Empowering local renewable energy communities for the decarbonisation of the energy systems

D1.1 – Assessment of regulatory feasibility

09 June 2023

This project has received funding from the European Union's Horizon 2020 Programme under the Grant Agreement no. 957819

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Date	Version	Author	Comment
30/03/22	V1	Karine Laffont-Eloire	First full version including inputs from contributors
13/04/22	V2	See list of co-authors	Final inputs from contributing partners
29/04/22	V3	Karine Laffont-Eloire	Final version; integration of comments from reviewers (Artelys, CARTIF) (first submitted version)
09/06/2023	V3.1	CARTIF	Revised version

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Executive summary

The LocalRES project will deploy innovative local energy systems driven by Renewable Energy Communities (RECs) for a socially fair energy transformation that puts renewable energy into the hands of communities and people. LocalRES includes four demonstrations across Europe, where the LocalRES concept will be deployed:

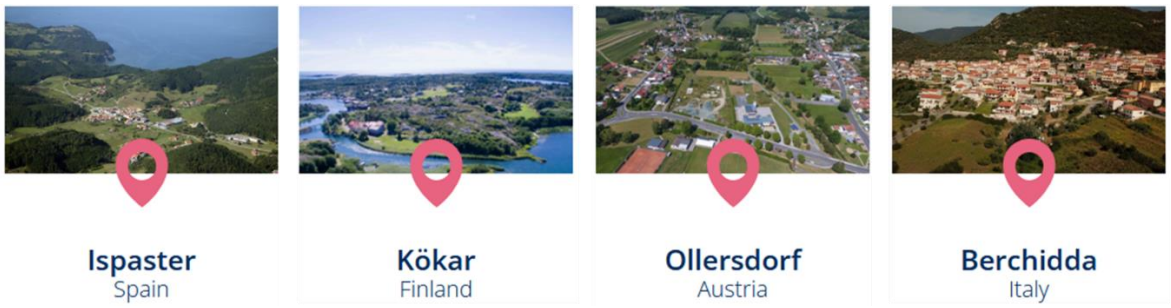

Figure 1: Demonstration sites of LocalRES project

The main determinants of the feasibility of RECs are the national legislations in the EU Member States, which are closely related to the state of adoption of the Renewable Electricity Directive. The feasibility and viability of energy communities are also impacted by uncertainties in legal and administrative procedures, challenges with bureaucracy, the maturity of the energy markets, the network codes, tariff schemes and grid fees, to name but a few.

This deliverable therefore **aims at investigating the complex regulatory framework impacting the demonstration activities and associated use cases** (with a particular focus on REC-based flexibility), **and at delivering potential options for implementation and proposals that will make project use cases feasible from the regulatory perspective.**

To achieve these objectives, a workflow in five main steps was applied:

1) Identification of key regulatory topics
2) Mapping of the most relevant regulatory topics to the preliminary Use Cases (UCs)
3) Analysis of regulatory conditions for the relevant topics (with inputs from partners Flexens, AIT, Aiguasol, Tecnalia and R2M)
4) Identification of gaps between the existing regulatory framework and the one required for the implementation of the UCs
5) Proposal of solutions to adjust the UCs to make sure they are in line with the existing regulation

Identification and mapping of the most relevant regulatory topics to the preliminary Use Cases

An initial list of key regulatory topics was defined, based on the list of services to be potentially included in the Use Cases (see D1.2 for the complete description of the services), as well as a literature review.

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Once the draft description of the Use Cases became available (i.e., pre-selection of services to be included in each UC), regulatory topics were mapped to the different UCs. Based on this mapping, relevant regulatory topics were investigated for each of the demo countries.

Table 1: Relevant regulatory topics for the draft Use Cases

Regulatory topic	Sub-topic	Ispaster UC	Kökar UC	Ollersdorf UC	Berchidda UC
Renewable Energy Communities	Collective self-consumption	X		X	
	Aggregated Energy trading				X
	P2P trading			X	X
	Energy storage	X	X		X
	Electric flows optimisation		X	X	X
eVs	Public charging points	X	X	X	X
	V2G				X
Heating supply	DH operation and integration of RES	X			
	Sale of waste heat to DH				
	DH balancing (thermal DR)	X			
	P2H / H2P	X	X	X	
Grid services provided to TSOs and DSOs	Voltage control				
	Frequency control				
	Black start	X	X	X	
	Congestion management	X			

Analysis of regulatory conditions for the relevant topics

Three main types of legal, regulatory and market conditions have been investigated in this report, as depicted in Figure 1:

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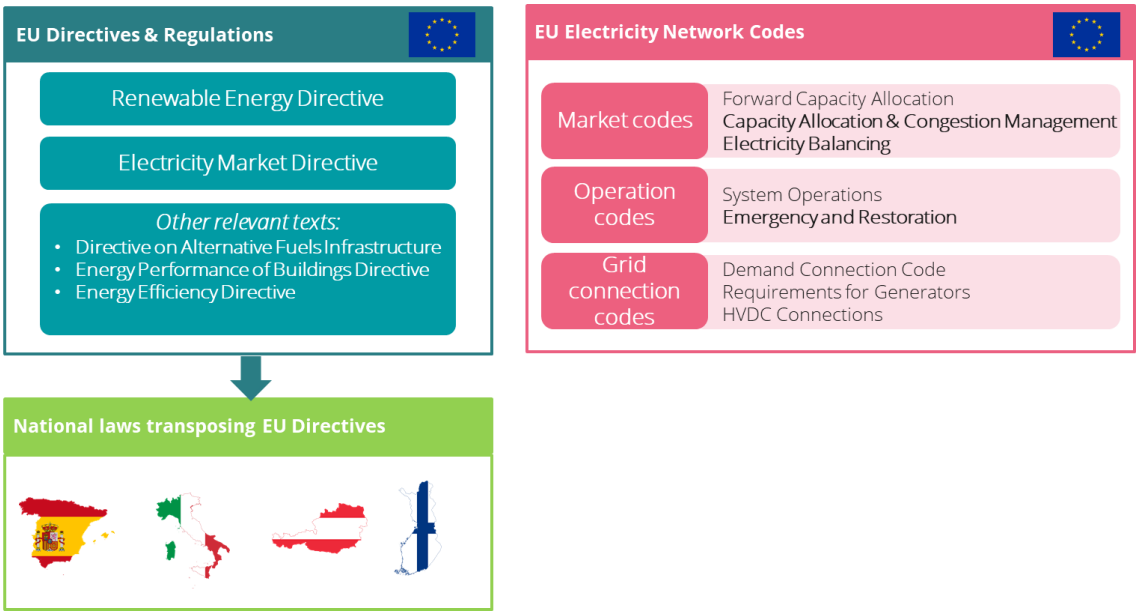

Figure 2: Main regulatory sources reviewed (relevant network codes are highlighted in bold)

- **Regulation for Energy Communities**.

The Clean Energy Package for All Europeans, first published on 2016 and adopted in 2019, brings new Directives that will have to be transposed into every single EU Member State. Two specific regulations are of special interest: the Internal Electricity Market Directive, which introduces Citizen Energy Communities, and the Renewable Energy Directive (REDII), which defines Renewable Energy Communities.

At the time of writing this report (March 2022), the actual progress of the transposition still varies from one country to the next and most Member States are behind schedule. Once the transposition is done, the clarity and 'ambition' of the transposing laws also vary a lot across Member States:

- In several countries the transposition law is just a copy-paste from the Directive, with no clear definitions and no guidance on how to set up communities (e.g., Spain). They need to be supported by technical regulation and other "rules of the game" which take time to be defined and rolled out,
- The laws and the associated technical regulations can be more or less supportive of energy communities. For instance, the geographic scope and maximum allowed power differ depending on the country, and energy communities might be strongly incentivised and well supported in some, but have close to no viable business model in others. The economic viability of energy communities is indeed strongly related to the taxes and grid fees applied to the energy produced and consumed within the community and to available subsidies.

The main outcomes are summarised below (Figure 3), and more detailed country overviews are provided in section 3.2.

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	SPAIN	ITALY	AUSTRIA	FINLAND
Status	Enforced since June 2021 but still in progress	Enforced since December 2021	Enforced since July 2021	Enforced since June 2021
Geographic limitation	Not specified yet (but existing law on CSC)	Maximum installed power 1MW/plant, under the same medium voltage station	Low or Medium Voltage grid	Very limited: Same property or cross-property with/without separate lines
Allowed activities	Not specified yet	Generation, sharing, storage, sales of surplus through PPA is possible	Generation, consumption, storage, or sale of energy from RES, other services, aggregation	Generation, consumption, storage and sales of renewable energy.
Process to set up a REC	Not specified yet	Authorization handled by GSE	Information of grid operator Koordinationsstelle	Declaration to DSO, DSO approval needed for now
Grid fees, taxes & incentives	Incentives Grid fee reduction for CSC	Grid fees reduction, incentives, Ecobonus, Superbonus	Grid fee reduction Exemption from levies	Energy aid and other subsidies

Figure 3: Synthesis of the regulatory framework for RECs in the demonstration countries[1] (as of March 2022)

- **P2P trading**.

According to REDII: *« Member States shall ensure that renewables self-consumers, individually or through aggregators, are entitled to generate renewable energy, including for their own consumption, store and sell their excess production of renewable electricity, including through renewables power purchase agreements, electricity suppliers and peer-to-peer trading arrangements."*

Network codes do not explicitly mention P2P.

As for national regulations of the concerned demo countries:

- **Austria:** the Austrian law does not explicitly prohibit P2P trading, but the measuring and allocation of energy has to be done by the grid operator, and there is no process in place to inform the grid operator of any agreements between participants.
- **Italy:** authorization from DSO is required for now. Since Berchidda has also the role of a DSO, P2P trading can be implemented over the course of the project.

- **eVs charging and Vehicle-to-Grid (V2G)**

Several EU Directives & Strategies are relevant with regard to eVs charging points, most of them being revised as part of Fit-for-55 package, a set of proposals to revise and update EU legislation in line with the 2030 goal. The Electricity Market Directive states that Citizens Energy Communities "*may engage*" in charging services for electric vehicles.

[1] CSC : Collective Self Consumption, PPA: Power Purchase Agreement, GSE: Gestore Servizi Energetici

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There is however no clear regulation on V2G, and network codes do not provide any specific rules for V2G, which is considered as a Distributed Energy Resource.

With regard to national regulations, only Berchidda (Italy) is considering including V2G in its Use Case. V2G is regulated in Italy by a Ministerial Decree of 30 January 2020[2] "Vehicle to grid. Criteria and modalities to promote integration between electric vehicles and the electricity grid".

- **Grid services**

Ancillary Services (AS) are defined by the CEP as "*a service necessary for the operation of a transmission or distribution system including balancing and non-frequency ancillary services but not congestion management*[3]". This concept includes balancing and other "non-frequency" services (e.g., voltage control, fast reactive current injections, inertia and black start), but excludes congestion-management, which could however be considered an ancillary service according to the CoordiNET project.

The potential for Distributed Energy Sources (DER) to deliver AS and (new) grid services is recognised by many of stakeholders, however:

- regulatory framework of most countries prevents the DER operators from offering their services (technology and size limitations, minimum bid size requirements – usually >1MW)
- aggregators are expected to play an important role in unlocking the potential of small DER, however independent aggregation is still at an emergent stage
- flexibility markets are not regulated in detail by network codes or guidelines at European level. The Agency for the Cooperation of Energy Regulators (ACER) will develop framework guidelines for demand side flexibility markets by the end of 2022[4]

Identification of gaps between the existing regulatory framework and the one required for the implementation of the UCs

The design of the Use Cases was in general compliant with the regulatory framework from the start. The only barriers identified (as of March 2022) are the following:

- The P2P trading in Austria cannot go ahead as there is no process in place to inform the grid operator of any P2P agreements between participants.
- The grid services cannot for now be provided directly by the REC to the DSOs or TSOs, mostly because of minimum bid size requirements.

