therefore, the additional communication infrastructure will need to collect the data from the smart meters and transfer them to the other processes.

Prosumers need to have a bi-directional meter in place. The meter is provided and managed by the DSO. A formula and additional rules for calculating the minimum remuneration are set by law. This is

to be paid by the supplier for the surplus of electricity. However, prosumer and supplier are free to agree on a higher remuneration.

Grid access and distribution/grid management

The rules for providing permits for distributed energy sources and storage to connect to the grid (transmission or distribution) should be transparent and non-discriminatory according to the law on the electricity market (Official Gazette Nos. 22/13, 95/15, 102/15, 68/18, 52/19). Croatia made progress on decreasing the delays caused by bureaucracy when setting small-scale production. The delays and unnecessary cost can lead to challenges in setting the RES and energy communities. In Croatia, the recent development of the regulatory framework has been favourable, as the Grid Code of the Transmission System (OG 67/17) and the Grid Code of the Distribution System (OG 74/18) with the linked regulations have been adopted in 2017 and 2018 respectively. The grid codes defined the technical requirements for the connection of the users of the grid, as well as the planning and operation of the grid.

The exact procedure of the grid connection is governed by the General Electricity Supply Conditions (Official Gazette No. 104/20). The technical details of grid connection are governed by the Grid Code of the Transmission System (OG No. 67/17) and the Grid Code of the Distribution System (Official Gazette Nos. 74/18, 52/20).

If grid capacity does not allow any new RES-E plants to be connected to the grid, the grid operator can refuse the connection. There are no direct obligations for the grid operators to expand their grids to enable the connection of RES-E plants (Art. 3 General Electricity Supply Conditions). However, the grid operator is obliged to outline the grid development plans following the Energy Strategy Plan of the Republic of Croatia and the National Renewable Energy Action Plan.

Even though there is no legal definition for EnC in Croatia, a community can manage a closed distribution system (as defined in the Electricity Market Act, Article 37). This option only applies to industrial and commercial prosumers. A closed distribution system (CDS) is defined as a system, which distributes electricity within a geographically closed industrial and/or commercial location. CDS needs to meet the following requirements: (1) metering point of the system owner is connected to the transmission network, (2) the system doesn't distribute electricity to households, except households located in the CDS area, (3) business and production processes of CDS users are integrated/interconnected, e.g. technical or security reasons, (4) the system distributes electricity primarily to the owner or operator of the CDS (or his affiliates), taking up at least 80% of the capacity. Furthermore, the connection of a production system with the status of a privileged producer is not allowed within the closed distribution system. "Privileged" producers are producers that are within the feed-in quota. As the quota was very small and the feed-in tariffs very favourable, the term "privileged" was used. Privileged producers at the same time had to be eligible producers according to the above explanations.

Grid tariffs

For prosumers, network costs are charged only for energy taken from the grid. For household prosumers, this amount is decreased by the energy fed into the grid. This is not the case for commercial prosumers, leading to a more favourable framework for the household sector.

In Croatia, transmission and distribution system costs are determined by fixed tariffs. There are no special provisions for energy communities, and dynamic pricing or adjustments for locally traded energy within microgrids or energy communities is currently not foreseen.

Treatment of surplus electricity/support schemes

Since 1 January 2016, in principle, renewable energy in Croatia is supported mainly through a premium tariff and a fixed feed-in tariff (for installations of less than 500 kW) allocated through tenders. However, so far no tenders have been organised due to the delays in adopting the necessary secondary legislation. The RES act prescribes that renewable energy demonstration projects shall not be supported through market premium or feed-in tariff incentive models, but through general research and development, and innovation support programmes.

Further by-laws were adopted in 2019 to implement the support scheme operational in practice. These by-laws should lay out the details on the register of renewable energy producers, the conditions of acquiring the status of privileged producers and the quotas for different renewable energy technologies.

A fee that is charged on each kWh purchased by the final consumer's funds the support scheme. The amount of the fee is determined by the government through a decree (Art. 41 § 3 RES Act). According to the RES Fee Decree which entered into force on 1 September 2017, the fee amounts to HRK 0.105 (€ 0.01) per kWh (§ 3 RES Fee Decree). For the electricity consumers, which are subject to greenhouse gas emission allowances, the fee amounts to HRK 0.007 (less than € 0.01).

Other means of support are also available. The loans granted for the implementation of renewable electricity projects are part of the “environmental protection” loan scheme by the Croatian Bank for Reconstruction and Development (HBOR) in cooperation with commercial banks. The Environmental Protection and Energy Efficiency Fund (FZOEU) offers financial incentives (interest-free loans, subsidies, financial assistance, donations) for the use of renewable energy sources.

Specific tariffs apply to prosumers (commercial customers) for the electricity they feed into the grid, which are lower than the price of the electricity drawn from the grid. However, prosumer and supplier are free to agree on a higher remuneration. Prosumers with the capacity to feed in their surplus electricity need to sign a contract by which the prosumer is entitled to be compensated for the surplus electricity. The electricity suppliers are obliged to accept the surplus electricity generated by the priority electricity producers that are registered as such, have a connection to the grid and a meter for netting the electricity consumed and fed in. As mentioned above (section Energy sharing and metering), a formula and additional rules for calculating the minimum remuneration is set by law. The prosumer schemes in Croatia can be summarized as follows:

(1) For businesses and industry prosumers (commercial sector): self-generation is related to renewable energy and high-efficiency cogeneration below 500 kW. The RES Act obliges suppliers to purchase excess electricity injected into the grid at the minimum 90% supply tariff (net billing). The generation capacity needs to be less or equal to the contracted power.

(2) For household prosumers (household sector): net metering and billing are limited to households with self-generation if the annual injected electricity is lower than the electricity consumed from the grid. Suppliers purchase excess electricity injected into the grid at 80% of the supply tariff. This scheme is in place since January 2019.

Electricity market access

The measure of the Integrated Energy and Climate Plan, “Elaboration of a regulatory framework for active participation of customers in the electricity market” (UET-3 measure), states that “In order to enable the **active role of grid users in the electricity market**, the existing regulatory framework

should be appropriately amended, in particular by introducing an **aggregator** as a market player and by facilitating the launch of **ancillary service pilot projects**."

Currently, balancing responsible parties are producers, suppliers, and traders. Those entities must have signed Balance Responsibility Agreements with the TSO or be a member of a balanced group. The Grid Codes of the Distribution System (OG 74/2018) define the **ancillary services** that grid users can provide to the DSO, as voltage and reactive power control, electricity production in isolated operation and others (e.g. increase or decrease of production or consumption). Ancillary services that grid users provide to the TSO are defined as Automatic or Manual frequency restoration reserves (aFRR & mFRR) and power limitations/load shedding as demand response service for grid congestion management. However, according to the national system for monitoring the implementation of policies and measures in 2019, "It is necessary to ensure the implementation of an appropriate balancing mechanism that involves all the entities responsible for imbalances and to ensure an appropriate remuneration or pricing mechanism for these services. It is necessary to ensure an adequate secondary and tertiary P/f reserve for balancing, including the intraday market and the organization of balancing energy market." **The analysis of the potential to provide ancillary services and flexibility services by consumption response of network users is yet to be conducted**. Relevant methodologies will be defined after an aggregator has been properly introduced as a market participant.

The operation of the energy community, which includes peer-to-peer electricity trading, would be stimulated if the **dynamic pricing** of energy that is traded between the peers was allowed. Therefore, if the prices are regulated in a way that does not allow dynamic pricing in the microgrids or local energy communities, it will be a discouraging factor. Also, tariffs for producers that are strongly in favour of self-consumption or feed-in tariffs do not stimulate peer-to-peer trading within energy communities. Therefore, **peer-to-peer electricity trading is currently limited to pilot projects** only. Further, to set the near real-time peer-to-peer electricity trading within an energy community, the near real-time data on energy consumption is needed. For that purpose, smart meters can be used where available, but with additional communication infrastructure.

Energy services

The measure of the Integrated Energy and Climate Plan, "Energy efficiency obligation scheme for suppliers" (ENU-1 measure) foresees the implementation of the following: "Suppliers can fulfil their obligation in one of the following three key ways: investing in and stimulating energy efficiency improvements in immediate consumption; by buying savings from another obligated party or by paying contributions to the Environmental Protection and Energy Efficiency Fund. Suppliers are not prescribed neither eligible investment sectors nor eligible investment measures." The objective of the ENU-1 measure is to achieve 50% savings under Article 7 of the Energy Efficiency Directive through the energy efficiency obligation scheme.

Croatian law does not specifically support **electricity storage**, and consumers with battery energy storage systems are treated as consumers with their own production (prosumers) as regards to the use of the public grid.

Related to develop a competitive market for balancing and ancillary services, the Integrated Energy and Climate Plan states that "Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets, including a timeframe for when the objectives are to be met". It

is still needed to establish market mechanisms that will enable more market participants, as well as end consumers, to provide balancing and ancillary services.

Financing

The Croatian pilot project of COMPILE as well as the general approach of the responsible project partner ZEZ importantly builds on crowdfunding. The biggest challenges of crowdfunding from the Croatian perspective, are a small overall awareness of innovative financing tools, relatively low use of the internet in online purchasing of goods, poor development and mistrust towards e-business. However, there is a growing interest in crowdfunding in Croatia (including RES, according to a survey done by ZEZ).

The local crowdfunding platform, zez.invest was used to raise funds to finance the first RES projects in Croatia (loan model for public buildings in the City of Križevci). Currently, there are no equity-based crowdfunding or peer-to-peer lending platforms in Croatia.

There are no legal obstacles concerning donation-based crowdfunding, but this can only be initiated by non-profit entities. However, crowdlending is strictly regulated by the law on capital markets, which makes the financing process complicated and expensive. Public authorities cannot use this model for any type of project [10].

Crowd investing is also possible in form of investing in shares in private limited liability companies for a stake in a cooperative or an exchange for a “silent” (secret) partnership stake in the profit of the fund-seekers company. In the first case, the equity share will correspond to the proportion of investment in the company’s registered share capital. In the second case, no matter the size of the investment, all members of a cooperative will have equal voting rights and will have to participate in its operation, gain profit through it or otherwise participate in achieving its goals.

Governance

One possible legal form of a local EnC is a cooperative, the approach chosen in the COMPILE pilot (energy cooperatives are not explicitly defined in the Croatian legislation). Cooperative bodies (according to the Law on Cooperatives) consist of the assembly, the supervisory board, and a manager. The minimum number of members in a cooperative is seven, and the minimum capital is 1.000 HRK (130 EUR).

Cooperatives in Croatia meet legislative and administrative barriers. The legal framework for cooperatives could be described with the following key points, according to the Law on Cooperatives:

(1) Members of cooperatives cannot be regarded as unemployed persons, thus excluding cooperative members from all rights which unemployed persons have, which heavily discourage citizens to join cooperatives.

(2) After covering expenses, cooperatives are required to set aside a mandatory 30% of profits for the development of cooperatives – on which they need to pay income taxes. At the same time, all economic entities, except cooperatives, are exempt from income tax on reinvested capital.

(3) Profits of cooperatives are distributed as follows: besides the 20% of the profit allocated for the development of cooperatives, 5% of the profit is distributed as a reserve, while the remaining 65% is distributed to members of the cooperative.

3.2 PILOT SITE IMPLEMENTATION

3.2.1 Pilot set up and regulatory and policy aims

The pilot site consists of an urban technology development centre with office buildings, which is a part of the town of Križevci. The pilot site is focused on public buildings, mainly the technology park, where the first Croatian citizen crowdfunded PV plant was built in 2018 through ZEZ's crowdfunding platform. The PV system of 30 kW intended for self-consumption was installed within the facility, which is hosting some 30 organizations ranging from IT start-ups to chemical companies. An additional 30 kW PV system was installed in a nearby library in 2019, also to be used primarily for self-consumption.

The main challenge is the need of the organizations in the pilot site for a reliable power supply, highly relevant for their own and the city's economic expansion. At the pilot site, the potential of co-optimisation of electricity and heat with new co-ownership models for stimulating the investment in renewable energy will be utilized together with the establishment of an EnC. The aim is to develop additional PV production, which is low in Croatia, as well as promoting prosumers and local energy sharing which are still not widespread in the country. The pilot site will increase power supply reliability in the office complex and improve the energy services for companies in the technology park and the nearby library. The setup aims to test innovative blockchain technologies, including peer-to-peer market, which will also be a first of a kind application. Thereby, given the limited legal framework currently in place, the pilot can highlight potentials for energy community activities and barriers that should be considered in the future legal framework.

3.2.2 Role of actors and organisation: models and experiences

Actor: Local EnC (KLIK cooperative)

The KLIK energy cooperative has been established in March 2020 and could be transformed into a renewable energy community or citizen energy community. Eleven local founding members attended the founding assembly, while many more were already interested in joining the new entity (natural persons, citizens that participated in crowdfunding projects for the tech park and city library in 2018 and 2019). The KLIK cooperative is created with a mission to contribute to the development of an energy independent and climate-neutral city.

One example of the cooperative's work is participating in setting up a micro-network based on peer-to-peer trading with blockchain technology based on a regulatory exemption (between the production and consumption sites of the demo). KLIK is also a local partner for the implementation of a utility-scale solar park in the City of Križevci (5 MW), a project currently being developed by the City and national power company (HEP Group). KLIK is also exploring options to register as a local energy supplier.

Actor: Local government (the City of Križevci)

The City has envisioned administrative and financial support measures for the local EnC (e.g. financing parts of the system, owner of the battery energy storage system, and EV charger in the Križevci pilot site, sharing workspace and other). The City is also a potential user of the local EnC services, as it can benefit from the experiences for drafting energy policy, mobilizing citizens to invest in local RES projects by the EnC and other. The City takes part in linking good practice examples with new initiatives through knowledge exchange and capacity building, thus supporting new EnC and RES projects.

Actor: Energy producers and consumers – City Library and Križevci Entrepreneurial Centre

The City Library and the Križevci Entrepreneurial Centre (owner of the Tech Park) are both public bodies and registered as "buyers with own production" (according to the definition of prosumers in the Croatian Law on Renewable Energy Sources and Efficient Cogeneration, Art. 44, OG 100/15, 123/16, 131/17, 111/18). So far, 33 kW of photovoltaics have been installed on the public library and 39.6 kW on the tech park. Both systems were financed by crowd-funding initiatives of ZEZ, where equipment is financed by the micro-loans from the citizens and rented to the owners of the buildings for a 10-year period. After that period, the equipment will be handed over to the owners of the buildings.

Actor: Energy consumers (City library and the tech park)

NGOs, businesses, and individual consumers at the Tech Park are members of the local EnC (KLIK cooperative) and take an active role in the management of the energy community (effective control and non-technical). They financed the PV systems for public buildings through crowdfunding (with a fixed interest rate of 4.5% for 10 years, for the tech park).

Actor: Service provider

The energy cooperative does not technically manage the devices at the library and the tech park, but an equipment installer and service provider takes care of the technical management of the installations on the buildings.

Actor: Electricity supplier (HEP Opskrba)

Role: The electricity supplier buys excess electricity fed into the grid by the energy producers (prosumers).

Actor: DSO (HEP ODS)

The DSO is responsible for the safe and secure operation of the distribution system. The DSO is the meter operator and provider of related technical services. The DSO services sometimes pose significant administrative challenges to a local RES project (e.g. slow process of issuing grid connection permits).

Actor: Supporting organisation (Green Energy Cooperative, ZEZ)

ZEZ, in collaboration with the City, has carried out the two crowd-investing projects mentioned above for solar PV installed in the Technology Park and the City Library of the City of Križevci. These were the first crowd investments for RES in Croatia. ZEZ provides continuous support (legal, technical, etc.) to the local EnC.

3.3 LESSONS LEARNED

3.3.1 Conclusions on enabling factors and barriers for energy communities

The table below summarises the enabling factors and barriers for the implementation of energy communities in Croatia, based on the experiences made in the COMPILE pilot project and the activities of the project partner ZEZ.