[2] https://www.mise.gov.it/index.php/it/normativa/decreti-ministeriali/2041750-decreto-ministeriale-30-gennaio-2020-vehicle-to-grid-criteri-e-modalita-per-favorire-l-integrazione-tra-veicoli-elettrici-e-rete-elettrica
[3] Electricity Directive, Article 2(17)
[4] https://extranet.acer.europa.eu/Events/Public-Workshop-on-scoping-of-Demand-Side-Flexibility-Framework-Guidelines/default.aspx

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Proposal of solutions to adjust the UCs

- Given the current regulatory framework in Austria related to P2P, P2P-related activities cannot be provided to energy communities as of today. The project is looking into alternatives to be able to demonstrate P2P trading, i.e. a more favourable regulatory framework, with DSO support. At the time of writing this deliverable, this solution is not ready yet.
- Although the grid services cannot for now be traded directly by the REC to the DSOs or TSOs, similar services (e.g. congestion management, peak shaving, electric flow optimisation, blackout strategies) can be offered to the members of the REC to make the local grid more reliable. Two of the pilot sites are indeed isolated communities and two are located in geographical islands, which means that maintaining minimum conditions with regard to grid stability represents a challenge.

It is important to note that the transposition of the REDII Directive – which includes the principles of RECs – has substantially progressed while this deliverable was being written, in parallel to the definition of the Use Cases. Adjustments to the current state of play are foreseen in the coming years, in particular in Spain (with clearer definition of RECs, allowed activities, geographical scope and process to set up a REC), Finland (geographical scope), Austria (processes involving the DSOs, for instance for P2P). New network codes for flexibility markets should also be put in place in 2023.

It is therefore likely that services that cannot be provided by RECs at the time of writing this deliverable (March 2022) will be enabled in the near future, in particular thanks to the development of flexibility markets.

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List of acronyms and abbreviations

AC	Alternating Current
CEC	Citizen Energy Communities
CEP	Clean Energy Package
CSC	Collective Self Consumption
DH	District Heating
DHN	District Heating Network
DR	Demand Response
DRES	Distributed Renewable Energy Sources
DSO	Distribution System Operator
EC	Energy Community
EE	Energy Efficiency
EMD II	Recast of Electricity Market Directive
ENTSO-E	European Network of Transmission System Operators for Electricity
EPBD	Energy Performance of Building Directive
eV	Electric Vehicle
FACTS	Flexible AC Transmission Systems
FCR	Frequency Containment Reserves
FFR	Fast Frequency Response
FRR (aFRR, mFRR)	Frequency Restoration Reserves (automatic, manual)
HVDC	High Voltage Direct Current
LV	Low Voltage
MEVPP	Multi-Energy Virtual Power Plant
MS	Member State
MV	Medium Voltage
P2H/H2P	Power to Heat / Heat to Power
P2P	Peer-to-Peer
PPA	Power Purchase Agreement
REC	Renewable Energy Communities
RED II	Recast of Renewable Energy Directive
RES	Renewable Energy Sources
SVC	Static Var compensator
TEN-T	Trans-European Transport Network
TSO	Transmission System Operator
UC	Use Case
V2G	Vehicle-to-Grid

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1 Introduction

1.1 Background

EU energy policy aims to deliver energy to consumers at affordable prices, enhance security of supply, and decarbonise the energy sector. According to the new Clean Energy Package (CEP, 2018) consumers shall be entitled to have an active role in the EU energy system, leveraging on the possibilities offered by renewable energy. The CEP allows individuals and communities to generate, consume, share, or sell electricity and mandates that the Member States (MS) take necessary actions towards a more flexible and competitive electricity market that is also customer-centred and non-discriminatory. The main determinants of the feasibility of energy communities are the national legislations in the EU Member States, which are closely related to the state of transposition of the Directives related to the CEP. The feasibility and viability of energy communities are also impacted by uncertainties in legal and administrative procedures, challenges with bureaucracy, the maturity of the energy markets, the network codes, tariff schemes and grid fees, to name but a few.

The focus of LocalRES is on Renewable Energy Communities (RECs), introduced by the CEP as key actors to lead the structural change towards the decarbonisation of the local energy systems through the involvement and awareness-raising of citizens and communities. LocalRES will develop a Planning Tool to enable citizen participation in the REC planning decision-making processes, and a Multi-Energy Virtual Power Plant (MEVPP) approach to optimize in real time different energy vectors and different energy and flexibility services provided by the REC according to their community preferences.

LocalRES includes four demonstration cases across Europe (Figure 4), where the LocalRES concept will be deployed:

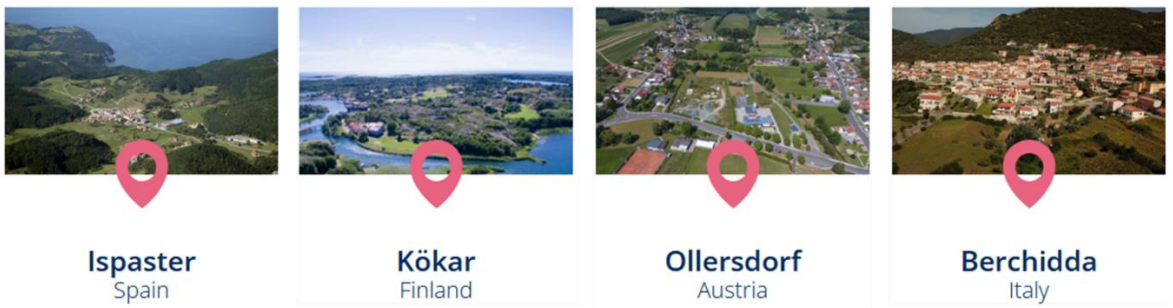

Figure 4: LocalRES demonstration sites

All four demonstration sites have in common being **remote communities with a weak connection to the national electricity grid.** Two of these pilot sites are isolated communities (Ispaster and Ollersdorf), and two are located in geographical islands (Kökar and Berchidda). In all cases, maintaining minimum conditions with regard to grid stability represents a challenge, so each of them has committed to promote the creation of a REC to overcome this barrier. Through the constitution of a REC in these communities, both technical and non-technical benefits are foreseen.

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Thus, it is expected that energy resources will be managed jointly and in an integrated manner making local grids more reliable and resilient, but also, the volunteer participation of both private users and the municipality will strengthen the community and promote the creation of other social initiatives and new jobs.

1.2 Objective

Task 1.1 "Regulatory assessment" investigated the complex regulatory framework impacting the demonstration activities and associated use cases, with a particular focus on REC-based flexibility.

The main activities of T1.1 were the following:

- Analysis of legal, regulatory and market conditions for REC participation
- Analysis of existing gaps between the existing framework and the one required for the different use cases
- Proposals of solutions to enable REC participation in electricity markets, the use of their flexibility for grid support, etc.

D1.1 delivers potential options for implementation and proposals that will make project use cases feasible from the regulatory perspective. The task therefore focusses on the countries of the demos: Finland, Italy, Spain, Austria.

1.3 Partners contributions

Table 2: Main contributions of partners in this deliverable

Organisation	Contribution
DOWEL	Main author of deliverable. Development of methodology, literature review and collection of partners inputs, writing of deliverable.
AIT	Inputs to analysis of Austrian regulatory framework (RECs and ancillary services): filling of questionnaire and update, participation to calls, review of deliverable
Ollersdorf	Inputs to analysis of Austrian regulatory framework (charging points, P2P, district heating, local context): participation to calls, review of deliverable
Flexens	Inputs to analysis of Finnish regulatory framework (all topics): filling of questionnaire and update, participation to calls, review of deliverable
Tecnalia	Inputs to analysis of Spanish regulatory framework (RECs): filling of questionnaire and update, participation to calls, review of deliverable
Aiguasol	Inputs to analysis of Spanish regulatory framework (RECs, district heating, charging points, ancillary services): filling of questionnaire and update, participation to calls, review of deliverable
R2M	Inputs to analysis of Italian regulatory framework (all topics): filling of questionnaire and update, participation to calls, review of deliverable

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1.4 Relation to other activities of the project

Table 3 shows the relation of the present report with other deliverables of LocalRES project, which should be considered along with this document for a proper understanding of its contents.

Table 3: Relation of current report to other deliverables

Deliverables	Relation
D1.2	Report describing the REC-driven energy market services, with a focus on LocalRES demo sites. These services are used as a basis for the project Use Cases that will be fundamental guidelines for the remaining WPs. The list of services and preliminary Use Cases were derived from D1.2. D1.2 also defines the regulation in force and regulatory conditions for the services identified for the use cases, with inputs from D1.1.
D3.3	This report contains the REC trading strategy and optimal dispatch of different markets and services separately. The regulatory framework identified within D1.1 serve as inputs for D3.3

2 Methodology

2.1 Overall workflow

To achieve the objectives set out for this deliverable, the methodology illustrated in Figure 5 was applied.

Firstly, the key regulatory topics to be analysed were identified. For this purpose, a literature review and the preliminary list of services to be included in the Use Cases (UCs) served as a baseline (output from T1.2, see D1.2 for more details). Once the Use Cases were drafted by the project partners (i.e., selection of services to be included in those UCs), the second step was to map the most relevant regulatory topics to the different UCs.

In a third step, the analysis of regulatory conditions for these topics was carried out, with a focus on the national regulatory frameworks for the four countries where demonstrations will be implemented by LocalRES: Austria, Finland, Italy and Spain. As a first input for the country description, a questionnaire was sent to the LocalRES partner involved in the demonstration (called from now on: "demo teams"). The questionnaire was very much focused on the national regulations for Renewable Energy Communities. Four questionnaires were completed, one per demonstration site, and were also updated to account for the latest legislative advances. The latest versions can be found in Annex 1. Additional desk research was used as a secondary source of information to complement the information received in the questionnaires, for instance on grid services.

The analysis of the regulation in the demonstration countries led to the identification by the demo teams of gaps between the existing regulatory framework and the one required for the implementation of the UCs. This enabled to adjust the UCs to make sure they were in line with the existing regulation, and to provide recommendations to allow for the future roll-out of services that are for now not allowed by the current regulatory context.

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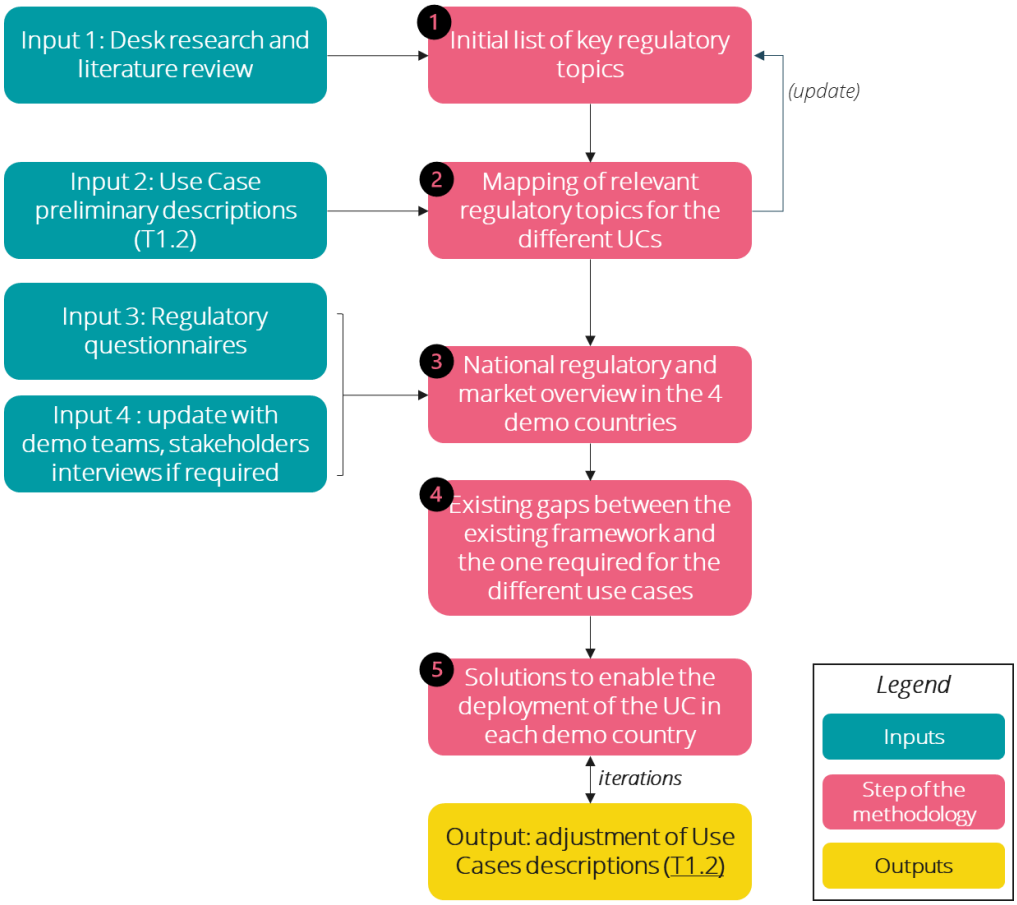

Figure 5: Methodology deployed in Task 1.1

2.2 Initial list of regulatory topics

The regulatory assessment started with a literature review to:

1) Find recent peer-reviewed papers and reports in the field of energy regulation and market design;
2) Review methodologies developed to identify regulatory barriers for the implementation of Use Cases, so as to develop a consistent approach;
3) Identify resources providing updates on the latest regulations for Energy Communities.