Table 6: Enabling factors and barriers for energy communities in Croatia

Identified challenges/barriers and enabling factors	Description	Actors affected
No legal definition of energy communities yet	The term energy community and related provisions are still not transposed in the national regulatory framework.	EnC, AGGR
Barriers linked to the operation of energy cooperatives	Some of the potential issues are in unfavourable legislation, such as cooperative members not having the rights of unemployed persons. Other potential issues include lack of trust of the citizens, cost of deposits for the establishment of the energy cooperative, unsupportive taxation system, etc.	EnC
Crowdfunding	In addition to the absence of a clear legal framework, one of the biggest challenges of crowdfunding is a small overall awareness of innovative financing tools, and generally a poor development of and mistrust towards e-business.	EnC, LAU
Closed distribution systems (CDS)	Industrial and commercial prosumers can manage a closed distribution system (as defined in the Electricity Market Act, Article 37). A significant obstacle for CDSs and energy communities might be that the connection of a production system with the status of a privileged producer is not allowed within closed distribution systems.	EnC, DSO-L
Permitting process for grid connection	Rules for providing permits for grid connection of distributed energy sources and battery energy storage systems should be transparent and non-discriminatory. Croatia made progress on decreasing the delays caused by bureaucracy when installing small-scale production. The delays and unnecessary costs can however lead to challenges in setting up the RES system and energy communities.	EnC
Ensuring data security and availability	For peer-to-peer trading within the energy community, near real-time data on energy consumption is needed. For that purpose, “smart meters” can be used. In Croatia, the plan is to install smart meters for over 95% of the customers until 2030 (meters will be owned and managed by the DSO). The data collected from the meters will be stored in the database of the DSO (HEP-ODS). The user, DSO, supplier, retailer and Electricity market operator (HROTE) will have the right to access this data. However, the data stored at the DSO level will not be suitable for the use of peer-to-peer electricity trading because it is stored only once a day. Therefore, additional communication infrastructure will be required.	EnC, FC, AGGR, ESP
Pricing of the electricity for final consumers	The operation of an energy community, which includes peer-to-peer electricity trading, would be stimulated with dynamic pricing. Prices regulated in a way that does not allows dynamic pricing in the microgrids or local energy communities will be a discouraging factor. Also, tariffs for a producer that are strongly in favour of self-consumption or feed-in tariffs do not stimulate peer-to-peer trading within energy communities. Dynamic pricing, or adjustments for locally traded energy	EnC, FC

Identified challenges/barriers and enabling factors	Description	Actors affected
	within microgrids or energy communities, is currently not foreseen. Moreover, an adaptation of taxation policy (VAT, excess duty, levies) could foster the viability of local energy trading and energy communities, but like any other major policy change it could have complex impacts and it has to be done in line with allowed state aid rules in the EU.	

3.3.2 Lessons for the implementation of energy communities and further transposition of the EU framework

Some elements of the Croatian legislation allow the operation of energy cooperatives, such as the possibility for cooperatives to become suppliers or the option to operate a closed distribution system. However, energy cooperatives face a range of barriers, including administrative procedures, lack of trust of the citizens, cost of deposits for the establishment of the energy cooperative, or an unsupportive taxation system. Still, the experiences with the governance mechanisms made by Croatian energy cooperatives will provide important lessons for the future set up of energy communities following the EU framework. Key elements of the EU directives such as energy sharing, e.g. via peer to peer trading, or the setting of appropriate incentives needs to be further investigated in regulatory sandboxes.

There is a huge potential of the civil society in Croatia to advance the transition to renewable and decentralized energy to stimulate local and regional development. This potential currently remains largely untapped in the country. The development of the renewable energy sector is still mainly in the hands of individual large private and state-owned companies.

There is often strong political will in cities and municipalities to implement measures developed by the Action Plans (about 90 cities with developed Sustainable Energy Action Plan, signatories of Covenant of Mayors), but lack of expertise and/or financial resources to implement local initiatives.

Until an energy community framework is established on national level, different community business models for the implementation of local energy initiatives are however possible in Croatia:

Table 7: Different participation models in Croatia

Direct Citizen Participation	(1) Individual Citizen Investments – Prosumers
	(2) Energy Cooperatives
	(3) Crowdfunding of specific projects/activities (3a) Investment based crowdfunding (Loan/Equity) (3b) Community based crowdfunding (Donation/Reward)
Indirect Citizen Participation (through local authorities)	(4) Projects owned by cities and municipalities
	(5) Public-Private Partnership (e.g. cities and local energy cooperatives)
	(6) Private-Civic Partnership (e.g. Investor-Citizen Partnership)

4 GREECE

4.1 THE LEGAL AND REGULATORY FRAMEWORK IN GREECE

4.1.1 General status of legal framework for energy communities and collective self-consumption

In Greece, there is no vertical integration of generation, transmission and distribution of electrical energy and consumers can choose the retail electricity provider. Transmission and distribution are regulated while generation is becoming deregulated. There is **only one DSO and one TSO** in Greece namely HEDNO and IPTO accordingly. They are subsidiaries of the Public Power Corporation (PPC), which is controlled by the Greek Government, which is the major shareholder (51%).

Greece is committed to increase the share of renewable energy sources and reach the European goal of 27% by 2030. Eurostat expects Greece to reach the 18% goal set for 2020 [11]. These targets are legally binding, due to EU regulations and the Kyoto Protocol agreement. In the broader plan to reach the targets for renewables penetration and greenhouse gas (GHG) emission reduction, the Greek policy makers introduced the law N.4513/18 [12] in 2018, which gives a wide scope on energy communities. **Energy communities are defined as citizens' associations in the form of local and regional cooperatives of exclusive purpose.** The legal framework aspired to combine Social and Solidarity Economy and the energy sector in a new type of civil cooperative, the Energy Community. Overall, the purpose of the law is to enable citizens and communities to participate directly in energy production, with a particular emphasis on promoting solidarity and

Even though the current law 4513/2018 addressed major parts of the EU framework on energy communities, it was passed before the finalization of the EU directives and is not fully in line.

4.1.2 Specific provisions

Definition of local area

The regulatory framework specifies that an energy community has local characteristics. The local area is defined within a region. In that, at least 50% plus one of the members has to be a citizen or own a property in the same region that the community will be registered[1]. Special arrangements and privileges are applied when considering energy communities for the case of small islands (below 3 100 people). More specifically, profitable energy communities can be formed in islands with a decreased number of members, compared to energy communities formed in the mainland. Additionally, in the case of a non-profitable energy community, part of the profits may be available for actions of general interest. Those actions shall be linked with the sufficiency and supply of raw materials, fuels and water.

In terms of the virtual net metering, in the case of the interconnected network, the local area is defined within the district where the community is established. In the case of the non-interconnected islands, the production facility shall be installed in the same district and be connected in the same isolated electrical system with the relevant consumption facilities.

[1] Attica region (where the municipality of Rafina is located) is the only exception, where the local area definition includes the adjacent regions.

Generation, supply and system operation

In Greece, the liberalisation of the electricity sector started in 1999, which aimed at compliance with the provisions of Directive 96/92/EC. The electricity sector was divided into two sub-sectors: a) production and b) distribution, the networks have remained monopolistic and regulated, whereas free market rules have been applied for electricity generation and supply to eligible customers. The Regulatory Authority for Energy (RAE) was also established as an independent administrative authority within the same framework.

The Production part in itself operates in two segments. ADMIE (Independent Power Transmission Operator) undertakes the role of TSO and as such performs the duties of system operation maintenance and development. HEMO (Operator of Electricity Market) is responsible for the operation and settlement of the energy market as well as daily energy scheduling.

The Retail Supply Market started in 2001. In 2016, Law 4389/2016 [13] introduced quarterly auctions whereby PPC sells the electricity term products with physical delivery to the alternative electricity suppliers. These auctions enable alternative suppliers to emerge.

Energy sharing and metering

In 2014, a net metering system for autonomous producers was introduced in Greece [14]. Later on, in 2016 the "virtual net metering" was also introduced [15]. City councils, schools, universities, farmers and farming associations will be allowed to develop PV and wind power projects of up to 500 kWp. The application of net metering in the case of energy communities was implemented in 2018 with the law 4513/18. For the case of energy communities, the right to be involved in virtual net metering can be provided to natural and/or legal persons that are members of the energy community. This particular right can also be provided to vulnerable consumers or citizens living under the poverty limit, in case the energy community wishes to include them in the relevant contracts for virtual net metering. These persons shall not necessarily be members of the energy community but shall live in the same district where the energy community is established. The application of net metering in the case of energy communities is implemented according to paragraph 13 of article 2 of Law 3468/2006 [16][2]. PV, small wind power plants, biomass, biogas, small hydro and CHP for self-production are the eligible technologies.

The ministerial decision ΥΠΕΝ/ΔΑΠΕΕΚ/15084/382 [17] sets several measures to promote the application of **virtual net metering within an energy community**. More specifically, the ministerial decision allows higher limits for the power of the production facilities, when considering energy communities.

The DSO (HEDNO) does the metering, yet the netting is going to be done by the retailer. This establishes an issue in the framework because for a community to perform virtual net metering it needs all the members to be at the same energy supplier.

The community itself defines energy sharing rules within an energy community. Thus, energy sharing is defined by the needs of each member and the general assembly must perform the allocation rules.

[2] Paragraph 13 in Law 3468/2006 has been added according to paragraph 2 of article 13 of Law 4414/2016 and has been modified according to paragraph 1 of article 12 of Law 4513/2018.

Grid access and distribution/grid management

RAE is an independent energy regulator that supervises the operations of all sectors of the energy market. Its competencies include the issuing of energy operation licences, certification of the Transmission System Operator, approving and issuing of the codes and approving methodologies for the access tariffs to the networks. RAE grants licenses for electricity production for RES/ CHP production. Depending on the power output of the RES project, the license holder must apply either to the DSO (HEDNO) for projects up to 8 MW, or the TSO (IPTO) for projects above 8 MW, in order to obtain a RES Installation license. In general, for the project smaller to one MWp, no licence is required (60 kW for wind turbines).

Electricity generated from renewable energy sources is given priority in the interconnected system and on non-interconnected islands. However, the priority might not be granted for wind power plants located in regions, characterized as "congested" for reasons of safety [14].

Energy communities enjoy favourable conditions concerning the procurement of electricity generation licenses. More specifically, according to Law 4513/2018, energy communities are excluded from the obligation to pay the annual fee for holding an electricity generation license. Finally, according to Law 4513/2018, for an electricity generation license to be issued to an energy community the cooperative capital shall be equal to 60,000 €, significantly lower than the 600,000 € of corporate capital required for a typical acquisition of the relevant license.

Grid tariffs

Grid charges apply to the consumers irrespective of the power supplier selected, for the use of the national electricity system. These charges cover the operation, maintenance and development expenses of the transmission and distribution network, Services of General Interest and renewable energy levy.

In the case of net-metering and virtual net-metering installations, charges for public service obligations are calculated based on the total consumption (the sum of energy withdrawn from the network and consumption covered by energy coming from behind-the-meter). Network charges, renewable energy levy and any other regulated charges are calculated based on the amount of energy physically withdrawn from the network (so not including consumption covered by energy coming from behind-the-meter but, also, not considering energy netting).

Treatment of surplus electricity/support schemes

In Greece, renewable electricity generation was mainly promoted through a guaranteed feed-in tariff by the end of 2015. From 2017, electricity from RES and CHP plants is promoted through a feed-in premium granted by participation in tenders. Also, a new tax regulation mechanism and subsidies are available under the 2016 Development Law along with a net metering scheme (as described above). Moreover, electricity generation by rooftop PV installations of up to 10 kWp is supported through a guaranteed feed-in tariff scheme. The scheme applies to private individuals, small enterprises and public entities.

The net metering support scheme follows an annual cycle. Electricity produced by an installation or plant is offset with self-consumed energy. Any surplus electricity is fed into the grid without any obligation for remuneration. The virtual net metering scheme follows a similar process. Nevertheless, a three-year cycle is applied.

Electricity market access

The electricity market in Greece is currently in process of a fundamental transformation in the context of implementing the EU directives. The current wholesale market model is organised based on a regulated compulsory offer of electricity to a day-ahead market leading to a centrally organised sale of the electricity at a uniform price (Marginal Price). Participants to the Mandatory Pool are producers and importers of electricity and suppliers and exporters of electricity. A distinct mechanism exists for the settlement of imbalances, but there is no balancing market.

Energy communities are eligible to participate in the electricity market and enjoy favourable conditions for operating RES or CHP. In particular, unlike typical RES production, energy communities are excluded from any competitive procedures required by Law 4414/2016 [18], as long as their production power is less than 18MW (as defined in law 4602/2019, [19]). Additionally, as we have already mentioned, energy communities enjoy favourable conditions concerning the procurement of electricity generation licenses. Moreover, competitive charges may apply for the participation of RES and CHP, operating within an energy community, in the electricity market. Additionally, when considering the installation of photovoltaics, energy communities can enjoy increased prices for the compensation of the power produced from RES, according to Law 4602/2019.

Energy services

According to Law 4513/18, Energy Communities can participate in the fields of:

- Renewable Energy Sources,
- Combined Heat and Power (CHP) system,
- Rational use of energy,
- Efficient use of energy,
- Sustainable Transport,
- Demand Management,
- Production, distribution and supply of energy.

Apart from that, the law indicates that an energy community can act as an ESCO (Energy Services Company) and provide energy services of all kinds.

Financing and support

Law 4513/2018 sets an increased number of financial incentives to promote the adoption of energy communities. For instance, according to this law energy communities can be considered in Law 4399/2016 [20], for the establishment of *Private Investment Aid schemes* for the regional and economic development of the country. Moreover, energy communities shall also be considered in programs funded by national or European Union resources according to their purposes.

To summarize, the overall list of financial incentives the law states are as follows:

- Energy communities can be considered in Law 4399/2016, for the establishment of Private Investment Aid schemes for the regional and economic development of the country,
- Energy communities shall also be considered in programs funded by national or European Union resources according to their purposes,
- Competitive charges may apply for the participation of RES and CHP operating within an energy community in the electricity market,

- When considering the installation of photovoltaics, energy communities can enjoy increased prices for the compensation of the power produced from RES, according to Law 4602/2019,
- Energy communities are excluded from any competitive procedures required by Law 4414/2016 in order to receive the Operational Aid provided for RES,
- Energy communities are excluded from the obligation to pay the annual fee for the holding of an electricity generation license,
- In order to issue an electricity generation license to an energy community, the cooperative capital shall be equal to 60,000 €, significantly lower than the 600,000 € of corporate capital required for a company to acquire the relevant license.

Governance

Regarding the governance model for energy communities, law 4513/18 is based on the law 1667/1986 for civil cooperatives and builds on the principle of voluntarily, open participation, and equal opportunity. The effective control remains within the General Assembly where the principle "one member – one vote" applies, regardless of the shares held by the members. A member cannot obtain more than 20% of the shares except energy communities with two local authorities who can own up to 40% and 50% if they are located in islands with a population below 3,100 inhabitants.

Legal entities, local authorities including municipalities and SMEs can be members of an energy community with a proximity limitation, stating that 50% plus one of the members must be related to the location (region) of the energy community.

Both non-profit and for-profit energy communities can be established, distinguished by the question of whether financial surpluses may be distributed to the members. To establish a non-profit energy community (no distribution of surpluses to the members) the minimum number of members is:

- 5 if the members are natural persons, legal entities of public law apart from municipalities, legal entities of private law,
- 3 if at least 2 of the members are local authorities,
- 2 if the members are local authorities of islands with a population below 3,100 inhabitants

In for-profit communities, 15 members are required with 50% plus one of them being natural person.