Among the different reports reviewed (see list of references in Section 7), the report "Current regulation in target countries and regulatory barriers identified for the implementation of the use case" written by Comillas in the framework of the EU-funded project IElectriX in 2021 (deliverable D4.4) was one of the main resources used to both develop our methodology and draft a first lit of key regulatory topics (the objectives pursued were indeed similar to those of the present report).

A "long-list" of potential services to be included in the Use Cases was also provided by T1.2 *Definition of REC-driven services and Use Cases* (see D1.2 for more details), including:

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- Operation of a DHN (District Heating Network) with RES (Renewable Energy Sources)
- Sale of waste heat to a DHN
- Help to balance a DHN (Thermal demand response)
- Heating/Cooling as a service
- P2H (Power to heat) and H2P (Heat to Power)
- Building heating optimization (systems and electricity consumption optimization)
- Collective Peak shaving
- REC-level/Collective self-consumption
- Optimisation of electric flows within the REC
- Demand response (Implicit and explicit)
- V2G (Vehicle-to-Grid) services
- Voltage and reactive power control
- Frequency control (FCR, aFRR, mFRR)
- Blackout strategies
- P2P energy trading
- Aggregated (REC-level) energy trading
- Public EV (Electric Vehicles) charging stations
- Smart Storage Management System
- Congestion management
- Anomalies detection at REC-level
- Sale of waste heat for the purpose of drying products
- Capitalisation of monitored data
- Legal advice
- Preliminary feasibility assessment
- End-user engagement
- Support on technical execution

Drawing on these two main resources, an initial list of key regulatory topics was defined (Table 4).

Table 4: Initial list of regulatory topics

Regulatory topic	Type of regulation	Sub-topic
Renewable Energy Communities	National regulation transposing REDII *(or any relevant regulation or sandbox in the meantime)*	Collective self-consumption
		Aggregated Energy trading
		Energy storage
		P2P trading
		Electric-flows optimisation
eVs	National legislation. *Charging services for EVs are included in CECs/ IMDII, not in RECs/ REDII*	Public charging points
		V2G
Heating supply	National legislation, highly country dependent (if any).	DH operation and integration of RES
		Sale of waste heat to DH
		DH balancing (thermal DR)
		P2H / H2P
Grid services provided to TSOs and DSOs	Network codes	Voltage and reactive power control
		Frequency control / Operating reserve
		Black start
		Congestion management

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2.3 Mapping of relevant regulatory Topics for the Use Cases

Once the draft description of the Use Cases became available (with a pre-selection of services to be included in each UC), relevant regulatory topics from the above list were mapped to the different UCs (Table 5).

Table 5: Draft Use Cases (as of November 2021)

Regulatory topic	Sub-topic	Ispaster UC	Kökar UC	Ollersdorf UC	Berchidda UC
Renewable Energy Communities	Collective self-consumption	X		X	
	Aggregated Energy trading				X
	P2P trading			X	X
	Energy storage	X	X		X
	Electric flows optimisation		X	X	X
eVs	Public charging points	X	X	X	X
	V2G				X
Heating supply	DH operation and integration of RES	X			
	Sale of waste heat to DH				
	DH balancing (thermal DR)	X			
	P2H / H2P	X	X	X	
Grid services provided to TSOs and DSOs	Voltage control				
	Frequency control				
	Black start	X	X	X	
	Congestion management	X			

A few regulatory sub-topics were not relevant to any of the Use Cases. Others (related to eV charging for instance) were applicable to all. Although most grid services were not selected by any of the demonstrations, they will nevertheless be reviewed as relevant for the Multi-Energy Virtual Power Plant (MEVPP) tool developed by the project (WP3, namely Task 3.3 and Task 3.4).

Based on this mapping, relevant regulatory topics were investigated for each of the demo countries: they are detailed in the next sections.

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3 Analysis of legal, regulatory and market conditions for REC participation in the 4 demo countries

3.1 Introduction

Three main types of legal, regulatory and market conditions have been investigated in this report (Figure 6):

- **Binding EU regulation**, which comprises Directives (legislative act that requires transcription by Member States into their own laws) and Regulations (binding legislative act which must be applied in its entirety across the EU).
- **European Network Codes and Guidelines**, a detailed set of rules pushing for the harmonisation of national electricity markets and regulations (eight network codes and guidelines have already been published in the Official Journal of the European Union as Commission Regulations).
- **National regulations** transposing EU Directives.

Other national laws, building codes, standards are mentioned when relevant but were not studied in-depth.

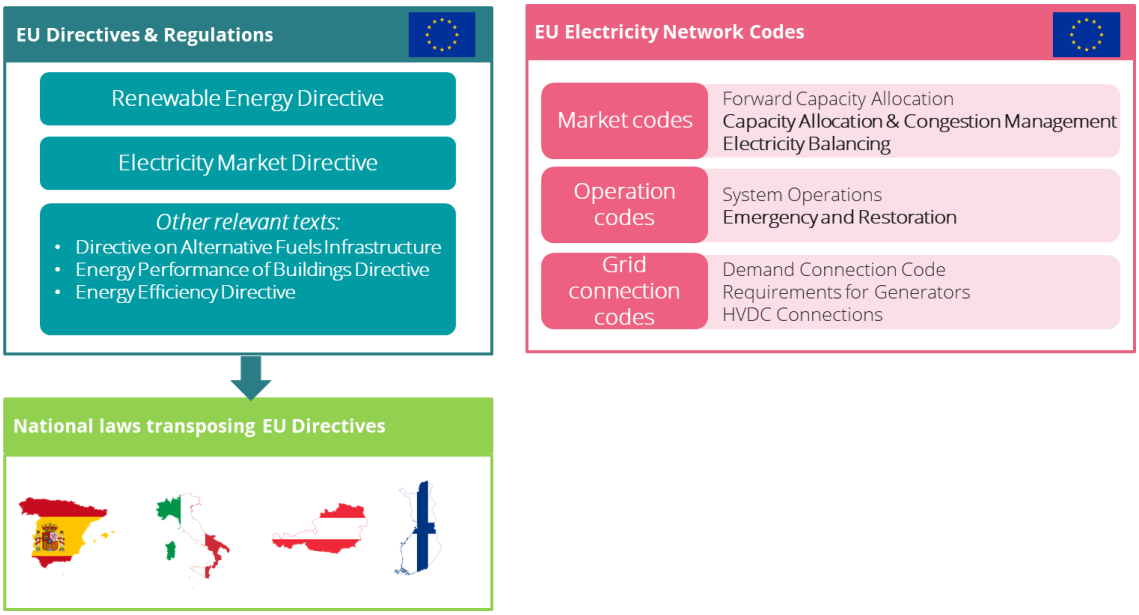

Figure 6: Main regulatory sources reviewed

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3.2 Regulation for Renewable Energy Communities

The regulation for Renewable Energy Communities is relevant for all Use Cases.

3.2.1 EU Regulation for Renewable Energy Communities and overview of transposition status in EU Member States

The *Clean Energy Package for All Europeans*, first published on 2016 and adopted in 2019, brings new Directives that will have to be transposed into every single EU Member State. Two specific Directives are of special interest: the *Internal Electricity Market Directive*, which introduces *Citizen Energy Communities*, and the *Renewable Energy Directive*, which defines *Renewable Energy Communities.* Both types of communities are outlined in Table 6, based on these Directives:

Table 6: Comparison between RECs and CECs according to their EU definitions

	Renewable Energy Community (REC)	Citizen Energy Community (CEC)
Clean Energy Package (CEP) Directive	Renewable Energy Directive (Directive (EU) 2018/2001, Article 22) 'REDII'	Electricity Market Directive (Directive (EU) 2019/944, Article 16) 'EMDII'
Deadline for transposition	June 2021	December 2020
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	
Energy carriers involved	Electricity, heating/cooling, transport	Electricity
Allowed activities	Generation, distribution, consumption, storage, sale, aggregation, supply and sharing of renewable energy	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.
Membership & control	Citizens, local authorities and small and micro enterprises *(for private: should not be the primary professional activity)*	Citizens, local authorities and small and micro enterprises. *Members/shareholders engaged in large scale commercial activity and for which the energy sector constitutes a primary area of economic activity do not exercise any decision-making power*
Geographic limitation	Shareholders or members must be located in the proximity of the RE	No geographic limitation, MS can choose to allow cross-border CEC

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	projects that are owned & developed by the REC	
Enabling framework, support schemes	MS to provide enabling framework to promote and facilitate the development of REC - Remove unjustified regulatory/ administrative barriers - Fair, proportionate and transparent procedures - Non-discriminatory treatment - Tools to facilitate access to finance and information; - Regulatory and capacity-building support to public authorities in enabling and setting up RECs - Equal/non-discriminatory treatment of consumers that participate in a REC - MS to consider specificities of RECs when designing RES support schemes	MS to provide an enabling regulatory framework for CEC - Participation is open and voluntary - Members/shareholders entitled to leave - Members/shareholders do not lose their rights and obligations as household or active customers. - DSOs cooperate with CECs to facilitate electricity transfers within the community - Non-discriminatory, fair, proportionate and transparent treatment - Transparent, non-discriminatory and cost-reflective network charges

At the time of writing this report (March 2022), **the actual progress of the transposition still varies from one country to the next and most Member States are behind schedule**.
Once the transposition is done, the clarity and 'ambition' of the transposing laws also vary a lot across Member States:

- In several countries the transposition law is just a copy-paste from the Directive, with no clear definitions and no guidance on how to set up communities (e.g. Spain). They need to be supported by technical regulation and other "rules of the game" (including network codes) which take time to be defined and rolled out,
- The laws and the associated technical regulation can be more or less supportive of energy communities. For instance, the geographic and power limitation differ depending on the country, and energy communities might be strongly incentivised and well supported in some, but have close to no viable business model in others. The economic viability of ECs is indeed strongly related to the taxes and grid fees applied to the energy produced and consumed within the community and to available subsidies.

A synthesis of the current state-of-play is provided in REScoop.eu[5] "transposition tracker"[6], regularly updated, which assesses the progress of the transposition of the REC and CEC definitions in the European Member States. Despite this tracker represents the view of REScoop.eu (which considers

[5] The European federation of citizen energy cooperatives
[6] https://www.rescoop.eu/policy

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that Energy Cooperatives are the 'golden standard' of Energy Communities), it illustrates the differences in the way the different Member States are transposing EMDII and REDII.

The next sections synthesise the key points of the transposition in the four countries where demonstrations will be implemented in the framework of LocalRES. **The analysis in these sections is based on information collected by the LocalRES partners and reflects the transposition status as of March 2022**.

3.2.2 Austria

Austria's Electricity Industry and Organisation Act and Renewable Energy Expansion Act covers both RECs and CECs, which are subject to voluntary and open participation. Both concepts should primarily provide their participants with environmental, economic or social community benefits. Financial gain is not allowed to be the primary purpose of the foundation of a REC or CEC. RECs are limited geographically via grid levels (participants need to be connected via the low- or the medium-voltage grid), while CECs may span over whole Austria. RECs forbid the participation of large enterprises or electricity suppliers, while CECs also allow the participation of the these, but without control function. A REC must conclude agreements that include at least the following elements: data management by the grid operator, operation, maintenance and servicing of generation facilities, liability, insurance.

In the Austrian legislation, much thought has been put into clear rules and obligations for DSOs towards energy communities, in order to ensure smooth collaboration of DSOs with the novel energy community concepts. Moreover, an official authority has been designated to help with organisational and regulatory questions and issues ("Österreichische Koordinationsstelle für Energiegemeinschaften") in order to facilitate the uptake of energy communities.