4.2 PILOT SITE IMPLEMENTATION

4.2.1 General considerations on the role of actors in energy communities

Local government/Municipality:

Overall, one of the main objectives of law 4513/18 is to enable municipalities and local authorities to directly participate in renewable energy projects. Municipalities are already taking steps towards establishing local energy communities. They have also been involved in the promotion of energy communities by actively supporting groups and workshops related to the subject.

In the current state, municipalities are reluctant to participate in hybrids models with effective control by citizens. They prefer to form partnerships with other public stakeholders such as municipal development companies and public entities (local schools etc.). Nevertheless, tackling energy poverty by including vulnerable citizens in the virtual net metering is within their scope.

Moreover, municipalities have expressed their interest to support special categories of citizens by providing available infrastructures such as municipal buildings' rooftops or fields for community projects owned by energy communities. The municipality may get a share of the produced energy instead of rent or get some shares in the community itself and become a member.

Policymakers:

The Ministry of Environment and Energy apart from policymaking is also responsible for public funding via the Greek Development Law. Many measures have been set in place to promote the formation of Energy Communities and increase the penetration of Renewable Energy Sources (RES) in these communities. Relevant incentives are provided in Law 4513/2018, however, additional measures are described in Laws 4602/2019 and 4546/2018.

It is announced that there will be a public fund for energy communities covering up to 50% of an energy project cost.

DSO/TSO:

The DSO is responsible for:

- distribution network planning and development,
- safe and secure operation and management of the distribution system,
- data management associated with the use of the distribution system,
- procurement of flexibility services.

In Greece, HENDO (the DSO) contributed to the development of the framework for energy communities. It is keeping up with developments about Citizen Energy Communities on the European level and is actively supporting them by prioritizing the review of applications for energy projects network connection to the grid, providing information for grid users and collaborating with retailers for the effective implementation of virtual net metering. Also, HEDNO has announced to be ready to support the microgrids that will be developed by energy communities by providing security and assistance in micro-transactions of energy that will take place amongst prosumers.

Nevertheless, there are still omissions concerning the regulatory framework that have not yet been covered by the DSO. **For example, the technical specifications for the connection of batteries storage systems to the grid and the modes of operation have not yet been defined.**

Energy Suppliers:

The framework for energy communities when applying Virtual Net Metering **requires the members to have contracts with the same supplier. This is because the energy "netting", meaning the attribution of, e.g., PV electricity share to the participants of the community, is performed by the energy supplier**. To facilitate the adoption of this new framework the lawmaker decided to remove this task from the competence of DSO. This potentially violates the right of consumers to change energy suppliers. Nevertheless, suppliers have the potential to play a significant role in the development of EnCs since they can provide financial and technical support. One such model is currently in the development stage, the model specializes in PV projects with virtual net metering.

The energy supplier fund (loan) the energy project on behalf of the energy community. The loan is paid back through the monthly electricity bill. The members are starting to have a small benefit from the first year and as the payback progresses the benefit grows. The amount of loan servicing depends on the agreed interest rate and the duration of the contract.

Aggregators:

The role of aggregators is expected to strengthen shortly given that the participation of renewables into the energy market will become compulsory within the year 2020. Aggregators will be the main entities for medium and small energy producers for participating in the energy market.

Individual Consumers/Prosumers:

Individual consumers/producers are entities that either both consume and produce energy or just consume. They can be members of energy communities and enjoy the benefits of net metering. As members of a community, they are entitled to a single vote in the general assembly and can also be members of the community's steering committee.

Local Companies:

Local companies are SMEs that by the individual consumers/prosumers can be members of an energy community.

Universities/ research institutes:

Universities and research institutes can play a significant role in supporting energy communities in their early stages. They have the expertise and experience through research activities and collaborations on European and International level. They can also assist policymakers and take place in public discussions about framework development. Moreover, universities are usually prestigious institutions and can help give credibility and validation to products developed by private corporations for energy communities.

For the Rafina case, ICCS/NTUA is an educational institution with technical knowledge and experience in the energy sector. It can support communities on technical and framework issues. It can also provide support to companies trying to develop tools for energy communities.

Vulnerable Households:

Vulnerable households are defined in the Greek legislation as residential electricity end-users, which have trouble dealing with their energy bills. The law N.4513/18 on energy communities provides support for vulnerable households. Each energy community can offer part of their production for such households tackling energy poverty.

Banks:

For schemes owned by community co-operatives, a significant challenge is raising sufficient capital. These non-member sources of funds may include cooperative or commercial banks that are generally providing loans that are legally secured by collateral (pledged assets of the cooperative). This is one of the main barriers especially for new Energy Communities where no assets or properties are available to secure the loan. Without existing financial capacity in the local community, innovative approaches are needed (Crowdfunding).

Media:

Media have a key role in the promotion of energy communities. Positive promotion can become a key factor for people accepting the new model and become familiar with it. Dissemination of events and best practices, policy-making and incentives towards energy communities can create fertile ground for citizen engagement. On the contrary, negative media promotion can form opinions against citizen initiatives.

Environmental organizations

Environmental organizations (such as Greenpeace and WWF) have played an important role in the promotion of the institution of the EnC. within the country. Bringing examples from across Europe, they have shown how the new EU renewable energy laws can help remove barriers to community-own renewable energy. Lobbying is another common practice among these organizations to influence policymakers and political networks.

4.2.2 Pilot set up and regulatory and policy aims

In the pilot site of Rafina, two energy community models will be investigated. The first one is municipality-based, aiming to maintain the effective control of the entity and the second is a citizen based where the municipality acts as enabler/supporter.

The main objective for both is to utilize and test the recently established legal and regulatory framework and explore different cooperation and governance models between citizens and local authorities to develop renewable projects, boost social welfare and tackle energy poverty.

While the national framework for energy communities is quite advanced and several examples are starting to emerge, there is still a lack of best practices and good experiences. Through the municipality's participation in the different community models, the goal is to identify opportunities, barriers, and obstacles to develop a clear roadmap towards the establishment of successful energy communities that will be scalable and replicable. Moreover, this process could generate insights and recommendations for regulators and policymakers towards the transposition of the European framework in the national legislation.

4.2.3 Role of actors and organisation: models and experiences

Various models have emerged in Greece the last couple of years, whose specifics vary in terms of ownership and size. These models concerning the ownership can be categorized into the following types:

- **Cooperative model**: This is the most common entity of citizens' partnership. Citizens association, cooperatives or community-owned social enterprises have been activated on community energy projects. Good examples are the:
  - Sifnos Island Cooperative
  - Karditsa Energy Cooperative Company
  - Hyperion Energy Community
- **Local government model**: Municipal ownership model for creating local renewable energy projects. The effective control remains on local authorities. This model is well combined with actions of tackling energy poverty in their respective area. Part of the energy project's benefits is directed towards vulnerable households. This model has good potential to be widely replicated among the local authorities if proved viable.
  - Municipality of Rafina
  - Municipality of Trikala
- **Collaboration of commercial enterprises**: This model is starting to become common all over the country. The partnership is set up among commercial enterprises without citizens to take advantage of the financial and non-financial incentives that result from the EnC.

In COMPILE, the first two models are investigated.

In a citizen-driven model, the municipality of Rafina provides the available infrastructure to citizen energy communities for the development of renewable projects and becomes a member of the EnC or gets a share of the project as "rent". Local citizens and organisations can form the energy

community or it can be an existing citizen energy community related to Rafina. In Greece, the legislation allows the distribution of the energy via virtual net metering so the members can benefit directly through a reduction in electricity bills. The municipality can enjoy a share of the energy to cover the needs of the building where the project is installed, or receive some other form of compensation or rent for their financial support or the provision of, e.g., roof surfaces. The energy community that intends to use the municipality's infrastructure, in this case, assumes the project development. The financing, installation, operation, and maintenance (O&M) of the project is performed with the responsibility of the energy community, which in turn distributes the benefits of the produced energy.

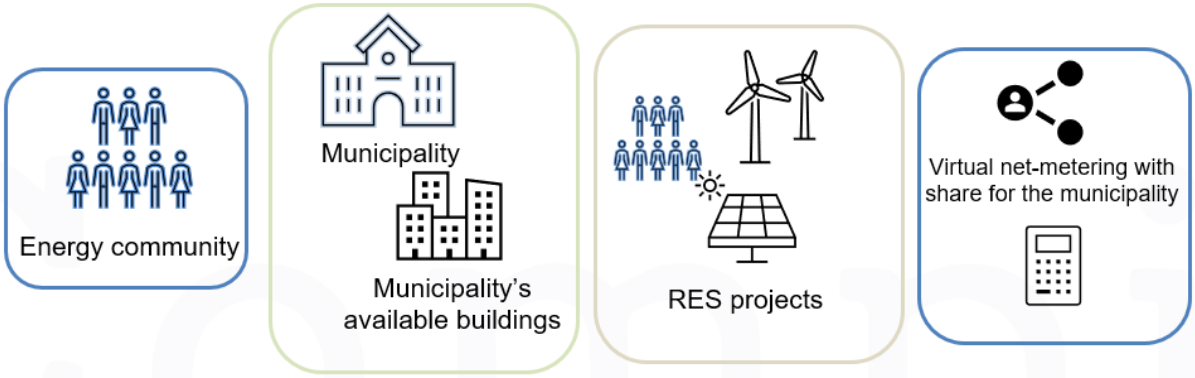

Figure 1: Citizen-driven organisational model (Greece)

In the local government model, the municipality of Rafina, municipal development companies, and local citizen groups (organisations, associations, etc.) will investigate the possibility of developing energy projects and applying virtual net metering to reduce municipal bills and tackle energy poverty. Through this model, the local authority aims to maintain the effective control of the energy community leveraging on the existing legislation. A share of the produced energy is offered to vulnerable households to help tackle energy poverty. Moreover, the benefits from the cost reduction the municipality will enjoy via the RES project can be directed towards reducing municipal taxes, or investing in activities boosting the social welfare of the local community. So far, the experience from this model shows that:

- The coordination with stakeholders within municipalities (mayors, deputy mayors, municipal board, development companies, legal departments, etc.) is rather challenging since they are large organisations.
- The role of citizens and their active participation is not clear.

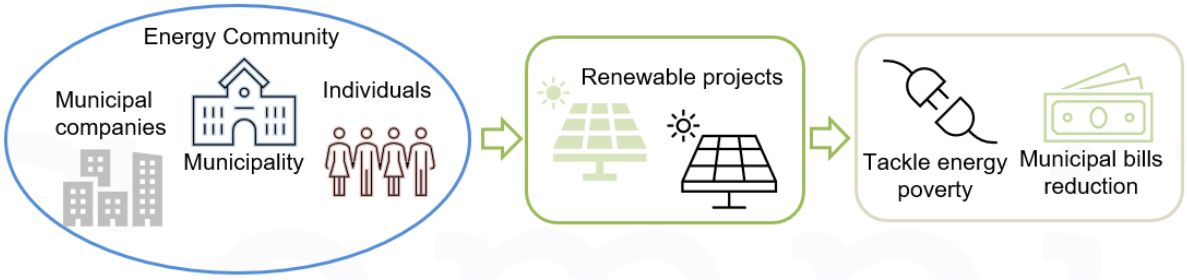

Figure 2: Local government organisational model (Greece)

Preliminary analysis for the Municipality of Rafina-Pikermi showed that with the current legislation, incentives and terms for virtual net metering, the development of RES project is an investment with a high internal rate of return (IRR). Moreover, an analysis was performed to classify the available infrastructure according to the appeal of the investment in each building. Factors for this analysis were the effective size of the rooftop (RES hosting capacity), cost, orientation, visual disturbance, and ease of deployment.

4.2.4 Experiences with the national framework and implementation

Considering the models that were described in the previous sections, several barriers are identified which affect their implementation. Municipality-driven models mainly involve municipal companies and the goal is to develop RES projects and support vulnerable social groups. The examples of Municipality of Rafina-Pikermi as well as other municipalities have already made some progress, capitalizing on the recent legislation while others are starting to investigate the community models. The main enabling factor is the quite advanced legal framework for energy communities with specifies the requirements for setting up and operating energy communities, adopting the EU directives for RECs and CECs. Moreover, several incentives available for energy communities, such as grid connection priority and favourable terms for participating in the energy market can foster their adoption. Active support from high impact organisations like the Ministry of Energy and Environment, Greenpeace, NTUA can also enable energy communities. The main issues arising from this model, considering the legislation can be summarized in the following:

- Despite having an implemented legal framework for energy communities there are still pending issues. Several capabilities are described but it is not yet defined how to implement them.
- The legal form for EnCs is based on the legislation governing civil cooperatives, balancing responsibilities and permitting procedures for RES projects can be costly and present a challenge for small EnC.
- Even though Energy Communities have a permissive mechanism to support vulnerable households, there is no clear framework that explicitly defines the vulnerable social groups.
- Effective control. By law, each member has one vote. In a municipality model, for the municipality to have the main control, the municipalities need to involve several municipal companies.
- Funding is difficult and is mostly based in government subsidies considering project development.

Municipalities are also exploring the provision of available roofs to energy communities for RES project development. The concept seems promising for municipalities since they benefit by utilizing available rooftops that were not being used before, and energy communities solve one of the main obstacles, which is finding available space for project development in urban environments. The key issues to be solved before the successful implementation of the concept can be summarized below:

- The magnitude of “compensation” for municipalities should be significant to make an impact but not to undermine the profitability of the investment from the EnC
- Finding energy communities that are mature enough to invest in a project
- The tendering process for the rooftop provisions should give advantage to local energy communities

4.3 LESSONS LEARNED

4.3.1 Conclusions on enabling factors and barriers for energy communities

Having a concrete legal framework describing how energy communities are established and operated, is the most important enabling factor for setting up EnCs. In Greece, the framework is quite favourable overall for EnC, thus making it easy and promising to engage in such activities. The participation of municipalities in energy communities is also favoured and fostered with the law N.4513/18, enabling them to act on a local level regarding RES, reduction of emissions and engaging citizens into participating in the local energy system. Moreover, incentives that are included in the legal framework enable both citizens and municipalities to participate in energy community schemes.

Moreover, the Greek Ministry of Energy and Environment and high impact organisations such as environmental organizations are actively supporting and promoting energy communities, providing information, tools, funding mechanisms, administrative support and promoting material. Universities like the National Technical University of Athens (NTUA) are also active in supporting the concept of energy communities, working on social and technical aspects of such schemes.

Despite having a legal framework on energy communities, including the different roles an EnC can play in the local energy systems, there are still several aspects that need to be clarified. There are several examples where the law N.4513/18 provides the possibility and describes a functionality when, in practice, it is not quite straightforward how to proceed. For example, the legislation allows an energy community to own and operate its own distribution grid, acting as a DSO, but in practice, there is no framework to define how to procure equipment, install and operate a distribution grid.

Also, funding is not easily accessible for energy communities since there no available banking schemes for cooperatives, particularly for a recently established organisation, which does not own properties to provide as collateral. Some corporate funds have presented interest in funding EnC PV projects, but this applies only to for-profit EnCs who can distribute profits and pay the investor directly.

From organizational point of view, EnCs are legal entities, based on voluntary and open participation and are effectively controlled by members that are natural persons, local authorities, including municipalities, or small enterprises. Their structure is like that of corporate organisations and is based on the framework governing civil cooperatives. This renders the establishment and operation of communities that need to serve simple purposes such as energy sharing, quite complex and not appealing.

The table below summarizes the key enabling factors and barriers, arising from the Greek legislation on Energy Communities.