In general, Austrian legislators have put efforts into proposing legislative guidelines for energy communities, nevertheless, a number of barriers can be detected. The realisation of energy communities in practice will show if the current regulation needs to be adapted, or if it provides sufficient guidance.

The information provided by the Austrian demo team is synthesised in Figure 7. Additional information can be found in Annex 1.

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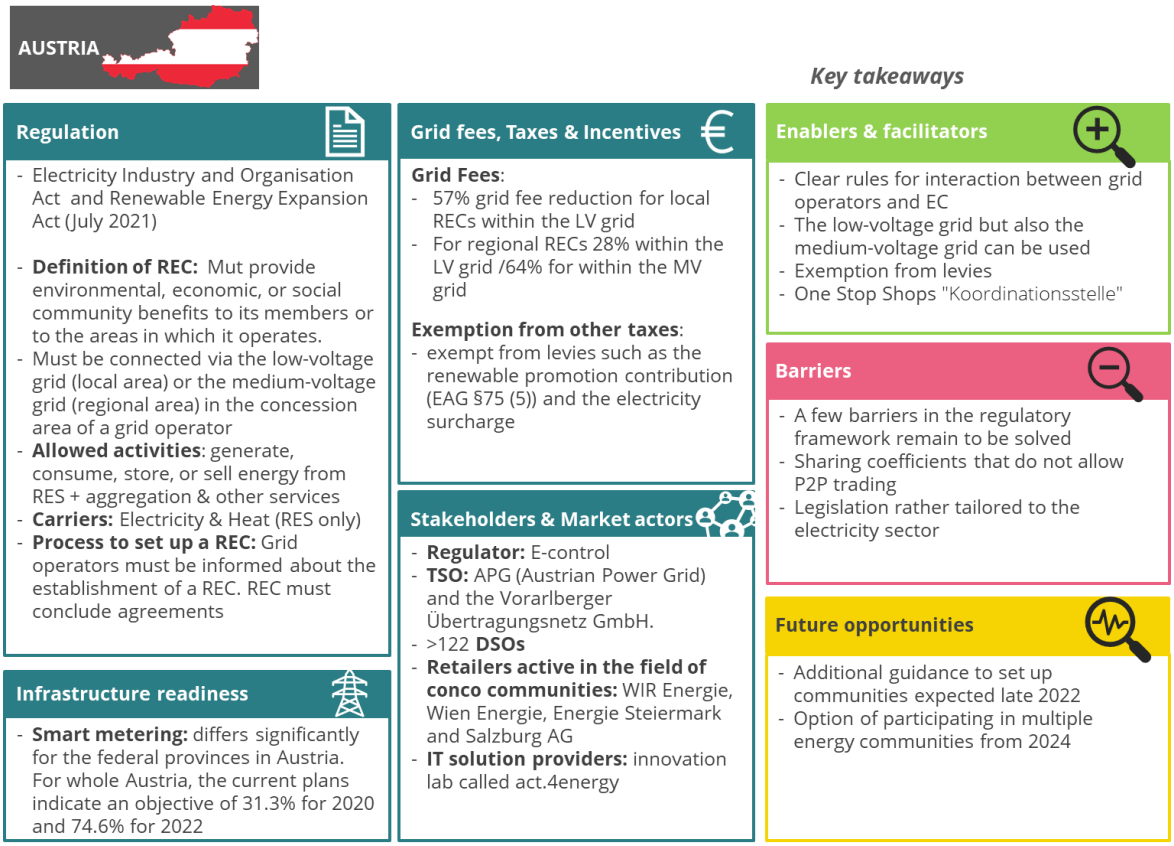

Figure 7: Synthesis of regulatory context in Austria (as of March 2022)

3.2.3 Finland

Finland has transposed the REC definition with the law 1145/2020 on the licensing procedures and other administrative procedures for renewable energy production facilities. It enables RECs in the same property or cross-property via separate (private) lines, and for now only fulfil the minimum requirements. Members of a REC need to be in one property lot, or multiple properties owned by a single entity that form a coherent area (e.g. some industrial areas). Amendments are in discussion to enlarge the scope, as it is for now not possible to trade energy from one building to the other if they do not share the same private grid, and Collective Self-Consumption beyond the private grid is therefore not allowed.

The information provided by the Finnish demo team is synthesised in Figure 8. Additional information can be found in Annex 1.

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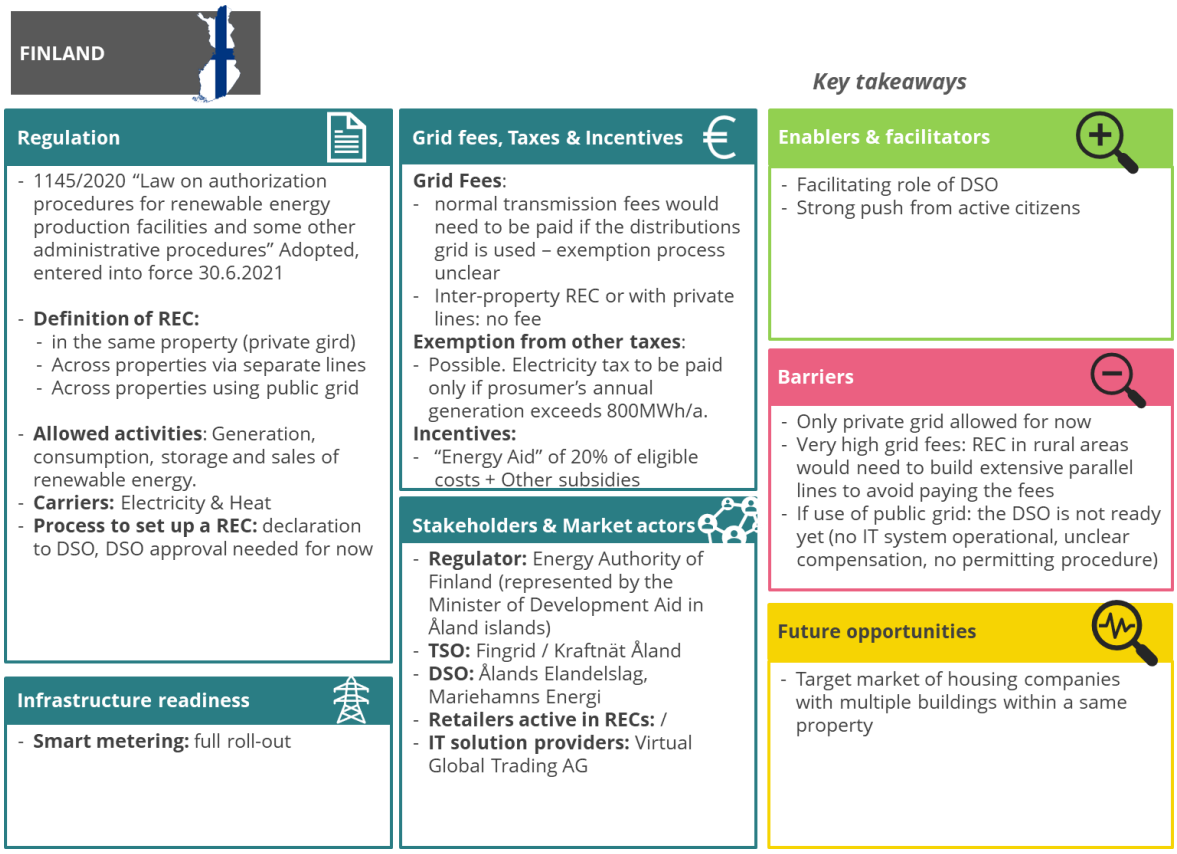

Figure 8: Synthesis of regulatory context in Finland (as of March 2022)

3.2.4 Italy

Italy has transposed the REC definition with legislative decree 199/08.11.2021 and the CEC definition with the legislative decree 210/08.11.2021. The RECs definition refers to most of the criteria contained in the RED II definition, including autonomy and effective control, which were not touched upon in previous legislation. It stands side-by-side with the collective self-consumption definition, presuming an inherent technology focus for RECs, which may limit their ability to operate across the energy system.

With this, Italy is finally going to conclude the path of transposition of REC thanks to 2 main advances:

- increase in the power limit of plants eligible for inclusion in a REC, which goes from 200 kW to 1 MW;
- removal of the secondary cabin limit, which allows the establishment of EC with members connected to the same primary cabin.

While representing an important step for the development of energy communities, a few bureaucratic and administrative barriers remain (e.g. authorisation procedure, role for the DSO). There are specific incentive mechanisms provided by the Ministry of Economic Development (MiSE)

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that bring benefits to the participating parties to stimulate and incentivise the establishment and functioning of the energy communities (e.g. incentives on the self-consumed energy, Ecobonus, Superbonus). Additionally, some Italian regions have already issued a legislation on energy communities and allocated funds to define expressions of interest for the creation of energy communities on their territory.

The information provided by the Italian demo team is synthesised in Figure 9. Additional information can be found in Annex 1.

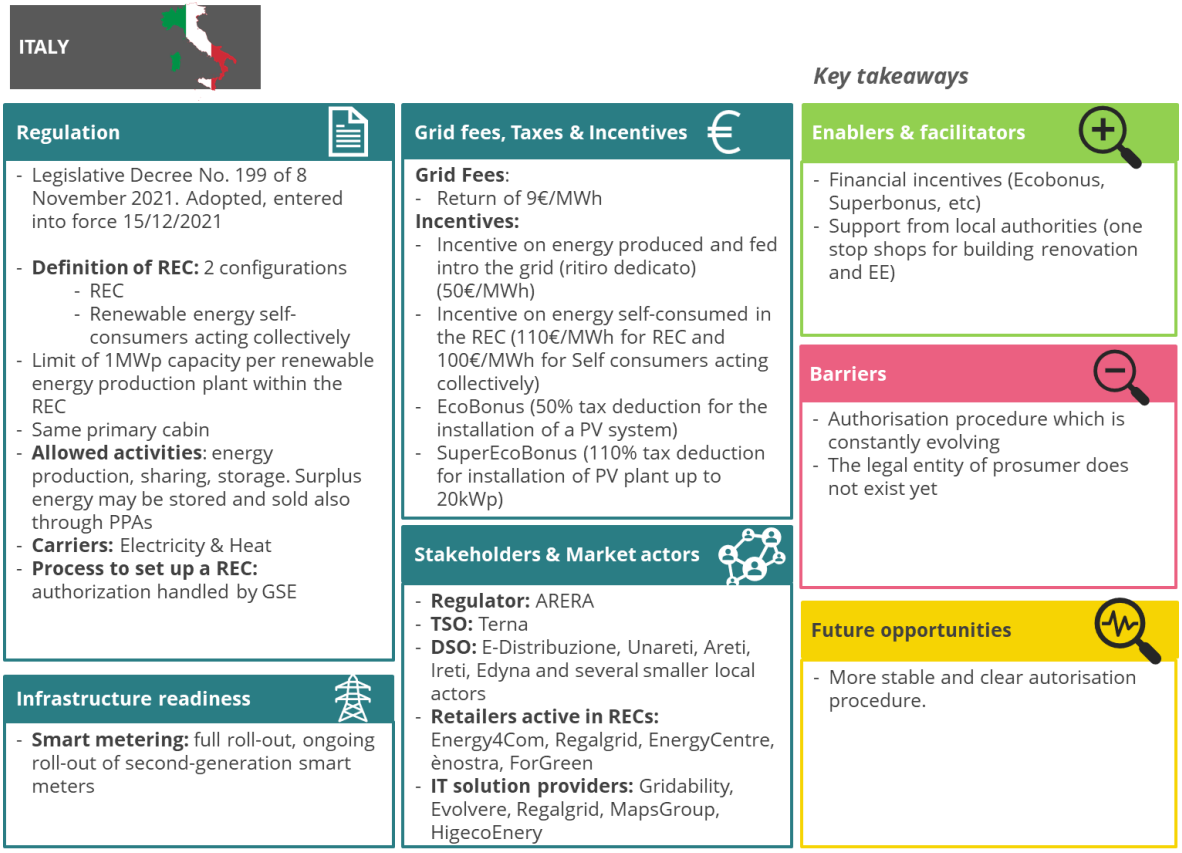

Figure 9: Synthesis of regulatory context in Italy (as of March 2022)

3.2.5 Spain

Spain introduced the definition of RECs in Royal Decree-Law 23/2020, which approves measures in the field of energy and in other areas for economic reactivation. The definition of RECs is a copy-paste of the EU definition, without any elaboration on what each term means and how they should be set up (e.g. what kind of legal entity). The Spanish NECP (National Energy and Climate Plan), however, foresees several measures to foster energy communities. There is no transposition of the CEC definition at the moment, it is expected in 2022. The national regulation is therefore still in progress.