Table 8: Enabling factors and barriers for energy communities in Greece

Identified challenges/barriers and enabling factors	Description	Actors
Established legal framework	The key enabling factor for EnCs in Greece is the established legal framework in the law N.4513/18, which set the specifics for setting up and operating an energy community, adopting in a big scale the EU directives for REC and CEC.	GOV, EnC

Identified challenges/barriers and enabling factors	Description	Actors
Incentives for EnCs	Several incentives are available for EnCs ranging from favourable terms and prices when joining the energy market, to priority in grid connection.	GOV, DSO
Support from ministry, organisations, universities	The Greek Ministry of Energy and Environment, organisations such as Greenpeace and universities like the National Technical University of Athens are actively promoting and support energy communities.	GOV, ORGs, UNIs, EnC
Emerging cooperative movement	During the last years, a rise in the cooperative way of thinking and acting is being observed which is affecting the adoption of energy communities.	COOPs
Small cooperative tradition	Despite the rise in the cooperative mind-set, Greece has a small cooperative tradition in the energy sector, while agricultural cooperatives have bad reputation.	Coops
Funding	Funding is difficult for energy communities since there are not banking schemes for cooperatives, particularly for new ones, who have no collateral to offer. Private or corporate funds have been observed but they focus only on for-profit EnCs.	EnC, GOV
Regulatory framework unclear	Despite having an implemented legal framework for energy communities there are still pending issues. Several capabilities are described but there is not yet a definition on how to implement them.	GOV, Regulator
Crowdfunding	No crowdfunding mechanisms are available in Greece for energy communities. Also, small experience in crowdfunding schemes.	EnC
EnC maturity	Even though there are several established energy communities, they are at a low maturity level and not ready to undertake complex projects	EnC
Complex enterprise structure of EnCs	The legal form for EnCs is based on the legislation governing civil cooperatives, balancing responsibilities and permitting procedures for RES projects can be costly and present a challenge for small EnC.	GOV
Grid connection	Delays and uncertainty associated with connection to the grid	DSO, EnC
All members need to be customers of the same electricity retailer	Hampering implementation, potentially conflicting with the free choice of supplier.	EnC / members

4.3.2 Lessons for the implementation of energy communities and further transposition of the EU framework

Since the law N4513/18 was implemented in 2018, energy communities have been emerging in a growing manner, aiming to explore the legal framework, virtual net metering and the possibilities to actively participate in the energy system. According to recent data from the General Commercial Registry where EnCs must be registered, there are currently more than 300 EnCs established in Greece. The Greek framework for Energy Communities is a notable example of transposing and implementing EU legislation but also defining specific national objectives and incentives for local energy communities. The following are some of the key elements of the framework that also reveals the special particularities of the Greek case.

- Allows a vast variety of energy activities including electric mobility.
- Expands the scope of virtual net metering to energy communities. This is critical in parts of Greece where residents live in multi-apartment buildings and lack the space for micro-generation installations.
- Preserves the locality by setting minimum requirements about the local ownership. Locality translates into the obligation of at least 50% plus one of the members to relate to the place where the registered office is located.
- Recognizes the insularity, in which special arrangements and privileges are introduced for the case of islands with a small number of inhabitants.
- Introduces an innovative mechanism for supporting vulnerable social groups, by allowing vulnerable households to benefit from virtual net metering without being members of an EnC.
- Provides a set of incentive mechanisms (connection priority, discount on generation licenses, etc.).
- Gives specific care to municipalities and local authorities to form EnC with fewer members.
- Understands the special needs of the capital city where the available space for micro-generation installations is limited. Attica region is excluded from local area restrictions regarding the RES projects.

Nevertheless, there is still room for improvement towards the transposition of the EU framework. N.4513/18 specifies that an EnC can apply virtual net metering to distribute the produced energy, but to perform the “netting” all members need to be customers of the same electricity retailer, which goes against the free choice of energy supplier. This may simplify the netting of the energy and the application of virtual net metering, yet modifications need to be made to ensure that every member can freely choose individually his supplier of preference. This issue is because the energy supplier is responsible for the netting of energy production and consumption. In the other EU countries, this responsibility is generally attributed to the DSO, which allows independence from the supplier.

Moreover, despite clearly describing the governance model of Energy Communities, which is based on the model for civil cooperatives, established in Greece in 1986 (N.1667/1986), the structure is not favourable for small scale energy sharing schemes. Consideration should be made to extend the

framework for self-consumption of renewable energy on a collective level beyond the Energy cooperatives including associations, condominiums etc.

5 PORTUGAL

5.1 THE LEGAL AND REGULATORY FRAMEWORK IN PORTUGAL

5.1.1 General status of legal framework for energy communities and collective self-consumption

While in Portugal a legal framework for both collective self-consumption and energy communities was missing in the first period of the project, a new law from October 25th, 2019 introduced a framework for self-consumption of renewable energy on the collective level and by renewable energy communities (*Comunidades de Energia Renovável*) (Decree Law 162/2019, [21]). This law entered into force on January 1st, 2020 with a stepwise implementation of the included provisions. Thereby, the REDII was partially transposed, while the law does not yet include citizen energy communities defined in the EMD. Previously, self-consumption was limited to the individual level (Decree-Law No. 153/2014) of 20 October 2014, [22]). The 2019 decree law adopts the major lines of the EU REDII in terms of membership, possible activities etc. and the need to form a legal person. The following text primarily builds on that law 162/2019 and the corresponding regulation 266/2020 [23]. Regulation No. 266/2020 further specifies the conditions for self-consumption of renewable electricity. This is, other forms of renewable energy (in particular heat) are not yet part of the framework and activities other than self-consumption and the treatment of potential surpluses are currently not yet established. Since January 1st 2020, individual and collective self-consumption projects and projects for collective self-consumption in RECs are possible as far as they have an intelligent metering system and are installed at the same voltage level. From January 1st 2021, other self-consumption projects will be possible [21].

Collective self-consumption schemes and RECs require registration and application on an online portal of the Portuguese Directorate General of Energy and Geology (DGEG). This portal serves to present and process applications for registration, licensing and other procedures for the management and control of self-consumption activities and energy communities. This includes the establishment of a register of existing production units for self-consumption. The interaction with this portal needs to be carried out by a management entity designated by collective self-consumers. This entity is in addition responsible for the operational management, including the management of a potential internal network, the interaction with the system operators, the sharing of electricity production including respective coefficients, the commercial relationships to be adopted for potential surpluses, and the connection with the public grid. For the latter, a contract between the management entity and the DSO needs to be established. In the case of renewable energy communities, the REC itself can be the management entity. In the COMPILE pilot project, it is still to be decided who takes the role of the management entity. This task may be taken over by, e.g., Coopérnico or the condominium commission, where Coopérnico could also market the potential surplus electricity (which is, however, unlikely to occur).

The **DGEG** will **assess the obstacles for and potential of RECs within two years** after the entry into force of the 2019 decree-law **and every three years thereafter**. **This assessment will be used to specify a framework** that shall promote and facilitate the development of RECs.

5.1.2 Specific provisions

Definition of local area

So far, a specific spatial limitation for renewable energy communities is not yet defined. However, the terms of *close neighbourhood relationship* and *proximity* of the project are introduced and must be assessed, on a case-by-case basis, by DGEG, assuming the physical and geographical continuity of the project and the respective self-consumers or participants. Three elements are explicitly mentioned in Decree Law 162/2019 that may be taken into account for the assessment:

1. The transformation stations to which the project is linked;
2. The different voltage levels associated with the project;
3. Any other technical or regulatory element.

In fact, until January 1st 2021 projects need to be located at the same voltage level.

The case-by-case decisions provide for the flexibility to consider project-specific situations. Thereby, more projects might potentially be possible as compared to a strictly defined spatial limitation. At the same time, this approach is not fully transparent and projects may not be able to assess their chances for registration upfront, i.e., before submitting their application.

Generation, supply and system operation

A supplier licence is not required for the sharing of electricity. The managing entity will need to coordinate the activities with the DSO and with the system operator(s) and take care of the implementation of the distribution between participants. The managing entity will also be billed for potential imbalances that the renewable energy community causes. All generation installations need to be registered as self-consumption installations. To fulfill its tasks, the DSO provides the managing entity with the relevant information on, e.g., the measured production and consumption.

Energy sharing and metering

In the current law, where a connection to the public network exists, the DSO is made responsible for the metering and the attribution of the generated electricity to the different participants. The metering of the total electric energy produced by the installation for self-consumption shall be done by telecounting and the corresponding meters need to be bidirectional. Under specific conditions, also the electricity withdrawn from or injected in storage units needs to be measured. The costs associated with the acquisition, installation and operation of equipment related to the measurement of the total production are borne by the self-consumer. For the metering of consumption, in areas not equipped with smart meters with remote counting, or in areas where their installation is not expected within 3 months, costs for the adaptation of the existing meters also need to be carried by the self-consumers. The metering system needs to be installed by the network operator within four months after the respective request. Counting is done in a 15 minutes interval and includes the measurement and “netting” of the electricity production, the consumption of the involved self-consumers and the electricity fed into the public grid. On this ground, it is to be avoided that electricity from the self-consumption installation consumed by non-participants is counted as self-consumption of the participants.

Different distribution rules (“distribution coefficients”) may be defined to be taken into account by the DSO. These coefficients need to be communicated by the management entity to the DSO through the self-consumption portal and RECs and apply to the sum of the included generation

installations. If no distribution coefficient is communicated, the DSO attributes the production in proportion to the measured consumption of each consumption unit in each 15 minutes. The potential types of distribution coefficients (static/dynamic…) are not specified in the relevant laws. The coefficients must not be changed earlier than 12 months after the last change.

Grid access and distribution/grid management

The use of the distribution grid for electricity sharing is foreseen as described above. In addition, self-consumers have the right to establish and operate internal networks and, when there is no access to the public network, to establish and operate direct lines.

Grid tariffs

Grid tariffs for self-consumption using the public grid are already in place, currently regulated by Directive nº 5/2020 of 20th March 2020 [24]. Collective self-consumption and energy communities have to cover the network usage tariffs when the generation plants and consumers are connected by the public grid; the tariff to be covered is calculated taking into account only the voltage level used (e.g. a REC in LV will pay only LV grid tariffs). However, if the REC feeds in its generation into higher grid levels, a lower or no tariff reduction may apply.

In June 2020, a new law was published that exempts RECs and collective self-consumption schemes to different extents from paying an element of the grid charges called CIEG (Custos de Interesse Económico Geral). For individual self-consumption projects 50% of CIEG costs are discounted, for RECs 100%. The reduction applies to initiatives registered until 2021 for the first seven years of their operation. The CIEG are the costs of energy policy, environmental or general economic interest associated with the production of electricity and the costs of sustainability of markets (Despacho nº 6453/2020, [25]). The fee includes, among others, expenses from previous years that still need to be recovered, expenses associated with the purchase of the production from renewables and cogeneration, as well as charges for sustainability measures, for the guarantee of power, and for the Promotion Plan of Consumption Efficiency (PPEC).

Treatment of surplus electricity/support schemes

Surplus energy from an individual or collective self-consumption can be traded, including aggregation and trade on a peer-to-peer basis:

a) In an organized or bilateral market, including through a renewable power purchase contract;
b) Through a market participant against payment of a price agreed between the parties;
c) Through a market facilitator, subject to an acquisition obligation with market remuneration.

If the sale from collective self-consumption or RECs is carried out directly by the managing entity, i.e. under point a) above, the managing entity must conclude a network use contract with the TSO applicable to producers and underlies the corresponding billings. The entity responsible for the integration of the surplus in the market is also responsible for deviations from the schedule.

When the sale of the surplus is not carried out through one of the modalities listed above, the concerned energy will be accounted for by the network operator and considered for reducing losses in the networks.

The government official responsible for energy is in charge of the design of a support scheme that takes into account the specificities of RECs according to the RED II. It is not allowed to connect generation units for self-consumption to the same point of consumption as electricity production

units that are covered by a guaranteed remuneration scheme unless the metering system allows differentiating the energy produced by the different installations.

Electricity market access

The major market activities as foreseen by the EU framework are included in the current Portuguese legislation on self-consumption including in RECs, namely the sale, aggregation, and peer-to-peer trading in particular of surplus electricity (see the previous section). Generation installations of self-consumption schemes need to be registered on the national platform as described above.

Energy services

Similar to the REDII, the Portuguese framework refers to aggregation services and "other commercial energy services" by RECs. In the definition of "stored energy", law 162/2019 refers to the storage in electric vehicles when bidirectional charging stations are associated with the consumption units of self-consumption schemes.

Financing

Regarding the financing of installations for collective self-consumption by a condominium, law 162/2019 refers to articles 1425 and 1426 of the Civil Code. This is applicable in the case of the COMPILE pilot project where the installations may partly be financed by the condominium means.

Governance

In law 162/2019, RECs are defined as a legal person with the general characteristics regarding (voluntary) membership, autonomy, effective control and main purpose largely corresponding to the EU framework. Registration and application for recognition on the platform as described above is a prerequisite, also for other (non-REC) self-consumption schemes. The REDII requires the participants to exercise effective control to be in proximity to the renewable energy project. In contrast, in the Portuguese framework, the members or participants of RECs are generally either to be located in the proximity of the renewable energy projects or to carry out activities related to the renewable energy projects of the respective energy community.

Law 162/2019 includes some details on the internal governance of collective self-consumers. For instance, the registration of generation installations or the passage of cabling or other components in a common part of a building requires authorization from the owners' assembly, decided by a simple majority (regarding paragraphs 3 and 4 of article 1432 of the Civil Code). Collective self-consumers need an internal regulation that defines at least:

- the requirements for the adhesion of new members and the withdrawal of existing participants,
- the rules for electricity sharing and for sharing the payment of network tariffs,
- the treatment of self-consumption surpluses, and
- the commercial relationship policy to be adopted including the use of potential revenues.

5.2 PILOT SITE IMPLEMENTATION

5.2.1 Pilot set up and regulatory and policy aims

The Lisbon pilot site is a residential quarter with eight buildings forming a condominium with 150 apartments. It is located in a residential area of Lisbon called "Alta de Lisboa". The owners of the apartment have already invested in the installation of photovoltaic (PV) panels which sums up to

9 kW of installed capacity to cover their energy needs for common areas of the buildings, including the lighting, elevators and heating, ventilation and air conditioning systems. They also have two private EV charging points and all 150 apartments are connected to the grid. The households' owners want to invest collectively in the installation of more PV panels in order to share the energy among themselves and become an energy community.

The project aims to establish a RES powered local energy system managed as a microgrid and create an EnC with the help of COMPILE methods and tools, as well as to provide an EnC role model for Portugal. By participating in COMPILE, the project partner Coopérnico aims at supporting the transformation of the concerned 400 citizens in a true EnC where they will be able to produce and consume energy among themselves and sell the surplus to the grid. Coopérnico wants to develop an EnC where it will be demonstrated that EnC can become a reality in Portugal and that they are an efficient way of controlling the demands of energy in the grid and a way to stabilize the energy grid. Thus, the pilot has a first of its kind character and can support the further development of energy communities and the corresponding legal and regulatory specifications to come.

5.2.2 Role of actors and organisation: models and experiences

In the COMPILE pilot in Lisbon, the project partner Coopérnico or the condominium commission is likely to take the role of the management unit. Thus, this actor would take over coordination with public bodies. Coopérnico assists with the planning of the PV Installations and may take over the marketing of potential electricity surpluses. Alternatively, a utility or an aggregator could do this. However, currently, the installations are supposed to have a dimension that will not lead to surpluses. Coopérnico would be able to market surpluses because it holds a supplier licence, which is not generally required for the management entity. In other cases, a separate market participant may be required. The installation as such will be done by another company.

The inhabitants will probably partially finance the installations indirectly through general condominium fees. However, the project team still investigates different models, in particular regarding different financing options by Coopérnico. Depending on the specific financing and management model, different approaches to form an energy community are equally under development. Most likely, there will be no consumption-based billing of the electricity consumption by the individual residents, as this would entail high efforts. Instead, it is foreseen that the produced electricity is shared using a static key, which will be based on the size of the apartments. This allows funding (upfront or by a payback over time) by the condominium commission equally receiving fees from the residents to the apartment sizes.

The commission of the condominium, representing the inhabitants, does the internal management and contracting of technical service providers. The commission equally has effective control over the project and involves the apartment owners.