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However, extended Collective Self-Consumption is enabled in Spain since 2019 (Royal Decree 244/2019) and the required technical regulation to complete RD 244/2019 was published before 30/12/19 and is in force. This includes for instance Orden TED/1247/2021 which defines the self-consumption sharing coefficients (either constant or dynamic[7]).

According to Royal Decree 244/2019, one or more producers and one or more consumers, signing a Sharing Agreement, can share the locally produced electricity if they are:

- Connected to the same MV/LV transformer station
- Connected to LV network and with less than 500m maximum distance between the location of the meters for the PV production plant and the location of the meters of the consumers
- Generation and consumption in an area with the same 14 cadastral reference code values

The owner of the production installation can be a third party. Self-consumed electricity is not covered by the IVPEE (*Impuesto sobre el Valor de la Producción de Energía Eléctrica*; *Tax on the Value of Electric Power Production* in English) and the generation toll.

Additionally, as part of Next Generation EU actions, incentives for energy storage are laid out in RD 477/2021. Specific ordinances at local level (I.e. municipalities) offer discounts in the property taxes (IBI in Spanish) for installing PV for collective self-consumption[8].

The information provided by the Spanish demo team is synthesised in Figure 10. Additional information can be found in Annex 1.

[7] The dynamic coefficients are composed by 8,760 fixed coefficients for each member of the CEC, submitted as a .txt file to the DSO. Each coefficient covers 1 hour of the year. The coefficients are "ex ante" and can be modified only once a year.

[8] https://fundacionrenovables.org/averigua-municipio-bonifica-ibi-icio-autoconsumo/

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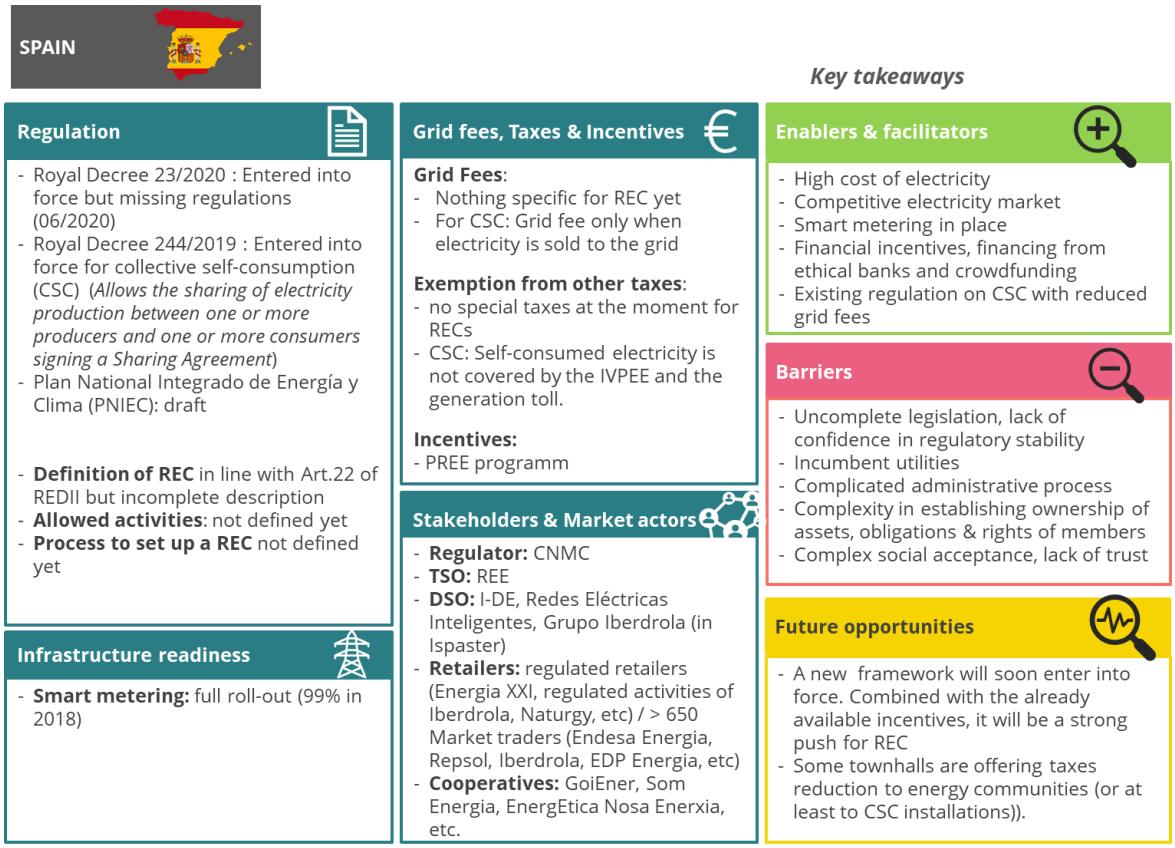

Figure 10: Synthesis of regulatory context in Spain (as of March 2022)

3.2.6 REC regulation: Synthesis

The national legislations enabling REC are in constant evolution, and changes are expected in the coming months or year in almost all reviewed countries. The figure below summarises some key points that are valid at the time of writing this report (i.e. end of March 2022).

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	SPAIN	ITALY	AUSTRIA	FINLAND
Status	Enforced since June 2021 but still in progress	Enforced since December 2021	Enforced since July 2021	Enforced since June 2021
Geographic limitation	Not specified yet (but existing law on CSC)	Maximum installed power 1MW/plant, under the same medium voltage station	Low or Medium Voltage grid	Very limited: Same property or cross-property with/without separate lines
Allowed activities	Not specified yet	Generation, sharing, storage, sales of surplus through PPA is possible	Generation, consumption, storage, or sale of energy from RES, other services, aggregation	Generation, consumption, storage and sales of renewable energy.
Process to set up a REC	Not specified yet	Authorization handled by GSE	Information of grid operator Koordinationsstelle	Declaration to DSO, DSO approval needed for now
Grid fees, taxes & incentives	Incentives Grid fee reduction for CSC	Grid fees reduction, incentives, Ecobonus, Superbonus	Grid fee reduction Exemption from levies	Energy aid and other subsidies

Figure 11: Synthesis of the regulatory framework for RECs in the demonstration countries, as of March 2022

3.3 Focus on Peer-to-peer trading

The regulation of Peer-to-peer (P2P) trading is relevant for Ollersdorf and Berchidda Use Cases.

3.3.1 EU regulation

P2P trading of renewable energy is defined in REDII as:

> *'The sale of renewable energy between market participants by means of a contract with pre-determined conditions governing the automated execution and settlement of the transaction, either directly between market participants or indirectly through a certified third-party market participant, such as an aggregator. The right to conduct peer-to-peer trading shall be without prejudice to the rights and obligations of the parties involved as final customers, producers, suppliers or aggregators.'*

P2P trading is mentioned in Art. 21 of the REDII on renewable self-consumers. Paragraph 2(a) of that article states that "*Member States shall ensure that renewables self-consumers, individually or through aggregators, are entitled to generate renewable energy, including for their own consumption, store and sell their excess production of renewable electricity, including through renewables power purchase agreements, electricity suppliers and* peer-to-peer trading arrangements."

As pointed out by REScoop.eu in their transposition guidance (REScoop.eu 2019), while P2P trading is characterised as 'the sale of renewable energy', the lack of a proper definition of energy sharing leaves its status open. As such, the relationship between peer-to-peer sale of excess production and energy sharing is not clarified in the REDII. Nevertheless, P2P trading could be relevant to collective self-consumption in two different contexts:

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1. As the means by which jointly acting customers share renewable energy that is produced on their site or sites between themselves.

2. As a means by which jointly acting customers sell excess renewable electricity (electricity that is not used collectively by all the participants) to other 'peers' as part of a larger virtual P2P trading platform.

To reap the benefits of P2P electricity trading, regulators need to ensure a level playing field for platform-based businesses versus traditional utilities and retailers. A fair formulation of network charges, as well as the electricity tariff structure, when P2P trading is using the main grid is however challenging (cost sharing principles should apply to fairly to remunerate the entities responsible for operating and maintaining the electricity infrastructure in place).

3.3.2 Networks codes

Rules related to P2P and energy communities are so far **not explicitly mentioned in the network code areas**. However, according to Schittekatte et al., 2019, and the INTERRFACE project, three areas are deemed relevant for active customers engaged in different forms of collective self-consumption:

- rules for demand response, including rules on aggregation, energy storage, and demand curtailment rules;
- network connection rules;
- third-party access rules.

The first network code area, i.e. rules for demand response, is relevant as DER assets used for self-consumption can also be used to provide explicit demand response (aggregated or not). An important technology in that regard is energy storage. The way demand response and energy storage will be regulated at European level can impact the business case for all forms of self-consumption.

The second network code area, i.e. network connection rules, is important because it is not clear how to categorize groups of P2P-exchanging individuals or communities within the existing categorization in the grid connection network codes. For example, microgrids with one connection point to the central grid can be seen as load from the perspective of the central grid at a certain point in time and as generation at another.

The third network code area, i.e. third-party access rules, is relevant as access to the transmission and distribution systems as well as the network tariffs that have to be paid for that access can be crucial for individually acting active consumers, active consumers engaged in P2P trade, and active consumers jointly acting within energy communities.

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3.3.3 Regulation related to data protection and cybersecurity

Regulatory texts related to data sharing and personal data protection, as well as cybersecurity, are relevant for P2P trading. They include:

General Data Protection Regulation (Regulation (EU) 2016/679):

GDPR, put into effect on May 25, 2018, is the toughest privacy and security law in the world[9]. Though it was drafted and passed by the European Union (EU), it imposes obligations onto organizations anywhere, so long as they target or collect data related to people in the EU. With the GDPR, Europe is signalling its firm stance on data privacy and security at a time when more people are entrusting their personal data with cloud services and breaches are a daily occurrence.

EU Cybersecurity Act[10,11]

A new EU Cybersecurity Strategy was presented at the end of 2020: it covers the security of essential services such as hospitals, energy grids and railways. It also covers the security of the ever-increasing number of connected objects in our homes, offices and factories. Part of this strategy, the EU Cybersecurity Act strengthens the role of ENISA. which now has a permanent mandate.

EU Cybersecurity Certification framework[12]

The purpose of the EU cybersecurity certification (EUCC) framework under the Regulation (EU) 2019/881 is to establish and maintain trust and security on cybersecurity products, services and processes. Drawing up cybersecurity certification schemes at the EU level aims at providing criteria to carry out conformity assessments to establish the degree of adherence of products, services and processes against specific requirements. EUCC, a candidate cybersecurity certification scheme to serve as a successor to the existing SOG-IS[13], was published in May 2021[14]. The SOG-IS agreement had been produced in response to the EU Council Decision of March 31st 1992 (92/242/EEC) in the field of security of information systems, and the subsequent Council recommendation of April 7th (1995/144/EC) on common information technology security evaluation criteria.

New Data Governance Act

At the end of 2020 the European Commission has announced and presented the Data Governance Act (DGA), a legislative proposal that aims to create a framework which will facilitate data-sharing[15].

[9] https://gdpr.eu/what-is-gdpr/
[10] https://digital-strategy.ec.europa.eu/en/policies/cybersecurity-policies
[11] https://digital-strategy.ec.europa.eu/en/policies/cybersecurity-strategy
[12] https://www.enisa.europa.eu/topics/standards/certification
[13] https://sogis.eu/
[14] https://www.enisa.europa.eu/publications/cybersecurity-certification-eucc-candidate-scheme-v1-1.1
[15] European Commission (25 November 2020). Proposal for a Regulation of the European Parliament and of the Council on European data governance (Data Governance Act) — COM/2020/767 final. Brussels, Belgium: European Commission. Retrieved 2021-07-01. Document 52020PC0767.

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According to the European Parliament[16], thanks to the DGA, *"Public sector bodies will have to avoid creating exclusive rights for the re-use of certain data, and exclusive agreements should be limited to a period of 12 months for new contracts, and 2,5 years for existing ones, to make more data available to SMEs and start-ups."* A provisional agreement on this new law was reached with the Council and the European Parliament in December 2021.

It is worth mentioning that blockchains, which allow for the automated execution of smart contracts in P2P networks, can enhance cybersecurity (Andoni et al., 2019).

3.3.4 Austrian regulation

While the Austrian law does not explicitly prohibit P2P trading, following the current regulation in force makes it impossible to do any true P2P trading, as the measuring and allocation of energy has to be done by the grid operator, and there is no process in place to inform the grid operator of any agreements between participants.

Current Austrian regulation in force *Gesamte Rechtsvorschrift für Elektrizitätswirtschafts- und -organisationsgesetz 2010, Fassung vom 23.03.2022* (Austrian Electricity Economy and Organisation Act, version of 03/23/2022) states in §16e *Metering and billing in energy communities*:

> *(3) The grid system operator shall allocate the static or dynamic share of the generated energy agreed between the participating grid system users to the respective installations of the participating grid system users. In the case of citizens' energy associations, this shall be done considering the data exchange pursuant to subsection (2). If dynamic shares are used, these may be reallocated between the participating grid users on a quarter-hourly basis. The values shall be determined in accordance with the following provisions:*
>
> *1. the allocation shall be made per quarter hour and shall be limited to the energy consumption of the respective installation of the participating network user in the respective quarter hour;*
>
> *2. the static or dynamic share of the energy generated allocated to the metering point of the participating network user's installation shall be recorded separately and shown on the invoice*

Additionally, a different legal document where the intents of the law are explained states, with respect to *dynamic allocation*:

> *The grid operator determines the quarter-hourly values (time series) of the generating plant and the plants of the participating entitled persons, calculates the allocation of the generated energy and makes the allocation to the individual metering points. The grid operator then determines for each metering point the netted values (consumption minus allocated generation share and excess feed-in quantity of the generating generation plant) per quarter hour, so that these can be used as a basis for the grid bill or reported to the energy supplier.*

[16] https://www.europarl.europa.eu/news/en/press-room/20211129IPR18316/data-governance-deal-on-new-rules-to-boost-data-sharing-across-the-eu

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3.3.5 Italian regulation

As of April 2022, there are no specific regulations governing P2P trading in Italy.

The Berchidda demonstration is a very particular case in Italy as the Municipality owns and operates its own electric grid[17]. This is a rather unique opportunity in a country where the distribution network is divided between 135 DSOs but where the largest DSO is still E-distribuzione (former Enel Distribuzione), which covers approximately 85% share of Italian electricity demand and 10% is covered by minor DSOs (A2A, Unareti, etc.).

In Berchidda, the municipality is therefore the DSO and will enable the test of P2P trading.

3.4 eVs

3.4.1 EU Regulation

The EU regulatory framework related to e-mobility (and in particular charging infrastructures) includes several Directives and strategies (ENTSO-E, 2021):

Directive on Alternative Fuels Infrastructure (2014/94/EU):

It establishes a set of measures for the creation of an alternative fuel infrastructure, to minimise oil dependence and mitigate the environmental impact of transport.

Ongoing revision: initiated in July 2021 as part of the Fit for 55 package (a set of proposals to revise and update EU legislation in line with the 2030 goal), the proposal for a Regulation repealing Directive 2014/94/EU aims to increase the build-up of publicly-accessible charging infrastructure, through, among others, possible binding and enforceable targets; to enable the deployment of smart charging infrastructure and to ensure the full interoperability of infrastructure and infrastructure use services.

Electricity Market Directive (Directive (EU) 2019/944:

The Directive defines a 'recharging point' as "*an interface that is capable of charging one electric vehicle at a time or exchanging the battery of one electric vehicle at a time*".

It also states that "*The transmission or distribution system operator may refuse access where it lacks the necessary capacity*." In that case, the "*regulatory authorities shall also ensure, where appropriate and when refusal of access takes place, that the transmission system operator or distribution system operator provides relevant information on measures that would be necessary to reinforce the network. Such information shall be provided in all cases when access for recharging points has been denied*."

Article 33 of the Directive make it clear that "*Member States shall ensure that distribution system operators cooperate on a non-discriminatory basis with any undertaking that owns, develops, operates*

[17] Troncia, Matteo, Marco Galici, Mario Mureddu, Emilio Ghiani, and Fabrizio Pilo. 2019. "Distributed Ledger Technologies for Peer-to-Peer Local Markets in Distribution Networks" Energies 12, no. 17: 3249

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or manages recharging points for electric vehicles, including with regard to connection to the grid." Finally, DSOs "*shall not own, develop, manage or operate recharging points for electric vehicles, except where DSOs own private recharging points solely for their own use*." (derogations are possible – see Article 33(3)).

Citizens Energy Communities "may engage" in charging services for electric vehicles.

Trans-European Network for Transport (TEN-T) Regulation review:

The Trans-European Transport Network (TEN-T) policy develops a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. In line with the European Green Deal, a legislative proposal for a revision of the TEN-T Regulation was published in December 2021[18].

Energy Performance of Buildings Directive (2018 / 844 / EU)

The EPBD outlines specific measures for the building sector, including preparatory work and the installation of charging points inside residential and non-residential buildings.

Ongoing revision: As part of the Fit for 55 package, the Commission adopted a legislative proposal to revise the EPBD on 15 December 2021. The proposal upgrades private recharging infrastructure in car parks in and adjacent to buildings, complementing the updated Alternative Fuel Infrastructure Regulation (AFIR) setting stronger ambitions on the overall targets, including on publicly available recharging infrastructure for electric vehicles.

3.4.2 Market design

In its 2021 Position Paper (ENTSO-E, 2021), ENTSO-E recommended the following to update market design and rules:

> *"Final users charging tariffs and energy price should stimulate the adoption of smart charging schemes. They should dynamically reflect infrastructure costs (capital and operational), energy costs and grid constraints. EV users should benefit from both reduced tariffs and energy price as they contribute to reducing grid investments, stabilising the grid and providing ancillary services. Double taxation and double counting of grid tariffs must be avoided to avoid hindering V2G services.*
>
> *Regulation authorities should intervene to enable new forms of participation to energy and flexibility markets. Present regulations allow only the partial adoption of smart charging schemes and represent an obstacle to introducing new flexibility schemes with new actors. Technical and dimensional requirements for market access are, indeed, too demanding to allow EV fleet participation. Even V2G implementation would require updates in regulations, e. g. on energy ownership, imbalance issues, the EV user role as energy producer, etc.*

[18] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A812%3AFIN

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A strategy should be defined to manage the services offered by EVs and their participation in flexibility markets. The strategy should be based on the evaluation of each of the potential services, considering their needs / capacity (how many EVs could participate or are required?) and an evaluation of their benefits (Who benefits? Are there economic or environmental advantages? How are they transferred to final users?).”

3.4.3 National regulations

- *EV charging points*

In Austria there is no need for special allowance or permit to operate a public charging point. The Energy Community is allowed to operate it as an unregulated business. It is however unclear if the charging point can be considered as a consumer in the EC (it is possible according to the law but needs to be tested with the DSO).

No specific constraints related to charging points (apart from technical specifications) were identified in Spain, Finland or Italy.

For instance, in Spain, Real Decreto 1053/2014 provides a Complementary Technical Instruction (ITC) for "Special purpose installations. Infrastructure for charging electric vehicles". It gives detailed requirements for new charging installations, for instance on power limitation, on the needs for initial inspections, electrical characteristics of circuits, connection points, metering, safety and protection, etc.

- *V2G*

Only Berchidda, Italy, is considering including V2G in its Use Case. V2G is regulated in Italy by a Ministerial Decree of 30 January 2020[19] “*Vehicle to grid. Criteria and modalities to promote integration between electric vehicles and the electricity grid*”. This decree enables electric vehicles to provide the following services through the charging infrastructure:

- tertiary reserve and balancing services;
- additional services including primary and secondary frequency and voltage regulation, where technically feasible.

The Decree details the modalities to be followed by the market actors providing V2G services through so-called “Mixed enabled virtual units” (“Unita' virtuali abilitate miste” (UVAM)). In particular, it states that managers of UVAM should obtain explicit consent of the vehicle holder, providing in advance detailed information on the terms and conditions, including economic conditions under which the vehicle participates in the provision of services.

[19] https://www.mise.gov.it/index.php/it/normativa/decreti-ministeriali/2041750-decreto-ministeriale-30-gennaio-2020-vehicle-to-grid-criteri-e-modalita-per-favorire-l-integrazione-tra-veicoli-elettrici-e-rete-elettrica

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3.5 Heating supply

3.5.1 District Heating

District heating and cooling is affected by numerous laws and policies, at EU, national and local levels. The legislative framework covers a wide range of areas, such as market regulation and customer protection, energy and environment, emissions and building standards. EU Member States offer a contrasted picture with different regulatory and policy environments[20].

The most important parts of EU legislation relevant for the district heating and cooling sector include:

- The Energy Efficiency Directive (2018/2002/EU), and ongoing revision: a particular focus is put on district heating and cooling, where the definition of efficient systems will gradually be tightened to move away from fossil fuel-based systems. For instance, any new or substantially refurbished system needs to meet the criteria of efficient district heating and cooling (Until 2025: at least 50% RES, 50% waste heat, 75% cogenerated heat OR their combination where those sources provide half of the heat)
- The Renewable Energy Directive (2018/2001/EU)
- The Energy Performance of Buildings Directive (2018/844/EU)
- The EU Strategy on Heating and Cooling (2016)
- The EU Emission Trading System

These regulatory texts and strategies do not raise any obstacles to the implementation of the REC services in the field of heating supply, but rather set requirements in terms of energy efficiency and contribution to the decarbonisation of the building stock and energy system.

At national scale, building codes and standards also need to be considered.

3.5.2 Austria

Heating supply is an unregulated business in Austria and no regulatory issues have been identified for the demonstration of the P2H/H2P service, since it involves heating equipment located behind the meter.

3.5.3 Finland

The Finnish DH networks are currently operated by one company in a local monopoly position. Such natural monopolies are regulated carefully to palliate the absence of competition. These companies are usually owned by the municipalities where they operate in (similar to many electricity DSOs). The DH companies can decide to buy heat from third parties (e.g., buy surplus heat from solar collectors on a roof of housing company), but are not obliged to do so. However, there has recently

[20] https://celsiuscity.eu/framing-the-possibilities-eu-legislative-framework-district-heating/

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been an increasing pressure to open the DH market so that it would be two-way market instead of one-way.

The demonstration in Kökar will actually not involve any District Heating, as there is neither DHN in place nor DHN operators.

3.5.4 Spain

A detailed review of all relevant regulations, building codes and standards appliable to District Heating in Spain was undertaken by AIGUASOL and can be found in Annex 2. It includes numerous texts, related to building requirements (performances of buildings, thermal installations, heating systems), engine rooms and air conditioning, cogeneration, legionella, energy efficiency, metering, energy costs. Municipal planning regulations and other local regulations may also be relevant. Although the regulatory landscape is complex, it does not prevent the participation of RECs in heating supply.

3.6 Grid services

3.6.1 Introduction

The nomenclature to define services that can be provided to TSOs and DSOs is often unharmonized among regulatory documents and literature (Lind and Chaves Ávila, 2019). The Clean Energy Package, for instance, defines such services as Ancillary Services (AS), meaning "*a service necessary for the operation of a transmission or distribution system including balancing and non-frequency ancillary services but not congestion management*[21]". This concept includes balancing and other "non-frequency" services (e.g. voltage control, fast reactive current injections, inertia and black start), but excludes congestion-management, which could however be considered an ancillary service according to the EU funded CoordiNet project.

CoordiNet suggested to refer to the following services (Lind and Chaves Ávila, 2019):

- Services for TSO: frequency control (balancing), congestion management, voltage control, inertia and black start.
- Services for DSOs: local congestion management, voltage control, and islanded operation

CoordiNET (Delnooz, A. et al., 2019) also defines grid services as "*services provided to DSOs and TSOs to keep the operation of the grid within acceptable limits for security of supply and are delivered mainly by third parties*" (based on (CEDEC et al., 2019)). The grid services for both TSOs and DSOs include balancing, congestion management, voltage control, inertial response, black start and controlled islanding (see Figure 12).