The remaining energy demand would come from external utilities, independently for each apartment, in line with the free choice of the supplier.

The fact that the Lisbon pilot site builds on an existing management structure within a condominium and with previous experience with PV importantly facilitates the organisation. The condominium commission as an existing legal body can already establish contracts with external partners and take care of internal decision-making. At the same time, decision processes within the condominium are partly difficult since these have to be registered and approved in a general assembly requiring the organisation of extraordinary assemblies. The fact that a sufficient number of participants to make decisions is not always present may cause additional efforts.

So far, the pilot operates as a collective self-consumption scheme not requiring to be organized in a specific legal body. If, however, additional activities are to be carried out, the formation of a legal energy community will be required and has to be registered on the described platform. The management entity would be responsible to form and manage a new legal entity. Such a legal body might also provide advantages regarding the organisation of financing by, e.g., Coopérnico and the security for paybacks. In any case, individual agreements or contracts will be required with the inhabitants in order to fulfill the requirement of voluntary participation (as opposed to, e.g., automatic membership as part of the condominium commission).

5.3 LESSONS LEARNED

5.3.1 Conclusions on enabling factors and barriers for energy communities

The online registration system for collective self-consumers and energy communities is a potential bottleneck due to the high need for data to be provided by applicants, e.g., all system information, and the technician responsible for the installation. This is, the planning of the technical installations needs to be very advanced before an application can be submitted. In particular, in the current context of uncertainty regarding the approval, e.g., due to the unclear definition of proximity, this may potentially lead to fruitless upfront efforts. However, the flexible approach to proximity also brings about important advantages, as it allows taking into account the individual situation of each initiative. In any case, the registration process is difficult for non-professional citizens without receiving help. A one-stop-shop or other kinds of easily accessible support is not available yet. In addition, if corrections are needed in the registration process, partly very tight deadlines are set.

Smart meters are yet to be widely spread for Portuguese residential electricity consumers. Moreover, the main DSO has not provided a roadmap to specify when and where new installations will be made. Because smart meters are a key requirement to start a collective self-consumption scheme, this situation creates uncertainties related to the development of new projects involving residential customers.

The cost to access the public network, before the tariff exemption of June 2020, was a big economic barrier and it might become again an impediment in 2021 when the regulation will be revised. The current tariffs are only for initiatives operating at the same voltage level and registered before 2021. Tariffs for other initiatives still need to be defined. Thus, it is still uncertain whether, for instance, a full exemption of CIEG will still be in place in the future and for initiatives going beyond the currently possibly schemes.

Table 9: Enabling factors and barriers for energy communities in Portugal

Identified challenges/barriers and enabling factors	Description	Actors affected
First framework and incentives in place	A framework for collective self-consumption of electricity including within renewable energy communities is in place. Reduced grid tariffs and charges are defined.	EnC
Tight deadlines for changes in the registration	Initiatives may not have enough time for major revisions of their registration, causing rejection due to missing deadlines.	EnC

Uncertainty of recognition / registration effort	The online register requires detailed information on the initiative before a decision on its recognition is taken. Not all criteria are transparent or decided, e.g., there is no rule on the localisation of projects. Decisions are taken case by case.	EnC
Flexible approach to, e.g., proximity	The flexible approach to proximity also brings about important advantages, as it allows taking into account the individual situation of each initiative.	GOV, EnC
Smart meters	There is no clear plan for the roll-out of smart meters that are a prerequisite for energy sharing.	EnC
Tariff scheme not finalized	The current grid tariff and charges reduction only apply to timely registered projects and the currently possible self-consumption schemes at LV level. Future tariffs are no known yet.	EnC

5.3.2 Lessons for the implementation of energy communities and further transposition of the EU framework

The potentially major barrier to new initiatives is the effort to register. Potentially stranded costs and efforts are reinforced by the fact that the decision criteria are not (yet) clear and transparent, e.g., regarding proximity and the general physical expansion of energy communities. However, this flexibility also has advantages as it may address specific conditions. Fruitless costs and efforts could be avoided by introducing a stepwise registration process, not requiring all data on the project from the beginning. In addition, longer timeframes for needed revisions could be helpful. Currently, no clear contact points for initiatives are in place to receive support. A one-stop-shop and other supportive measures could be helpful for the formation of new CSC schemes and energy communities.

Also, clarity on the smart meter rollout would provide more planning certainty as smart meters are required for energy sharing.

6 SLOVENIA

6.1 THE LEGAL AND REGULATORY FRAMEWORK IN SLOVENIA

6.1.1 General status of legal and regulatory framework for energy communities and collective self-consumption

Slovenia has adopted a bylaw (Regulation on self-supply with electricity from renewable energy sources) that entered into force on May 1st 2019 [26]. Slovenia treats the regulation not yet as a transposition of the Clean Energy Package but as a way to stimulate the private investments into renewable energy (RES) generation and an important step towards a later transposition. In addition to individual self-consumption of the owners of individual houses that were already in force, it allows for two forms of CSC:

- **CSC in multi-apartment buildings**, where the inhabitants can share energy from a RES-generation unit connected to the LV network of the building. All the consumption metering

points (of the individual consumers and the joint consumption) are connected to the LV network of the building. The RES production unit is located on the building and is connected through its own metering point to the point of common coupling of the building network with the LV distribution grid.

- **CSC in "RES communities"** that can be formed by customers in various types of dwellings. The RES production unit can be located at a separate building and is connected to a dedicated production metering point on the LV distribution grid. The consumers participating in the RES community can consume electricity through two or more consumption metering points that are connected to the LV distribution grid of the same LV transformer station as the metering point of the RES production unit. It is important that the RES production unit is not (and has never been) taking part in a RES support scheme. As opposed to the EU rules for RECs, no legal entity needs to be formed. However, a contract must be signed between the members of the scheme, clarifying the division of the produced electricity between the participants.

When the RES production unit is connected to the LV network behind the consumption metering point of a consumer, it is considered individual self-consumption.

Slovenia prepares the introduction of local flexibility markets but it is unclear when this will be legally implemented. Slovenia is preparing for new energy law in 2021 but it is unclear if this will include legislation on flexibility markets or an updated energy community legislation.

6.1.2 Specific provisions

Definition of local area

In the current CSC framework, participation is limited to an area behind a single LV transformer. Several collective schemes can exist in the LV grid of the same transformer station.

Generation, supply and system operation

The annual limitation of the total amount of self-supply capacity in Slovenia (7 MVA for households and 3 MVA for small businesses) was abolished. The sum of all capacities of the RES production units used in a single collective scheme shall not exceed 0.8 times the sum of the coupling capacities of the consumption metering points included in this collective scheme. The aim is to reduce the potential RES electricity overproduction and its injection into the distribution grid. This provision replaces the previous 11 kW limit of the installed power of RES production used for a collective scheme.

Energy sharing and metering

For CSC, net-metering systems apply and will be continued. The applied accounting interval remains one calendar year (or less, if the contract starts after the beginning or ends before the end of the year). A single metering point (of consumption and the RES production unit) cannot belong to more than one collective scheme. Likewise, electricity from a single RES production unit cannot be used in more than one collective scheme.

Treatment of surplus electricity/support schemes

If the owner of the self-supply RES production unit is a third party, the electricity produced in this unit can only be used for self-supply of this collective scheme. The owner cannot market the energy produced in this unit, and any excess energy produced in this unit above the self-consumed energy

in the collective scheme is turned over to the supplier. The level of remuneration is not determined, neither is specified as free of charge. In general, if the net electricity produced by the self-supply RES generation unit (generation minus the consumed energy) is positive, the energy is turned over to the supplier.

Electricity market access

No balancing requirement is imposed on RES generation units for individual self-supply. The supplier does the balancing. However, no rules on balancing obligations are mentioned for the collective schemes. The provision of ancillary services is not yet possible for the DSO, only for the TSO.

Governance

The regulation on CSC in place does not yet fully cover energy communities but only the self-consumption aspect. Governance aspects therefore are not defined in detail. However, the customers who belong to the same collective scheme must sign a contract specifying the mutual relationships and the key for the division of the RES production among them. If the owner of the RES production unit is a third party instead of the collective scheme members, he must also be a party to the contract. According to the Rules on the management of multi-apartment buildings (OG, 60/09, 87/11 and 85/13) [27], for installing new devices on apartment blocks a 100% consent is required.

6.2 PILOT SITE IMPLEMENTATION

6.2.1 Pilot set up and regulatory and policy aims

The overarching goal of the pilot site Luče is to establish a cooperatively enhanced EnC to increase the self-sufficiency and security of supply of the local energy system containing residential and commercial buildings with high penetration of RES. By becoming a part of COMPILE, the Luče EnC aims to improve network conditions resulting in many socio-economic benefits for the community such as the operation of local agricultural business. Luče EnC aims to keep the interest of citizens in energy and climate topics, establish trust in the local energy community and local RES production while becoming the first EnC in Slovenia. The pilot thus is a testing ground for the establishment of an energy community while the current legal framework still does not provide a full transposition of the EU framework. The pilot can thus provide first insights into the practical aspects of energy community establishment and operation and thereby provide relevant information for the further transposition as well as for upcoming initiatives.

Because the municipality of Luče suffers power outages due to a weak supply connection, the municipality has a high interest in improving the security of supply with the help of local renewables generation. Due to the low capacity of the local LV network, the distributed RES generation is curtailed as the voltage during the day rises above the limits, requiring suitable technological solutions. The Energy community Luče is located behind one LV transformation station. It got solar power plants on nine buildings with a total power of 102 kW, five household batteries (2 x 10 kW/23,2 kWh, 10 kW/11,6 kWh, 5 kW/9,8 kWh and 3,5 kW/7 kWh) and a community battery (150 kW/333 kWh). In addition, a public EV charger has been installed. The system is being managed by Petrol's technical information system (IoT platform) Tango and a Home Energy Management System (HEMS) which was developed within the project. The project also plans to install public and in-house electric charging stations.

Energy sharing

Energy sharing is not yet implemented; it will be tested in 2021 as part of a regulatory exception. The DSO is responsible for managing energy sharing in COMPILE, however so far there are no standard procedures for the DSO. DSO meters are already installed; they would serve to do the attribution of the production to the consumers on an hourly basis. Within the regulatory exception, the grid fees may be reduced by 20% for the community internal electricity exchange over the public grid (Article 137 of the Act on the methodology for determining the regulatory framework and network charges for the electricity distribution system [28]).

Operation of the grid/microgrid

The local DSO Elektro Celje is involved as the local meter operator and distribution company who is ultimately responsible for operating the grid. A third party can manage the microgrid. In the case of the Luče pilot, Petrol does microgrid management. As a part of microgrid management, Petrol is managing production and demand, including the integration of a community battery and home batteries and can switch off feeders in the transformer station for islanding mode operation etc. The DSO, however, can overrule Petrol's interventions.

Organisation

Currently, there are contracts between Petrol and individual end-users for the net metering scheme, covering consumption and production. Individual users and the municipality to take part in the pilot energy community sign application forms as described in the section on energy sharing above. So far, no legal community organisational structure is in place, which is also not required by law in the currently allowed CSC schemes. For new RES communities, an organisational contract would however be required for the energy allocation.

6.2.2 Role of actors and organisation: models and experiences

The initiator of this demo is Petrol, acting as an aggregator and supplier. The deployment of the technologies was done in close cooperation with a local company, Biomasa, and supported by the municipality. Etrel as a technology provider supplied electromobility solutions. Biomasa owns part of the local generation and storage facilities and acts as a local frontrunner, engaging residents and the municipality. Besides the municipality, the residents are involved as consumers of the generated electricity, heat and charging stations as well as in the financing of installations. In addition, the local DSO Elektro Celje is involved as the local meter operator and distribution system operator.

6.3 LESSONS LEARNED

6.3.1 Conclusions on enabling factors and barriers for energy communities

The current regulatory framework is the first step. In particular, the responsibilities and operation of the DSO in the context of energy communities needs to be standardized and legalized compared to current ad hoc solutions. Regulatory sandboxes in Slovenia need to become more flexible to cover all needs for energy community implementation.

Table 10: Enabling factors and barriers for energy communities in Slovenia

Identified challenges/barriers and enabling factors	Description	Actors affected
Non-standardized DSO activities	No standardized DSO activities for sharing and metering on an hourly level.	DSO
Municipality engagement	Installation of RES (especially PVs) on public buildings will be one of the key enablers of energy communities.	Municipality
Microgrid management	Undefined responsibilities between microgrid operators and external DSOs	DSO-E, DSO-L (microgrid operator)
Restriction to LV transformer	The current CSC scheme requires the establishment of several small communities to cover an area such as in the pilot town of Luče.	EnC

6.3.2 Lessons for the implementation of energy communities and further transposition of the EU framework

Currently, an expanded CSC system is in place in Slovenia, which is limited to the LV transformer level and does not require strict governance structures, as would be the case for RECs. Having LV communities combined with reduced grid fees may further incentivize their setup, and the mitigation of local grid issues may to an important extent be possible on LV level. At the same time, the Luče demo showed that there is a need for several LV communities to cover a village such as Luče. In addition, the restriction that members of the current CSC scheme need to be connected to the same transformer station can be discriminatory because not all the inhabitants, as well as public buildings, are connected to the same transformer station. Public buildings, however, are often most suitable for new PV installations. Thus, an expansion of the current localisation criterion for future energy communities may be of high value for their implementation. Also, the activities of the DSO in sharing and metering is not standardized. Equally, in connection to the DSO, the relation to a potential operator of a local microgrid is not clarified on the legal/regulatory level. These aspects should equally be addressed in the future rules on CSC and energy communities to facilitate grid management and cooperation with the DSO.

7 SPAIN

7.1 THE LEGAL AND REGULATORY FRAMEWORK IN SPAIN

7.1.1 General status of legal framework for energy communities and collective self-consumption

So far, no detailed legislation/regulation on energy communities exists in Spain. The decree law 23/2020 of 23 June 2020 [29] first introduced energy communities and aggregators, providing for their general purpose and nature. No more specification is in place so far. However, Spain has an advanced framework on self-consumption in place, allowing for the use of the public grid, which is explained in the following.

The Spanish government, on April 5th 2019, approved the Royal Decree 244/19 [30] that regulates the administrative, technical and economic conditions of self-consumption in Spain. This Decree completes the regulatory framework on this issue, driven by Royal Decree-Law 15/2018 [31], which repealed the so-called sun tax. Among other measures, the Royal Decree enables individual and collective self-consumption by groups of apartment owners or in industrial estates; it reduces administrative procedures, especially in the case of small self-consumers, and establishes a simplified mechanism for compensation of energy fed into the public grid. Self-consumption previously was allowed with generation facilities located in the same dwelling only. According to the current rules, power surpluses may be shared with nearby consumers also in other buildings or fed into the grid. Collective self-consumption using the public grid is physically and geographically limited by the following conditions:

- The participating entities must be located within the low voltage distribution grid derived from the same transformer station.
- The maximum distance between production and consumption is 500 meters.
- Participants are located in the same cadastral area.

The generation facilities are connected to the internal network of associated consumers (direct lines) or the low voltage network. The right for feeding on electricity and receiving compensation for surpluses underlies several conditions. A general distinction is made between self-consumption with and without surpluses. The law distinguishes between:

- Modalities for self-consumption without surpluses. In these modalities, an antifouling mechanism must be installed to prevent the injection of surplus energy into the distribution network.
- Modalities of supply with self-consumption and surpluses. In these modalities, production facilities that are close to and associated with consumption facilities may, in addition to supplying energy for self-consumption, inject excess energy into the distribution networks.

For voluntarily joining the surplus compensation system, certain conditions need to be met. For instance, the combination with other types of compensation schemes is excluded. Collective self-consumption schemes using the public grid are generally excluded from the compensation scheme. Non-self-consumed energy would offset part of the energy that had to be purchased from the grid, at the freely agreed price with the chosen supplier or the hourly average price of the electricity market. In any form of self-consumption, the consumer and the owner of the generating facility may be different natural or legal persons. Storage elements may be installed in all types of self-consumption.

Production facilities at low voltage level not exceeding 100 kW power associated with surpluses will be exempt from the obligation to register as electricity supplier and will be subject only to technical regulations. Regulations may be developed for production facilities below 100 kW for a simplified compensation mechanism between deficits of self-consumers and surpluses from its associated production facilities. For installations above 100 kW, surplus energy is sold on the energy market.

Besides the development of the legal framework for energy communities, also the tariffs for self-consumption regarding the use of the public grid and the compensation scheme are currently under revision.
In the COMPILE pilot site in Crevillent, due to the lack of a legal framework for energy communities, the project is currently carried out under the rules of collective self-consumption. Due to the distance criteria of 500 meters, several clusters for production and consumption will be established.

7.1.2 Specific provisions

Due to the lack of specific energy community provisions, the following explanations refer to the above-stated framework on collective self-consumption.

Definition of local area

The requirements that participants are located within the low voltage network derived from the same transformer station, as well as the maximum distance between them of 500 meters, applies to the COMPILE pilot site in Crevillent. In practice, the limitation in terms of the distance between the members of the cooperative is the limiting factor in the project.

Generation, supply and system operation

The described threshold of 100 kW installed capacity to achieve more favourable conditions is not a constraint in Crevillent, as the distance rule of 500 meters will lead to smaller entities that remain below this threshold. The solution may thus be to divide the pilot site area into smaller entities to comply with both limitations.

Energy sharing and metering

In Crevillent, sharing will most likely follow a static approach, meaning that each member will have the right to a fixed share of the produced electricity.

Grid access and distribution/grid management

The current legislation allows the installation of batteries for self-consumption and grid services (one battery of 600 kW was installed in a public grid in another remote area); the DSO probably has to accept the installation of the grid.

Grid tariffs

In the current self-consumption framework, no local tariffs for energy sharing are foreseen.

For the demonstration in Crevillent, Enercoop fixes the fee for their clients using the local grid. In the case of the energy community that is being created, the members will be offered a special tariff to promote its inclusion into the energy community.

Treatment of surplus electricity/support schemes

The primary distinction is the above-described differentiation between self-consumption with and without surplus where the compensation of surpluses underlies several conditions. There is no

supported feed-in tariff or premium, but surpluses are compensated with either the agreed price from a supplier or the market price. Consumed and compensated electricity are netted in the bill. Therefore, the compensated amount of electricity can never exceed the amount of the consumed electricity to avoid net compensation. Also, the compensation price cannot exceed the price of electricity consumed from the public grid.

In the pilot site in Crevillent, however, no compensation can apply because the project involves the public grid, which generally excludes the right for compensation.

Assuming that Enercoop is both DSO and retailer, the consequences of the surpluses are lowered since the accession to the grid is granted. In any case, if the installation is expected to have surpluses it should comply with a series of technical (an antifouling mechanism) and administrative procedures stabilised by law.

Governance

In Crevillent, the separate clusters will each form a legal entity. The legal organisational form still has to be decided. Generally, under current legislation, at least citizens can form e.g. a cooperative.

7.2 PILOT SITE IMPLEMENTATION

7.2.1 Pilot set up and regulatory and policy aims

Local users of an existing cooperative (see below) will form the energy community, due to the stated area restrictions, in the current CSC scheme, several smaller communities will be formed, and the legal organisational form still has to be decided. The town hall will be involved to provide a surface for the PV installation, which is likely to be provided for free. The installations will belong to cooperative Enercoop, which will also carry out the investment. Electricity will be provided to energy community members for a reduced electricity fee. The focus or the newly formed communities is to organize the consumption, while the already established cooperative Enercoop takes care of the production, owns the public grid, and acts as a community manager, including the engagement of participants, etc.

7.2.2 Role of actors and organisation: models and experiences

Enercoop primarily drives the model. Enercoop Group is a business organization with a presence in practically all the value chain of the energy sector. The cooperative “Cooperativa Electrica San Francisco de Asis” located in Crevillent is the main company of the Group, founded in 1925, and it is a cooperative where all the benefits are invested in Social Corporate Responsibility as a non- profit association. The Enercoop group has three main branches (Generation, Distribution and Energy Markets), and acts as the DSO in Crevillent. In the Crevillent pilot, the local cooperative is the company, which involves and joins the consumers in a local energy community and promoted already several self-consumption installations under an Energy As a Service Model, where the investment is carried out by Cooperative. In the self-consumption schemes, the local Cooperative equally acts as an electricity supplier in the framework of the self-consumption scheme. Both, the local cooperative and the involved consumers, will be part of the self-consumption scheme in order to allow for the electricity sharing. The municipality plays an important role in providing surfaces for PV installations free of charge. This concerns in particular the involvement of the town hall.

7.3 LESSONS LEARNED

7.3.1 Conclusions on enabling factors and barriers for energy communities

Enercoop is building facilities to be included in the community, but permits are a constraining factor. The generation facilities will be installed on public buildings. One difficulty is to engage citizens, which currently is also constrained by the situation due to COVID where people are more reluctant to engage in community schemes. Having experience as a well-established cooperative is highly supportive of the organisation between Enercoop, citizens, and the municipality. Other initiatives with cooperative finance schemes may have more problems due to a lack of experience. However, a generally supportive framework for cooperatives exists in Spain.

Table 11: Enabling factors and barriers for energy communities in Spain

Identified challenges/barriers and enabling factors	Description	Actors affected
500 m limit	Requires the establishment of several small entities and limits the scope of a local energy community and its internal self-consumption net balance.	EnC
Favourable basis through existing cooperatives and cooperative framework	Not only in the COMPILE pilot site an experienced cooperative is in place but a generally favourable framework exists in Spain, including specifically foreseen social cooperatives.	EnC

7.3.2 Lessons for the implementation of energy communities and further transposition of the EU framework

The current CSC framework shapes how energy communities are defined in Spain. The emerging “energy communities” are thus basing their boundaries on the 500m limitation, which is leading to an incipient need for inter-communities energy relationships. In the upcoming legislation on RECs, it could be helpful to modify this limitation.

In general, in Spain, very favourable conditions for PV exist and the regulation is simple regarding the permits to feed in self-produced electricity to the grid. In individual houses that, unlike larger building stocks, have enough area to place a well dimensioned PV self-consumption installation, the payback period is around 3,5 years [32].

Cooperatives in Spain are requested by law to set up reserves for education, training and information. Especially the so-called “social cooperatives” cover similar goals and are a suitable vehicle to engage in community development.

8 INSIGHTS ON THE ROLE OF MUNICIPALITIES AND COOPERATIVES IN ENERGY COMMUNITIES

The following sections describe the potential role of municipalities and cooperatives in energy communities. These two types of actors are specific in different ways: **Local authorities** are specifically included in the EU framework on energy communities as potential members and shareholders. They are often discussed as a potential driver and supporter of local initiatives and can benefit from energy communities for their development goals. In particular, Greece specifically addresses municipalities also in its national framework for energy communities. Equally, in Greece, cooperatives are prescribed as the legal format for energy communities. **Cooperatives** are generally a frequently chosen organisational format and legal form for energy initiatives. This was the case also long before the establishment of the current Clean Energy Package, in some cases leading to the formation of umbrella organisations specifically addressing energy cooperatives. Also in the COMPILE pilots, cooperatives play an important role. In addition, as discussed below, the EU governance criteria build on major lines of cooperative principles, making cooperatives per se a potentially suitable organisational format also to meet the European requirements.

8.1 POTENTIAL ROLE OF MUNICIPALITIES

8.1.1 Introducing the municipal business model

Local authorities have a clear role in the transition towards a more sustainable future, as it expressed in the Sustainable Development Goals (SDG) [33] published by the United Nations as well as in the European H2020 framework by the European Commission. To enhance this concept, the European Commission launched the Covenant of Mayors, an initiative that supports local and regional authorities to create, and submit their plans to implement sustainable and “green” actions to reach certain climate goals (SECAP/SEAP[3]). More recently, according to the legal concepts of Citizen Energy Community and Renewable Energy Community defined in EMD and REDII, municipalities can be members of energy communities and take part in the local energy systems along with citizens and other stakeholders.

To align with their targets and goals for RES increase and emissions reduction, municipalities can assume different roles in the process. They can facilitate activities that serve their energy and climate goals. This may include setting the local regulatory framework where this is within the municipality’s responsibilities, incentivise investments in RES and energy efficiency projects, provide administrative support or even act as a medium between possible investors and government, banks, regulatory bodies, etc. This includes, when a local framework cannot be set, to deliver non-binding political decisions that directly affect local procurement procedures. Moreover, consulting interested parties when considering RES development or other activity that serves energy goals can be of critical importance to this end. Municipalities can also boost the replication and upscaling of activities that promote the upgrade of the local energy system towards a more sustainable one. To this end, municipalities can support through funding, dissemination and promotion of such endeavours. Municipalities can also trigger specific rules on public procurement allowing for the promotion of energy communities.

[3] Sustainable Energy Action Plan (SEAP) / Sustainable Energy and Climate Action Plan (SECAP)

Acting as initiators, municipalities have the potential to bring together all types of local actors such as citizens, companies, local authorities, and associations to plan and act on a wider scale, thus facilitating the achievement of the municipality's energy and climate goals.

As a primary entity, municipalities can use their own resources to develop projects that will support and enhance the local energy system. Through these projects, they are also able to help tackle energy poverty on a local level by supporting vulnerable citizens through financial or schemes like virtual net metering, where the legal framework allows it.

Several business models are emerging where municipalities engage in the local energy system. Via own, government and private funds that are more easily accessible by local authorities, they can develop renewable projects and distribute the benefits to their citizens. Through these projects, they can tackle energy poverty by supporting vulnerable households through schemes like virtual net metering. The concept of energy communities and the legal framework as it is being implemented in Europe incentivizes and simplifies the participation of local authorities in such endeavours. Municipalities can be key actors within this framework and initiate or support energy-related activities. The benefits for both municipalities and their citizens are significant and vary from environmental to economic, social, organizational, etc. Indicative some of the benefits for municipalities are listed below:

- Reach emission reduction targets,
- Increase RES production,
- Attract government subsidies and private funds to develop renewable projects,
- Strengthen the local economy through investments for projects that can be developed by municipal companies or local businesses,
- Reduce energy bills, thus creating more space for investments or reduction in municipal taxes,
- Tackling energy poverty by supporting vulnerable households,
- Engage citizens in environmental driven activities.

Accordingly, citizens can benefit from cooperating with municipalities through energy communities in the following ways:

- Become involved in the decision-making process at the local level through the cooperation with the municipality,
- Financial benefits such as a reduction in municipal taxes,
- Gain access to funding that is available for local authorities,
- Municipalities can provide administrative support when setting up EnCs, or when an EnC develops a project,
- Have a key stakeholder (the municipality) supporting the scheme increases security, organizational level and financial viability of the projects.

8.1.2 Potential role and technical applications of municipalities in local RES projects

In the context of energy communities, COMPILE has identified three main models, with several variations depending on the specifics (legal framework, size, organizational maturity, etc.), in terms of effective control and active participation for municipalities.

Model 1: Municipalities as initiators

The municipalities can act as initiators having an active role by engaging municipal companies, local businesses and citizen groups (associations, organizations, etc.) and directly participating in the scheme and decision-making processes. In some cases, like in the Greek pilot site, through this model, the local authority aims to maintain the effective control of the energy community leveraging on the existing legislation. In Greece, where the energy community legislation defines that every member gets the same voting rights regardless of their shares, municipalities along with their development companies, local organisations and associations attempt to form energy communities to develop RES projects and distribute the benefits to the citizens indirectly (reducing energy poverty, reduction in taxes, investments in social/community projects, etc.). Other examples show that municipalities can even become electricity providers, own the local distribution grid, or provide energy services (ESCO) to their citizens, considering they reach a high maturity level and develop the necessary infrastructure.

This model assumes that the RES development is performed by the **municipality**, being responsible to design and implement a financing plan by using own funds, attracting external funds (government subsidies, loans, private investments, crowdfunding) or combining more than one funding mechanism. Municipal development companies may perform technical development, thereby reducing the overall cost. The operation and maintenance can be outsourced or be conducted by municipal personnel.

Model 2: Municipalities as facilitators

Municipalities can act as facilitators, providing administrative and organizational support to other entities (i.e. EnCs) when developing energy projects. In this case, it is assumed that the municipality provides its infrastructure, designs, and plans the development of a specific project and initiates crowdfunding to engage citizens into investing in the project. Where there is an implemented legal framework, municipalities can support in the energy community development by providing legal and administrative support. The benefits are distributed amongst the members of the EnC (investors) depending on the model (virtual net metering, sale of the energy and sharing the profits, etc.), while the municipality collects a share to cover the building's energy needs. A municipality may or may not become a member of the EnC. In 2017, Green Energy Cooperative (ZEZ) with local authorities of the City of Križevci launched the first crowd-investing initiative for renewable energy projects in Croatia. ZEZ initiated a crowdfunding process, which attracted 53 citizen-investors to install PV power plants on public roofs. The investors are paid back with a fixed interest.

Model 3: Municipalities as enablers

Municipalities can act as supporters or investors in Citizen Energy Communities, participating and benefiting indirectly. Several examples across Europe (Belgium, Portugal, and Greece) show that municipalities can host the development of renewable projects in their available infrastructure such as public roofs and get a share of the energy as compensation. This way, municipalities can foster the active involvement of their citizens in the local energy system, increase the share of RES in the local production and reduce their energy bills.

The energy community that intends to use the municipality’s infrastructure, in this case, assumes the project development. The financing, installation operation and maintenance (O&M) of the project is performed with the responsibility of the energy community, which in turn distributes the benefits of the produced energy. There are examples like Coopérnico in Portugal where the energy is sold, and the profits are distributed among the stakeholders. In Greece, the legislation allows the distribution

of the energy via virtual net metering so the members can benefit directly through a reduction in electricity bills. The municipality can enjoy a share of the energy to cover the needs of the building where the project is installed. Alternatively, it may receive some other form of compensation or rent for their financial support or their provision of, e.g. roof surfaces. In many cases, the RES project is transferred to the municipality when the contract expires. For example, the contract may specify that the community develops the project and receives the energy for 15 years and then the installation is transferred to the municipality. In this case, it is crucial to define the tendering process for the provision of the available roofs. Municipalities will need to draft the tenders considering terms that favour local energy communities over other organisations that might be interested in investing. Terms such as locality, citizen participation, non-profit type of organisation, etc. could be considered.

The municipalities can also leverage their public procurement procedure to support the development of energy communities. By providing specific criteria in the allocation of development permits for public land, or exploitation contracts for pre-existing municipal infrastructure, municipalities have a suitable tool to support the formalization of citizen collectives. The experiences in co-development triggered by the addition of “participative criteria” in public tenders have shown that municipalities can provide an opportunity for their local inhabitant to get involved and potentially grow a local energy actor: the energy community.

8.1.3 Feasibility of the municipal business model

The participation of municipalities in the local energy system through energy communities can have several benefits in economic, social, and environmental aspects. As it was mentioned before, local authorities will play a key role in the energy transition towards a more sustainable future. To this end, municipalities have started setting goals for RES penetration and GHG emissions reduction. To reach their goals, their active participation in the local energy systems is crucial in terms of investing in projects or enabling and fostering the active participation of citizens. Energy communities can be a useful vehicle toward these goals.

Moreover, through energy communities the cooperation between citizens and municipalities can be enhanced, engaging citizens in the decision-making process rendering them active entities in the local community. This boosts the local authority’s acceptance and social politics.