[21] Electricity Directive, Article 2(17)

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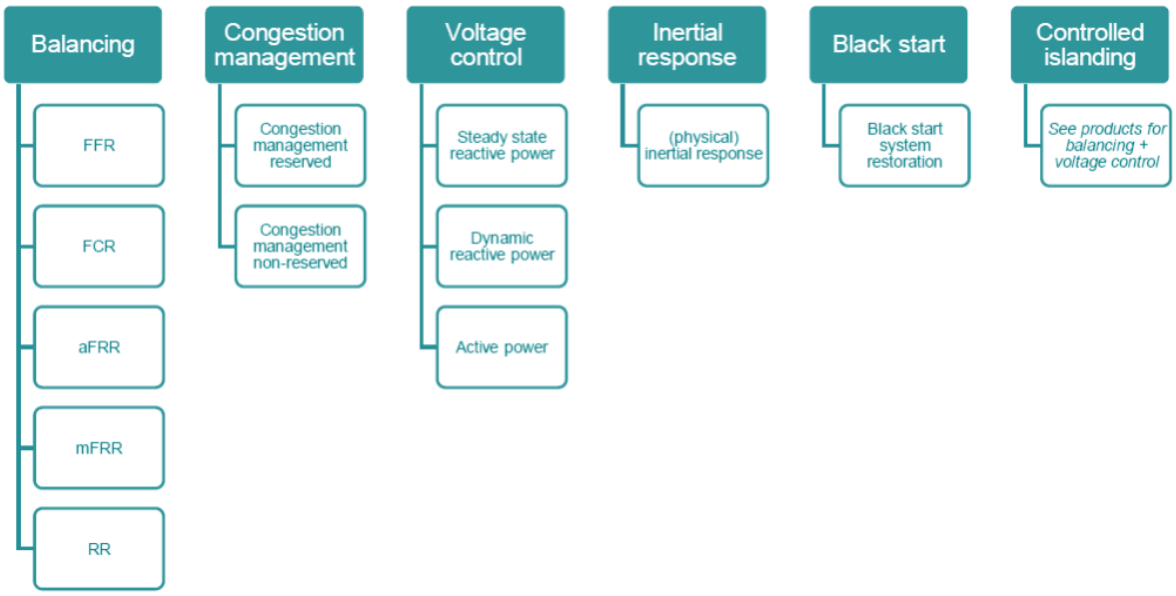

Figure 12: Products for grid services as defined by coordiNET project

As pointed out by the Regulatory Working Group during the latest BRIDGE General Assembly (March 2022), **the efficient use of flexibility in the system requires harmonised system services and flexibility products.** A standardised registry of energy flexibility assets is needed in a way that all market players can participate. Responsibilities of the many actors of the energy value chain and data ownership should also be clarified[22]

The purpose of this section is not to provide a detailed review of grid services neither to explore market-based mechanisms, but to rather give an overview of how RECs could engage in providing such services.

3.6.2 Overview of 'standard' grid services

The AS market facilitates the trading of services and improves the competition among different involved stakeholders (Oureilidis et al., 2020). Generally, the TSO is the operator and sole purchaser of products in the AS market, while sellers include the prequalified generators and in some cases demand response (involving large consumers and aggregators) and storage facilities. AS contracts between the TSO and prequalified sellers are long-term, usually annual, while the available capacity is offered on a daily basis through AS markets. Three main balancing processes exist in the AS markets: central dispatch, self-dispatch portfolio-based and self-dispatch unit-based. If they are remunerated (which is not always the case), ASs can be paid through a regulated price, a pay-as-bid price or a common clearing price.

Existing ASs were reviewed in-depth by (Oureilidis et al., 2020) and CoordiNET (Delnooz, A. et al., 2019) and include:

[22] https://ec.europa.eu/info/events/workshops-digitalisation-energy-system-2022-feb-16_en

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- **Balancing (or Frequency Control):** This service restores the frequency in the nominal operating level of 50 Hz/60 Hz after any deviation occurrence due to physical imbalance between generation and demand. Active power reserves include generator units, storage and in some cases demand response. The main ASs offered for frequency restoration are (Oureilidis et al., 2020, Delnooz, A. et al., 2019):

  - Fast Frequency Response (FFR) – only in some countries, such as Finland
  - Frequency Containment Reserves (FCRs)/ Primary Frequency Control
  - Frequency Restoration Reserves (FRRs)/ Secondary Frequency Control, with automatic activation (automatic Frequency Restoration Reserves—aFRR) or with manual activation (manual Frequency Restoration Reserves—mFRR).
  - Replacement Reserves (RRs)/ Tertiary Frequency Control

  Concerning the procurement methods of frequency control, all the previously mentioned approaches are applicable within EU countries. The same applies for the different remuneration types, which are interlinked with the procurement process (see Table 7 a.).

- **Voltage Control and Reactive Power Supply:** Specific obligations of TSOs regarding voltage limits, for high and extra high voltage, are defined in the Network Codes on System Operation To achieve this desired voltage profile, reactive power (leading or lagging) is required to be injected at specific locations of the network through controllable devices. Generally, the voltage control actions are distinguished at European power systems in a three-level hierarchy based on their activation time (Primary, Secondary, Tertiary – see (Oureilidis et al., 2020) for more details.
  This AS is not remunerated in all countries of EU. In the case of remuneration, settlement rules are similar to the frequency reserves (pay-as-bid, marginal pricing or regulated price, see Table 7 b.). The providers of voltage control can be synchronous generators, windfarms, photovoltaic (PV) systems (only in Spain and France), HVDC links, assisted by devices operated by the TSO such as SVCs, FACTS, capacitor/inductor banks, etc.

- **Black-Start Capability/Grid Restoration**: Black-start is the AS provided by generating units (black-start units), which are able to inject energy into the system, without any electrical energy supply external to the power generating facility, following a general or partial system operation interruption (shutdown) (EU, 2016). Technologies used include pumped storage, interconnections, hydro plants, gas and nuclear units, either connected to the transmission or the distribution network, while in some Nordic countries the TSO owns units for black start service.
  From an AS market perspective, black-start is seldom clearly defined, provided and remunerated (see Table 7 c.).

- **Congestion Management** *(not an AS according to the CEP)*: Congestion is a condition where one or more constraints (thermal limits, voltage limits, stability limits) restrict the physical

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power flow through the network. The service of congestion management refers to the process of mitigating grid congestion issues by avoiding the crossover of network capacity. CoordiNET (Delnooz, A. et al., 2019) identified two main products: congestion management reserved (at a certain availability price, to cope with structural constraints) and non-reserved (at an energy price, to cope with sporadic constraints). Most common measures for congestion management are redispatch, curtailment of renewable generation and countertrading (Bellenbaum et al., 2022). In the case of curtailment, in some countries such as Germany, compensation payments must then be made to the plant operators.

The conditions related to the procurement of Ancillary Services (e.g. bid sizes) are detailed in Table 7.

Table 7: Procurement of grid services in LocalRES demo countries, after Oureilidis et al., 2020; FINGRID, 2022; APG, 2021

a. Procurement of frequency reserve

Country	FCR	aFRR	mFRR	RR
Austria	Generators/ Load /Pump Storage/ Batteries > 1 MW (max 25MW if indivisible bid)	Generators/ Load/ Pump Storage > 1 MW	Generators/ Load/ Pump Storage > 1 MW	1MW < Generators/ Load/ Pump Storage < 25 MW
Finland	Generators/ Load/ Batteries > 1 MW* or 0.1MW**	Generators only > 1 MW	Generators/ Industrial Load > 5 MW	NA
Italy[23]	Generators only > 10 MW (no minimum)	Generators only > 10 MW - service must be fully delivered within 180 s	Generators/ Pump storage > 10 MW (5 min < t < 15 min) Virtual Enabled Units, in Italian "Unità Virtuali Abilitate, UVA" enabled in aggregate form - minimum size of 1 MW for participation	Generators/ Pump storage > 10 MW (15 min < t < 120 min) Virtual Enabled Units, in Italian "Unità Virtuali Abilitate, UVA" enabled in aggregate form - minimum size of 1 MW for participation
Spain	Generators only (no minimum)	Generators only > 10 MW (90 s < t < 5 min)	Generators/ Pump storage > 10 MW (5 min < t < 15 min)	Generators/ Pump Storage > 10 MW (20 min < t < 1 h)

* for Frequency Containment Reserve for Disturbances (FCR-D)

** for Frequency Containment Reserve for Normal Operation (FCR-N)

[23] Carlini, E.M.; Caprabianca, M.; Falvo, M.C.; Perfetti, S.; Luzi, L.; Quaglia, F. Proposal of a New Procurement Strategy of Frequency Control Reserves in Power Systems: The Italian Case in the European Framework. Energies 2021, 14, 6105

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b. Procurement of voltage control

Country	Mandatory	Providers	Voltage level	Paid
Austria	Mandatory for power plants in transmission system	Generators/ DSO/ Wind farms/ DSO connected units/ Transformers	Transmission/ Distribution	Partly
Finland	Mandatory for all power plants	Generators/ Wind farms/ DSO connected units/ Transformers	Transmission/ Distribution	No
Italy	Mandatory for power units > 10 MVA	Generators/ Transformers	Transmission	No
Spain	Mandatory service for all power plants > 30 MW connected to the transmission grid	Generators/ DSO/ Industrial consumers/ Wind farms/ PV/ HVDC/ DSO connected units/ Transformers	Transmission/ Distribution	No

c. Provision of black-start

Country	Mandatory	Voltage level	Paid by TSO
Austria	Hydro storage power plants. Not mandatory for power plants	Transmission	Yes
Finland	Not mandatory, agreed bilaterally by grid code	Transmission/Distribution	Yes
Italy	Mandatory for power plants defined in restoration plan	Transmission	No
Spain	Not mandatory, mainly provided by hydro plants	-	No

3.6.3 Ancillary services provided by distributed renewable energy sources

"*Distributed Energy Resources is a concept used to encompass the multiple types of end-users connected to the distribution grid, capable of providing energy and/or services to the grid by mobilizing the flexibility they have available" and encompass distributed generation, demand response, energy storage systems and electric vehicles, at all voltage levels of the distribution grid*." (Lind and Chaves Ávila, 2019)

In particular, the increasing penetration of Distributed Renewable Energy Sources (DRESs) in the distribution and transmission grids has created an opportunity for new type of ASs.

In contrast with the current power system operation, where the large conventional generators are the main sources for maintaining the system reliability, the DRESs in near future would constitute an alternative choice by providing ASs to the grid (Oureilidis et al., 2020). New ASs are currently provided or proposed to be introduced in weak grids, which may suffer from stability issues:

- **Frequency control**: converter-interfaced DRESs could suitably serve as frequency response providers, offering faster ramp rates and greater flexibility to the system through their proper control (Oureilidis et al., 2020).

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- **Voltage control**: There is a big opportunity of developing the voltage control AS market in the distribution network with an active participation of distributed generation, as reactive power cannot be transmitted over long distances. Voltage regulation in the distribution systems is already treated in the scientific literature as a possible AS despite the fact that currently there is not an actual implementation. Although a number of publications suggest financial tools for the remuneration of the reactive power, there is no research on the actual costs of a DRES to supply the required reactive power or the other costs that are deferred when the reactive is supplied by the DRES (Oureilidis et al., 2020).
- **Congestion management**: The increasing congestion management costs have led to an intense discussion about alternative approaches according to (Bellenbaum et al., 2022). Among these, flexibility markets bear the potential to complement existing congestion management practices by incentivising decentralised resources with large potentials of flexibility to participate in congestion management

A range of barriers still need to be tackled prior to the deployment of new ASs, one of them being that numerous DRESs within the distribution systems are not "visible" and controllable by the TSOs, and that validated and commonly agreed methods for the quantification of services at distribution system level are lacking (a service should be quantified in order to become tradable in a market). Additionally, the regulatory framework of most countries discourages the establishment of new ASs and prevent the DRES operators from offering their services (Merino et al., 2016). More specifically, **technology and size limitations imposed by the present regulations are one of the main reasons why DRES units and loads are excluded from the AS markets, even though they could potentially provide the requested services.** Additionally, minimum **bid size requirements are usually set for individual units and aggregation of services is forbidden in many countries, hence preventing small generating and load units from participating in the market.** Finally, the push towards market-based procurement of redispatch services has sparked fears of so-called Inc-Dec-Gaming (strategic bidding), i.e. the incentive to engage in arbitrage between the national wholesale market and the local redispatch market (the latter would increase both likelihood and severity of grid congestions) (Schnaars and Perino, 2021).