The economic feasibility of the municipal business model depends on the size of the investment, the funding mechanisms, the available infrastructure and the applicable regulatory framework. Due to the economy of size, larger installation tends to cost relatively less compared to smaller projects, making the RES hosting capacity of the available infrastructure a key factor to the feasibility. Funding mechanisms have also a significant impact when doing profitability analysis for similar investments. Subsidies or loans with favourable terms can reduce the return of investment time and make such projects profitable in a few years. The most important factor that defines the feasibility of RES development is the regulatory framework applied in the country of interest. Schemes like a feed-in tariff, net metering, virtual net metering, and market participation and their respective terms or prices can significantly affect the economic feasibility aspect of (small and medium scale) project development.

8.1.4 Lessons learned from Greece, Croatia, Spain and Portugal

Local authorities such as municipalities can play a key role in fostering the adoption of energy communities and the engagement in the local energy systems for example by the development of

renewable projects. They can initiate, support, enable or facilitate the process making them significant entities considering energy communities.

Experience from the COMPILE pilots shows that the provision of available infrastructure for PV development and the administrative and funding support can be the main contribution of the municipalities considering the studied examples. The key issues from their involvement revolve around their administrative structure, which can influence the decision-making process and can add delays to certain processes.

Greece – Municipality of Rafina-Pikermi

The models that were described in chapter 4 are starting to emerge in Greece and the implementation is being investigated to address possible issues, obstacles and opportunities. Municipality-driven models mainly involve municipal companies and the goal is to develop RES projects. The examples of Municipality of Rafina-Pikermi has already made some progress capitalizing on the recent legislation while others are starting to investigate the community models. The main issues arising from this model can be summarized in the following:

- The coordination with stakeholders within municipalities (mayors, deputy mayors, municipal board, development companies, legal departments, etc.) is rather challenging since they are big organisations.
- The role of citizens and their active participation is not yet clear. Mainly vulnerable households are considered to tackle energy poverty since they do not need to be members of the EnC.
- Effective control. By law, each member has one vote. Municipalities can have the majority by involving several companies.
- Funding is difficult and is mostly based in government subsidies considering project development.

Municipalities are also exploring the provision of available roofs to energy communities for RES project development. The concept seems promising for municipalities since they benefit by using available rooftops that were not being used before, and EnCs solve one of the main obstacles, which is finding available space in urban environments. The key issues to be solved before the successful implementation of the concept can be summarized below:

- Magnitude of “compensation” for municipalities should be significant to make an impact but not to undermine the profitability on the investment from the EnC,
- Finding EnCs that are mature enough to invest in a project,
- The tendering process for the rooftop provisions should give advantage to local EnCs.

Croatia – City of Križevci, ZEZ

ZEZ with local authorities of the City of Križevci has collaborated in initiating crowdfunding schemes for the development of rooftop PV projects, utilizing public buildings. The municipality’s role is to be an enabler and financial support if needed, as the owner of the buildings on the pilot site. They support the initiative publicly, making it more visible and accepted among the local community. Furthermore, they are collaborating with the EnC. on new projects that have the potential to engage

more local citizens and that are involving some of the public buildings under the municipality's authority.

One of the key lessons was it is crucial to have the municipality as a partner in the process, given that they own the buildings in the pilot-site. Also, the company operating the Technology Park (Križevci pilot-site) is a public institution partially funded by the city, so it is important to achieve a healthy collaboration with the energy community, to plan the costs and activities to be implemented from the municipality's budget. On the other hand, the limiting factor is the public procurement process, which can be a limiting factor with rules that sometimes do not support EnC. models and direct collaboration. Although cooperatives are often led by citizens, local communities, and are open to all, under the law they are considered as any other SME and therefore their partnership with the municipality is limited due to the legal limitations. By involving the municipality, EnC may become dependent on local politics, which should be avoided. The involvement of the municipality is generally considered as positive, as it often increases the trust of the community if the relationship is not too politicized.

Spain – Crevillent

Energy communities are only emerging in Spain and, the regulatory framework is still a work in progress. Advances in the right direction are being done, with initiatives being grounded on cooperatives and social cooperatives that are key for the development of the community and its environment. As a shared (ownership) model eventually considers making use of public spaces, having the municipality on board is crucial to ease procedures. This is also the case in the Crevillent pilot, where close cooperation with the municipality exists. Public buildings are key in order to provide enough area for the deployment of RES like PV. A major limitation in this regard currently is the 500m limitation for collective self-consumption that is set in the Spanish regulation.

Portugal – Coopérnico

Coopérnico is actively collaborating with local governments towards developing energy projects and energy communities. Mainly they collaborate with smaller administrative regions called Juntas de Frageusia but they have also been working with municipalities directly as well. Moreover, some of their projects have been developed on the roofs of public schools, which are managed in collaboration with municipalities. Overall, there are significant experiences from the active involvement of municipalities in the local energy system, which can produce insights on the cooperation.

Since municipalities are large organisations, they have complex administrative structure, which leads to delays and difficulties in the decision-making process, rendering the cooperation with them a bit tricky. The crucial factor mitigating or enhancing this issue is the capacity of the municipality in terms of the human factor and available funds. Working with different municipalities showed that capable and active employees could be enabling factors by sharing knowledge and bringing together interested entities into participating in the local energy systems. Despite the issues, the collaboration with municipalities can be a key enabling factor, which can foster the adoption of energy communities and the development of RES projects. The provision of available infrastructure is quite crucial in urban environments when considering renewable projects. Moreover, municipalities can bring together significant stakeholders, which can assist in the process of developing projects or providing policy suggestions (e.g. adoption of a framework for energy communities).

8.2 POTENTIAL ROLE OF COOPERATIVES

The EU provisions on the governance of energy communities are strongly based on cooperative models. Cooperatives can take several roles also besides organising the EnC as such. For instance, they can act as a financing provider or supplier, also providing services to other actors and EnCs. This includes the support of municipalities to set up energy communities. Due to the experience of already existing cooperatives such as Coopérnico, ZEZ, Enercoop, and many others across Europe, they can form an important basis for the foundation of energy communities.

8.2.1 Introducing cooperative models

Democratic governance, citizen participation and local control and management are demonstrated in local renewable energy projects through **the seven cooperative principles**. These principles are described by the International Cooperative Alliance (ICA), and distinguish cooperatives from traditional commercial enterprises. Those principles are voluntary and open membership; democratic member control; education, training and information, autonomy and independence; member economic participation; cooperation among cooperatives; concern for the community [34]. Guidance on the implementation of those principles is provided by the ICA and will also be described in the COMPILE Toolkit (Stakeholder Engagement Guide).

The primary objective of a cooperative is not to generate financial profits, but to provide solutions for improving the living conditions of their community. Furthermore, a cooperative is organised in a democratic, open and transparent way. This relates both to the internal organisation and to the financial decision-making.

Renewable energy cooperatives gather different types of stakeholders sharing mutual interests and visions regarding renewable energy and energy efficiency. Their interests often include sustainable development, social inclusion and poverty reduction, and access to energy as a crucial issue for development processes, including to eradicate poverty and help meet basic human needs [35].

Energy cooperatives are a suitable model to develop, finance, and implement local renewable energy projects, offering many advantages, largely in line with the EU provisions on energy communities [36]:

1. **Combining economic, social and communal interests of different actors**, enabling them to get involved in the decision-making process on a local level.

2. **Active participation of citizens** in the implementation of local RES projects, thus ensuring acceptance and successful implementation. Energy cooperatives operate between national/regional governments and individuals/firms and can play an important role in solving market failures and promoting collective action.

3. **Strengthening of the local economy** through citizens' joint investment in projects that are realized with local companies and banks, artisans and projectors. Also, municipalities profit from tax revenues and the investments may decrease unemployment.

4. **Reducing social injustice**, since all social groups can actively participate in the energy transition as cooperative members.

5. **Enabling the energy supply to be tailored to specific needs**, which is based on the support of the members. Energy cooperatives have the potential to shape the local and regional energy supply in the long term.

6. **Energy cooperatives as social enterprises** are not entirely capital-based participation of the citizens. Energy cooperatives disseminate information directly to a local community and put

democratic mechanisms in place to allow citizens to influence key decisions about renewable energy.

8.2.2 Potential role and technical applications of cooperatives in local RES projects

Energy cooperatives can take several roles in local RES projects:

- Mobilizing the local community and providing administrative and other support in setting up new EnC.
- Providing services in the energy market (cooperatives as energy producers, suppliers, aggregators, etc.).
- Managing entities of the energy systems/power plants / internal grid owned by an EnC. In the case of a public grid, the managing entity is a "formal interface" between the project and the DSO. In the case of an internal grid, the managing entity would be responsible for balancing. The managing entity does not have to be a formal supplier.
- Financing local projects (direct or shared ownership) or supporting the implementation of innovative financial mechanisms such as crowdfunding, ESCO/contracting models. Further models can be built on these approaches also for the energy communities to be developed. The joint organisation of generation and consumption within an energy community is not necessarily part of these models.
- Supporting municipalities in project development and financing. Cooperatives as local expertise hubs for replicating good practices in community management and ownership.

Technical applications of energy cooperatives in local renewable energy projects include:

- **Electricity generation from RES** – depending on the locally available resources and local preferences.
- **Electricity distribution** – operating a local distribution grid, which can be particularly interesting for energy communities in remote areas.
- **Electricity supply** – energy cooperatives could produce their own electricity and sell it to their clients, or buy and aggregate renewable energy from other producers for their members.
- **District heating** – district-heating cooperatives manage and own local heating systems, supporting members to optimize their heating installations. For instance, there are hundreds of heating cooperatives in Denmark, where the heat demand is high and the legislation is supportive for such cooperatives. Through the municipalities these district heating cooperatives get access to low rent loans to finance their investments.
- **Collective self-consumption & storage** – cooperative can implement innovative business models for collective self-consumption, e.g. for tenants living in apartments where they cannot install private solar panels. This model also provides opportunities for developing projects within districts that can be turned into an integrated local energy system powered by renewables.

- **Data management & blockchain** – consumption or production data is often registered by meters that are owned by distribution system operators. This gives consumers little control over what is private and sensitive information. Cooperatives can manage databases, for instance, based on blockchain technology, where production and consumption data can be stored and shared safely. This way, end-users or prosumers can keep control over their data and decide with whom they want to share information.
- **Electromobility** – e-car sharing cooperatives could invest and operate a fleet of electric cars, and offer related services within a city or a region (or within a local community).
- **Demand flexibility** – prosumers gathered in a cooperative can make a flexibility offer and accept to be limited in their electricity supply for a certain amount of hours per year, in return for remuneration.
- **Energy efficiency and building renovation** – Energy cooperatives have started to offer services to support municipalities and private citizens to renovate their homes and buildings. Members of cooperatives have financed a large variety of projects, from the deployment of efficient street lighting to deep renovation management services to condominium and private homeowners.

Finally, the cooperative movement has been active in supporting the development of other local actors. The models of replication of cooperatives are mostly turned toward strong network collaboration allowing emerging cooperative to receive support from larger ones. Europe has seen the structuration of this movement through a European federation (REScoop.eu, which is a partner of the COMPILE project) but also many national federations like REScoop Belgium (BE), Enercoop (FR), BBEn (DE), Union Renovables (ES), and other.

8.2.3 Lessons learned from Portugal, France, Spain, Greece and Croatia

Experience of already existing cooperatives can form an important basis for the foundation of energy communities. In the following, we present lessons from our demos and beyond based on a set of interviews.

Portugal: Coopérnico

Coopérnico has three main activity areas: renewable energy production, energy efficiency and commercialization (retail). Currently, Coopérnico has over 1750 members who have already invested in 28 RES projects, with a capacity of so far about 1.73 MWp. All these projects create environmental, economic and social value – the first for obvious reasons, the second because they are profitable projects and members get a 3% return on investment and the latter through direct collaboration with educational or social-economic organizations. These projects represent a rupture with the traditional models used for the promotion of RES in Portugal. Citizens who want to join Coopérnico can invest in projects where green electricity is produced and sold either back to the grid or to the entity whose rooftop is used for the project. With the sale of electricity to the grid, based on a feed-in tariff, Coopérnico can payback the members who have invested in the project and generate income or economic benefits for such an entity. Coopérnico's main partners in production projects are NGOs, charities and public entities (schools, libraries and municipalities). The conditions and factors that foster the cooperative approach in implementing local RES projects in Portugal include a lack of investment for the development of smaller renewable energy production (<250kWp). This leads many people to contact Coopérnico to study the possibility of developing a joint project. On the other hand, members want to invest in renewable energy projects with good

moral values and trust in the entity to which they are lending their money. Thus, Coopérnico's projects promote the citizens' initiative and decentralized renewable production. At the same time, Coopérnico members feel they are helping not only the environment but also the charity institutions where the projects are developed while belonging to an entity (Coopérnico) which is democratically managed and where they have a word to say on how things are managed.

Among the most important regulatory factors that can enhance energy cooperatives as one of the key actors in the decarbonisation of energy supply in the EU are specific goals for RES generation as part of the national RES targets. Furthermore, energy cooperatives should in practice have a level playing field among other energy companies, as foreseen by the Clean Energy Package.

France: Enercoop

Enercoop is a renewable electricity supplier in France. Their target group includes individual consumers of electricity as well as local authorities and businesses all over France. As of July 2020, Enercoop had around 92,000 customers including 82,000 individual consumers (households), 10,000 businesses and 100 local authorities (cities). Enercoop buys electricity directly from more than 300 local producers of renewable energy in France. They also provide energy-saving services to their customers to help them reduce their energy consumption, as well as provide support to energy community production projects.

According to Enercoop France, major factors for fostering energy communities in implementing local RES projects in France are:

1) Community engagement to empower local citizens with knowledge, methods, and tools in order to set up a RES project,
2) a regulatory context that allows RES projects led by communities to be developed and financed (adapted legal statutes for the energy communities, support mechanisms accessible by energy communities projects, etc.), and
3) adapted financing tools that allow citizens to collectively fund the projects taking into account their specificities (usually one-time projects as opposed to private RES project developers that have larger portfolios of projects and can manage the risk of failures, have a better ability to raise funds, more important equity, etc.).

The most important regulatory changes that would further enhance energy cooperatives as one of the key actors in the decarbonisation of the energy supply would be a more flexible legal framework that is better tailored for energy communities and support mechanisms for energy communities.

Spain: Enercoop Group/Cooperativa Electrica San Francisco de Asis

The role of the Spanish Enercoop Group and the local cooperative Cooperativa Electrica San Francisco de Asis in the Spanish pilot of COMPILE are described above in the country section.

The conditions and factors that foster energy communities in implementing local RES projects in Spain are the definition of Energy Consumption Cooperatives (*Cooperativas de Consumo* in Spanish) being entities in charge of managing different activities within the local energy environment. Thus, they are capable of implementing and managing an integrated RES project from a perspective close to the end-user. The cooperative Framework is very suitable for energy communities as they work in

different legislation fields from distributed energy resources (DER) to citizen/end-user consumption with legislation that enables and eases their operation. This cooperative framework sets the ground for energy communities, shared ownership of assets and collective self-consumption.

According to Enercoop Spain, the most important regulatory change that would further enhance energy cooperatives as one of the key actors in Spain would be to overcome the limitation to a 500m radius area to perform collective self-consumption. This boundary limits the scope of a local energy community and its internal self-consumption net balance.

Greece: Electra

Electra Energy focuses on all stakeholders interested in community energy and provides consultancy and development services to a high diversity of actors: from public authorities to SMEs, private companies, engineering teams and, in particular, households and citizens initiatives. The policy development started in 2018 with the new regulatory framework 4513/2018 on energy communities. The incentives established in this law helped attract the attention of stakeholders to the new framework and opportunities. Since then, more than 380 energy communities have been established, mostly led by the business sectors and public authorities with very low participation of citizens. The conditions that foster the cooperative approach are mostly economic due to the good conditions for PV in Greece.

Further conditions and factors that foster energy communities in implementing local RES projects in Greece should be distinguished between citizens based and non-citizens based energy communities; the set of incentives could be exclusive for a specific category, avoiding conflict of interests in the renewable energy markets. Schemes that are established targeting the participation of only businesses should not be defined as cooperative schemes unless they could prove the capacity to engage citizens and provide social benefits to the members.

According to Electra, the most important regulatory changes that would further enhance energy cooperatives in Greece include incentives and advantages for citizens-based energy cooperatives to participate in big renewable energy tenders, the reduction of administrative efforts, decision-making processes for citizens to establish and operate cooperatives in the energy market, and a crowdfunding regulation in Europe.

Croatia: ZEZ

The Green energy cooperative ZEZ is a renewable energy cooperative (REScoop) and social enterprise. In the focus of our work are locally initiated RES and energy efficiency (EE) projects, to empower local communities through the utilization of local resources. ZEZ's main fields of activity in RES&EE are innovative business models and financing mechanisms for local energy initiatives, citizen participation and ownership, energy poverty and policy advocacy. ZEZ is mobilizing local authorities, to collaborate on enhancing the knowledge and capacity to implement projects within their action plans on sustainable energy and climate. The mission we have set for this year is to accelerate the transformation and regeneration of cities in Croatia through a community-led solar revolution by delivering 1.000 solar PV systems to urban households. Croatian citizens are mainly just passive bystanders in the energy market and system overall, while local resources are utilized by foreign investors, or energy security is heavily dependent on imports and fossil fuels. This is generally true for the whole Balkan region. REScoops as local expertise hubs, in collaboration with entrepreneurs and local authorities, could support the development and implementation of RES projects – in which

green energy would be produced, used and managed locally. However, the Croatian energy legislative framework still does not fully recognize energy cooperatives and the value they create.

Cooperatives in Croatia also meet many legislation barriers. For example, members of a cooperative are excluded from receiving unemployment benefits and other help – even if they are unemployed, which is very discouraging for citizens to participate. According to the Croatian Law on Cooperatives, after covering expenses, cooperatives are required to reinvest at least 20% of the profit for the further development of cooperatives. This reinvestment is taxable, while all other business subjects are exempt from paying taxes on the reinvested profit.

8.2.4 Conclusions

The cooperative model is suitable/replicable for energy communities where: individuals can act jointly on the market and negotiate their position, it does not accumulate profit, it can be competitive to other companies, ideas and materials can be shared within the energy cooperative. It can be used to retrieve trust and community building which is largely lacking in some countries.

A cooperative approach for the governance of energy communities can have benefits because it includes an already defined democratic model, generally in line with the EU framework. Another reason is that it can help citizens and companies to be a part of energy communities without having to fear a takeover of the community by a third party. The cooperative model may also play an important role in unlocking financing streams of citizens.

Energy Cooperatives can become both, RECs and CECs, they can be local and more limited in activities but also larger market actors. They may have a critical role in providing local flexibilities and additional services as foreseen in the CEC concept, such as electric mobility via e-car sharing. They may need service providers in case of smaller cooperatives, while larger ones may take care of the technical management themselves and potentially provide services to other partners.

9 DISCUSSION OF THE NATIONAL TRANSPOSITION PROCESS

In addition to the countries that are subject to this report, the status quo of the national transposition of the Clean Energy Package was discussed for a broader range of countries in [1] and [37]. These papers were equally established in the framework of the COMPILE project and an update is currently under preparation. Some major lines are visible, in particular regarding the definition of local grid tariffs for RECs, the specification of “effective control”, membership rights, and autonomy, as well as the limitation of the spatial expansion and proximity concepts of RECs. In addition, the involvement of vulnerable groups which is specifically highlighted in the EU framework is briefly discussed as Greece, which is part of the COMPILE pilot countries, has the most encompassing (if not the only) framework aiming to reduce energy poverty. The following provides a discussion of the current developments including examples described in the previous country chapters.

9.1 LOCAL GRID TARIFFS

A trend towards local grid tariffs is visible. This is also motivated by the need to set cost-reflective tariffs, which may entail the principle of only paying for the actual network-level used for distribution within the community. While some countries develop local tariffs specifically for energy communities, Portugal and Spain also allow CSC initiatives to use the public grid to which specific tariffs apply.

The development of local tariffs for renewable energy communities generally involves a reduction of volumetric elements of the grid tariff and possibly of additional taxes and charges not related to the use of the public grid.

These developments clearly show two fundamentally different motivations for local tariffs: 1) cost reflectiveness and 2) support of CSC and renewable energy communities. Both are embedded in the EU framework, even though in different pieces of legislation (electricity market rules in the EMD and electricity market regulation, and the requirement to support renewable energy communities defined in the REDII). Roughly, reductions of the tariff element for the grid use can serve cost-reflectiveness, while the reduction of, e.g., renewables support charges falls under the supportive nature. However, given the actual cost reduction, grid tariff reductions can be expected to have a supportive nature as well. Therefore, in practice, the boundary cannot be drawn clearly. In addition, the need to co-finance the overall system, including higher grid levels, through energy communities and CSC strongly depends on the actual situation. This is highlighted by the fact that the REDII allows applying charges to self-consumption even without the use of the public grid if the financing of the system is otherwise threatened.

9.2 MEMBERSHIP RIGHTS, "EFFECTIVE CONTROL", AND AUTONOMY IN ENERGY COMMUNITIES

Besides the general eligibility of specific types of actors to become shareholders or members of an energy community and restrictions regarding "effective control", the EU framework does not further specify any membership and governance mechanisms for energy communities. A few countries have already defined more specific membership criteria and procedures limiting the power of individual members or types of members. In Greece, a minimum number of participants is required for the establishment of an energy community; between two and five members depending on whether they consist of individuals, municipalities, or companies (to the latter, the upper minimum of five members applies) limiting the possible power of individual participants and market actors.

The concept of autonomy overlaps with membership criteria to the extent that the power of individual members may be limited. Besides voting rights or membership criteria, this can involve the limitation of capital shares of individual members. This is equally foreseen in the Greek law that provides for a cap on the participation rate of each member in the cooperative capital of 20%. Only municipalities may participate in the cooperative capital with up to 40%.

9.3 SPATIAL EXPANSION OF CSC SCHEMES AND PROXIMITY CONCEPTS FOR RECS

In the definition of **CSC** schemes, the REDII refers to "the same building or multi-apartment block" as well as to direct lines. In most member states, CSC is indeed limited to, e.g., multi-apartment buildings. Thus, in these cases, CSC is rather limited in its spatial expansion. However, Spain and Portugal foresee CSC via the public grid in combination with limitations to their expansion. Portugal currently limits CSC to the same voltage level, while France uses grid typologies as well as a spatial limitation of 2 km for its CSC scheme. In Spain, where currently only a CSC framework exists in detail, the local system needs to be located within a 500-meter boundary, be located in the same cadastral area, and is also limited to a grid segment below the same LV transformer station. Thereby, Spain adopts the most encompassing spatial limitation in terms of criteria applied, also in comparison to the existing concepts for renewable energy communities.

While **CECs** are not per se limited in geographical or system-related scope, questions of locality play a major role for **RECs**. The REDII requires that RECs be "effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects". The concept of proximity thus refers to the governance of RECs rather than limiting the RECs as such in their spatial expansion. This implies, however, that, to be able to meet this requirement, a localisation of the involved renewable energy projects is necessary. Consequently, the REDII indirectly requires localisation of the projects, while it does not require that ALL members or shareholders need to be located in proximity to the involved projects. Both, a definition of the localisation as such, as well as the criteria defining proximity as regards to effective control, are left open in the directive.

The analysis has shown that, in absence of clear definitions on EU level, the term proximity and the definition of the local character in general, are used in strongly differing ways. A general tendency is that the spatial expansion of RECs, and thereby the notion of locality, is more frequently addressed as compared to the governance-related proximity term according to the REDII.

Regarding the **spatial expansion of RECs**, several Member states refer to the **typology of the public grid**, which facilitates, e.g., the implementation of local grid tariffs. Slovenia limits the current "RES communities" to the same LV transformer without additional spatial limitations.

Greece covers proximity with a **spatial and governance-related concept**, where 51% of the energy community members are expected to have local ties with the district within which the energy community has its headquarters, referring to local ownership or use rights, or official registration as residents in the concerned municipality. For legal entities, the local relation to the energy community requires the headquarters to be within the district in which the energy community has its headquarters.

If **membership and/or shareholding** is generally **limited to be in spatial boundaries related to** a project, the governance-related proximity aspect is addressed at the same time. This would, however, fully exclude members or shareholders located outside of the local REC even if they do not carry out effective control. Portugal partly follows this approach, but members that carry out activities related to renewable energy projects are not required to be located in proximity to the project. Whether a full limitation of membership to those in proximity to the project causes relevant practical constraints remain to be seen; membership or shareholding outside of the area in which the physical project is located (where, e.g., electricity sharing takes place), may not be of high interest without participation in the effective control. An exception may be members that primarily focus on investments for a financial return, including crowd-funding initiatives in case external funding is required. This could, however, depending on the case, conflict with the general aim of RECs to create local benefits.

It is worthwhile critically discussing the **practical implications of locality or proximity definitions**. The choice of a system-related boundary has a practical correlation to the definition of local grid tariffs and financing of the distribution (and transmission) system. At the same time, information on the precise grid architecture may not easily be available for planners and local initiatives while system-related limits may be located between, e.g., two neighbouring buildings within the same municipality. Distances are much more transparent for the general public and may expand over several municipalities (as opposed to, e.g., postal codes) but ignore the grid infrastructure. The case of Portugal is interesting in this sense, as it will (for now) be decided on a case-by-case basis whether a potential REC can be considered as such. This provides room to individual spatial limitations and for gaining practical experience. On the other hand, a lack of planning certainty may be an issue for the developers.

9.4 ENERGY SOURCES

Many member states currently limit CSC and RECs to electricity and partly explicitly foresee a potential expansion to other energy forms at a later stage (e.g. Portugal). While for CSC, the limitation to renewable electricity corresponds to the definition of the REDII, RECs are only limited to renewable energy in general including, e.g., heat.

9.5 INVOLVEMENT OF VULNERABLE GROUPS

So far, as far as the authors are aware, only Greece has embedded the reduction of energy poverty as a prime goal of energy communities in its legal framework among EU member states, also establishing specific measures. In particular, the inclusion of vulnerable or poor households in the net metering scheme without requiring membership in the energy community as such may be a powerful approach to reduce barriers for these groups. In the other cases, where such specific options are not defined in detail, further national transposition and actual community-level governance will need to address the question of access of vulnerable households to the benefits of energy communities. This means that the concept of "open and voluntary" participation in most cases still needs to be broken down to specific rules and measures. For instance, the need to become a member of an energy community by purchasing a share of, e.g., a cooperative, or the requirement to participate in joint investments may importantly hamper the involvement of vulnerable groups.

10 SYNTHESIS AND CONCLUSIONS

The transposition process of the Clean Energy Package is at strongly differing stages in the COMPILE pilot countries. The pilot in Croatia is still importantly constrained by the lack of a legal framework for energy communities. Spain as well as Slovenia have an advanced collective self-consumption scheme in place. Portugal implemented a framework for renewable energy communities, currently limited to electricity that is also still part of self-consumption legislation. The options for possible activities under the Portuguese framework will enter into force stepwise and may be adapted over time depending on the made experiences. Greece has the most advanced framework in place and addresses aspects such as energy poverty and governance details to an important extent, also in comparison to other EU member states that are not subject to the COMPILE project. However, some constraints apply in this framework, such as the need for energy community participants to be a customer of the same electricity supplier.

Even though this deliverable strongly focuses on the Clean Energy Package and its transposition, practical constraints for the implementation of collective self-consumption schemes and energy communities are by far not limited to the corresponding provisions in, e.g., the (renewable) energy or electricity laws. To facilitate the implementation of projects, related legal areas such as for financing and taxation (e.g. crowdfunding in Croatia and Greece), and administrative hurdles need to be addressed and harmonized in order to be supportive. This also includes permission procedures and the majority needs in the housing sectors for the installation of generation devices and other.

Accompanying measures will be needed to support the establishment of energy communities. These are particularly foreseen for RECs in the REDII and include information measures, the facilitation of administrative procedures ("one-stop shops"), active support for the formation of energy communities, and the alignment of support schemes to RECs. In most cases, these measures are not yet fully in place. Major developments can be observed in the area of grid tariffs and support

schemes such as the compensation of surplus electricity. Greece has a range of financial incentives in place. While currently member states strongly focus on the technical and financial aspects of energy communities and CSC, in a next step, more “soft” measures will need to be developed. So far, Croatia, for instance, foresees information, education and capacity building for energy communities in its National Energy and Climate Plan. In Spain, encompassing information material on self-consumption is available.

The Clean Energy Package is not the starting point of (local) energy initiatives but introduced minimum criteria for partly new types of actors and activities. Many previously existing initiatives already developed solutions and will continue their activities or may have to be aligned with the new context. Regarding the definition of a local area, for instance, local action groups in Croatia already apply the criteria of the European Network for Rural Development. Energy cooperatives partly exist for a long time, as is the case in the Spanish pilot of COMPILE. Cooperatives are largely in line with the governance criteria of the Clean Energy Package are thus good candidates to play an important role in energy communities as well. Municipalities may equally act as an important driver or partner and can benefit from energy communities to reach their goals. DSOs are in a specific situation as their services, in particular for metering and netting of the energy flows, are fundamental in most countries. Even though they will in most cases not have an active role in terms of participation, their activities and related regulations may be game-changers for the implementation of energy communities and CSC. These concerns, e.g., the installation of smart meters and the provision of measurement data in a suitable resolution. At the same time, DSOs may benefit from services provided by energy communities.

In addition, organisational aspects that refer to the practical implementation rather than to legal and regulatory questions are of high relevance. For instance, the engagement of local citizens partly proves to be difficult, in particular in the current context of the Corona crisis. Other works of the COMPILE project address corresponding questions of, e.g., the process of community building and the maturity of energy communities (see for instance COMPILE deliverable 2.1).

The transposition of the Clean Energy Package into national law is by far not yet finished. Even if deadlines for the transposition are met, full implementation may include a stepwise implementation, learning, and potential adaptation over a longer timeframe as is specifically foreseen in Portugal. The COMPILE pilot countries show an important range of provisions regarding major technical elements of the EU framework such a localisation of CSC systems and RECs, proximity, effective control and others. While the process of transposition is still fully going on in most countries, aspects aiming at broad access to information, administrative facilitation, open participation, and other facilitating features are mostly not yet addressed. These are, however, equally highlighted by the EU framework and can be expected to be highly relevant for a broad rollout of local initiatives and citizen participation in the energy sectors. In the longer run, fully embedding energy communities in the market may also allow benefitting from their potential to a much higher extent. This would include the integration in local markets for flexibility/ancillary services that are not yet in place in all member states.

11 REFERENCES AND ACRONYMS

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11.2 ACRONYMS

Abbreviations and Acronyms list	
AGGR	Aggregator
aFRR	Automatic Frequency Restoration Reserves
CEC	Citizen energy community
CDS	Closed distribution system
CHP	Combined Heat and Power
CSC	Collective self-consumption
DSO	Distribution system operator
EMD	Electricity market directive
EnC	Energy community
ESP	Energy supplier
EU	European Union
EV	Electric vehicle
FC	Final customer
GHG	Greenhouse gas
GOV	Government
ICA	International Cooperative Alliance
IoT	Internet of things
IT	Information technology
LAU	Local Authority (municipality, regional authority)
LV	Low voltage
mFRR	Manual Frequency Restoration Reserves
MS	(EU) Member State
NGO	Non-Governmental Organisation
PV	Photovoltaic
REC	Renewable energy community
REDII	The current (second) Renewable energy directive
RES	Renewable energy sources
SEAP	Sustainable Energy Action Plan
SECAP	Sustainable Energy and Climate Action Plan
SME	Small and medium-sized enterprises
TSO	Transmission system operator