As highlighted by (Oureilidis et al., 2020), the procurement of ASs provided by DRES – including from Renewable Energy Communities – requires first an enabling regulatory framework and a coordinated control or the DRES in order to provide AS of significant amount (with control to be taken over by another entity than the TSO, for instance a DSO or an aggregator)

This is also emphasized by the CoordiNET project in (Lind and Chaves Ávila, 2019): the fact that procurement of services by TSOs and DSOs should be market-based is still a barrier for many products and services, especially at the DSO side. According to the authors, aggregators are expected to play an important role in unlocking the potential of small DER, however independent aggregation is still at an emergent stage in most EU Member States. The revision of the current market design rules will therefore be key: a level playing field for all resources (including for imbalance settlement rules) has to be guaranteed independently where they are connected, the technology used, the size or other characteristics.

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Currently, flexibility markets are not regulated in detail by network codes or guidelines at European level. As mentioned in the latest BRIDGE General Assembly, the Agency for the Cooperation of Energy Regulators (ACER) will develop framework guidelines for flexibility markets by the end of 2022 (including rules on aggregation, energy storage and demand curtailment).

To summarise, the potential for DER to deliver AS and (new) grid services is recognised by many of stakeholders but…

- regulatory framework of most countries prevents the DER operators from offering their services (technology and size limitations, minimum bid size requirements)
- **aggregators** are expected to play an important role in unlocking the potential of small DER, however independent aggregation is still at an emergent stage
- flexibility markets are not regulated in detail by network codes or guidelines at European level. ACER will develop **framework guidelines for flexibility markets** by the end of 2022.

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4 Gaps between the existing framework and the one required for the different use cases

The analysis from the previous section enabled to identify a few gaps, synthesised in Table 8 using a traffic light system:

- 🟢 RECs are allowed to provide this service, and all rules and processes are in place to enable them to do so
- 🟡 the service can be provided within the REC to its Members but cannot be offered to System Operators (SOs)
- 🔴 as of March 2022, the service cannot be provided by the REC (to its members or to SOs)

NA means the regulatory or market feasibility of the service was not investigated as it was not included in the UC.

Table 8: Synthesis of gaps identified for each Use Case

Regulatory topic	Sub-topic	Ispaster UC	Kökar UC	Ollersdorf UC	Berchidda UC
Renewable Energy Communities	Collective self-consumption	🟢	*NA*	🟢	🟢
	Aggregated Energy trading	*NA*	*NA*	*NA*	🟢
	P2P Energy trading	*NA*	*NA*	🔴	🟢
	Energy storage	🟢	🟢	*NA*	🟢
	Electric flows optimisation	*NA*	*NA*	🟢	🟢
eVs	Public charging points	🟢	🟢	🟢	🟢
	V2G	*NA*	*NA*	*NA*	🟢
Heating supply	DH operation and integration of RES	🟢	*NA*	*NA*	*NA*
	Sale of waste heat to DH	*NA*	*NA*	*NA*	*NA*
	DH balancing (thermal DR)	🟢	*NA*	*NA*	*NA*
	P2H / H2P	🟢	🟢	🟢	*NA*
Grid services provided to TSOs and DSOs	Voltage control	*NA*	*NA*	*NA*	*NA*
	Frequency control	*NA*	*NA*	*NA*	*NA*
	Black start	🟡	🟡	🟡	*NA*
	Congestion management	🟡	*NA*	*NA*	*NA*

The design of the Use Cases was in general compliant with regulations from the start. The only barriers identified (as of March 2022) are the following:

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- The P2P trading in Austria cannot go ahead as there is no process currently in place to inform the grid operator of any P2P agreements between participants, but solutions are being considered by the consortium.
- The grid services cannot for now be provided directly by the REC to the DSOs or TSOs, but can be provided to the members of the REC to make the local grid more reliable.

5 Proposition of solutions to enable REC participation in a selection of use cases

5.1 General comment

The transposition of the REDII Directive – which includes the principles of RECs – has substantially progressed while this deliverable was being written, in parallel to the definition of the Use Cases. Apart from Spain, the national regulations are, as of March 2022, getting clearer in LocalRES demo countries, although some practicalities and 'rules of the game' remain to be defined. LocalRES demonstrations will therefore pioneer these new regulations and it is likely that the demos will bring invaluable good practices and lessons learnt which provide precious feedback on how to implement in real life the regulations framing RECs.

5.2 Use case Ollersdorf

While the Austrian law does not explicitly prohibit P2P trading, following the current regulation in force makes it impossible to do any true P2P trading, as the measuring and allocation of energy has to be done by the grid operator, and there is no process in place to inform the grid operator of any agreements between participants. Under the current regulatory framework, P2P-related activities cannot be implemented by Ollersdorf Energy Community. Project partners are therefore considering alternatives to be able to demonstrate P2P trading.

No other gaps have been identified.

5.3 Use case Kökar

No specific gaps were identified in relation to the implementation of the pre-selected services. Black-out strategies can for now only be provided as a service to the REC, and cannot be offered or traded to the distribution or transmission grid operators.

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5.4 Use case Berchidda

No specific gaps were identified in relation to the implementation of the pre-selected services. Black-out strategies can for now only be provided as a service to the REC, and cannot be offered or traded to the distribution or transmission grid operators.

5.5 Use case Ispaster

No specific gaps were identified in relation to the implementation of the pre-selected services. Although Royal Decree-Law 23/2020 is for now lacking the technical regulations required to define how to set up a REC, Royal Decree 244/2019 (which enables extended Collective Self-Consumption) can be used in the meantime. Black-out strategies can for now only be provided as a service to the REC, and cannot be offered or traded to the distribution or transmission grid operators.

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6 Conclusion

The regulatory assessments performed by the demo teams at an early stage of the project allowed identifying the existing regulatory gaps and make the required decisions to adjust the Use Cases.

Although the regulatory framework is complex, which means that Use Cases have to comply with a lot of different legislative texts, the preliminary design of the Use Cases (in the scope of Task 1.2) was in general compatible with regulations from the start.

The main barriers identified (as of March 2022) were the following:

- The P2P trading in Austria cannot go ahead with the current regulatory framework as there is no process in place to inform the grid operator of any P2P agreements between participants, but alternatives are being developed by the consortium.
- The grid services cannot be provided directly by the REC to the DSOs or TSOs for now, but can be provided to the members of the REC to make the local grid more reliable.

The final Use Cases are detailed in D1.2 Definition of REC-driven services and Use Cases.

As already mentioned in this report, the regulatory framework which has been analysed to provide these recommendations is evolving fast (at both the EU and national levels), and one can expect that services that cannot be provided by RECs today will be enabled in the near future:

- The clarification of the procedure to inform and get agreements from the DSOs on P2P trading schemes in Austria will make it possible to roll out P2P;
- Fine-tuning and improvement of technical regulations for RECs on e.g. procedures to set up / register RECs (including what kind of legal status they should have), or the roll out of dynamic sharing coefficients (instead of pre-set ones), are required to fully unlock the potential of RECs;
- The development of new framework guidelines for flexibility markets may facilitate the entry of RECs on such markets to sell grid services, without being limited by bid sizes requirement.

Updates to the key outcomes of this deliverable will therefore be provided during the second and third year of the project.

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7 Bibliography

Andoni, M., Robu, V., Flynn, D., Abram, S., Geach, D., Jenkins, D., McCallum, P., Peacock, A. (2019) Blockchain technology in the energy sector: A systematic review of challenges and opportunities, Renewable and Sustainable Energy Reviews

Anisie, A., and Boshell, F. (2020). The benefits of Peer-To-Peer Electricity Trading for communities and grid expansion, retrieved from https://energypost.eu/the-benefits-of-peer-to-peer-electricity-trading-for-communities-and-grid-expansion/

APG (2021) Ausschreibungsdetails der Austrian Power Grid AG für die Beschaffung der benötigten Regelreserve in Österreich, v1.1

Bellenbaum, J., Höckner, J., Weber, C. (2022) Designing flexibility procurement markets for congestion management – investigating two-stage procurement auctions, Energy Economics, Volume 106, https://doi.org/10.1016/j.eneco.2021.105775

CEDEC, EDSO, ENTSO-E, Eurelectric, GEODE (2019). TSO-DSO Report: An integrated approach to active system management with the focus on TSO-DSO coordination in congestion management and balancing.

Delnooz, A., Vanschoenwinkel, J., Rivero, E., Madina, C. (2019). CoordiNET Deliverable D1.3 – Definition of scenarios and products for the demonstration campaigns

ENTSO-E (2021) ENTSO-E Position Paper: Electric Vehicle Integration into Power Grids

ENTSO-E WGAS (2017). Survey on Ancillary Services Procurement, Balancing Market Design 2016. Available online: https://docstore.entsoe.eu/publications/market-reports/ancillary-services-survey/Pages/default.aspx

EU (2016). Commission Regulation (EU) 2016/631 of 14 April 2016 Establishing a Network Code on Requirements for Grid Connection of Generators; Commission. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0631&from=EN

Fina, B., & Fechner, H. (2021). Transposition of European Guidelines for Energy Communities into Austrian Law: A Comparison and Discussion of Issues and Positive Aspects. *Energies*.

https://doi.org/10.3390/en14133922

FINGRID (2022) Reserve products and reserve market places, Public presentation material. Available online: https://www.fingrid.fi/globalassets/dokumentit/en/electricity-market/reserves/reserve-products-and-reserve-market-places.pdf

Lind, L., Chaves Ávila, J.P. (2019). CoordiNET Deliverable D1.1 Market and regulatory analysis: Analysis of current market and regulatory framework in the involved areas. Universidad Pontificia Comillas

This project has received funding from the European Union's Horizon 2020 Programme under the Grant Agreement no. 957819

Merino, J.; Gómez, I.; Turienzo, E.; Madina, C.; Cobelo, I.; Morch, A.; Saele, H.; Verpoorten, K.; Puente, E.R.; Häninnen, S.; et al. (2016) Ancillary Service Provision by RES and DSM Connected at Distribution Level in the Future Power System. Available online: http://smartnet-project.eu/wp-content/uploads/2016/12/D1-1_20161220_V1.0.pdf

Oureilidis, K.; Malamaki, K.-N.; Gallos, K.; Tsitsimelis, A.; Dikaiakos, C.; Gkavanoudis, S.; Cvetkovic, M.; Mauricio, J.M.; Maza Ortega, J.M.; Ramos, J.L.M.; Papaioannou, G.; Demoulias, C. (2020) Ancillary Services Market Design in Distribution Networks: Review and Identification of Barriers. *Energies*, 13, 917. https://doi.org/10.3390/en13040917

REScoop.eu (2019) Energy Communities under the Clean Energy Package: Transposition Guidance https://www.rescoop.eu/uploads/rescoop/downloads/Energy-Communities-Transposition-Guidance.pdf

Schittekatte, T., Reif, V., Meeus, L. (2019) The EU electricity network codes (2019 ed.), Florence School of Regulation, Energy, Electricity - http://hdl.handle.net/1814/61644

Schittekatte, T., Reif, V., Nouicier, A., Meeus, L. (2019) INTERRFACE D2.4 Completed Regulatory Framework

Schnaars, P., & Perino, G. (2021). Arbitrage in Cost-Based Redispatch: Evidence from Germany. Econometric Modeling: Commodity Markets eJournal.

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8 Annex 1- Detailed analysis of regulations for RECs

8.1 Austria

Topic	National context
Regulation	
Name/reference of national regulation	EAG-Gesetzespaket (Renewable Energies Expansion Act Legislative Package) https://www.parlament.gv.at/PAKT/VHG/XXVII/BNR/BNR_00348/fname_989096.pdf EAG: Erneuerbaren-Ausbau-Gesetz (Renewable Energies Expansion Act) https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011619 ElWOG: Elektrizitätswirtschafts- und Organisationsgesetz (Electricity Industry and Organisation Act) https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20007045
Status	The first draft of the novel legislation for energy communities (both RECs and CECs) was proposed in September 2020. After expert feedback it was revised and made public again in March 2021. Again, after some changes, the final legislation has been enforced since July 2021. Currently, the first energy communities are being set up. An official body to support energy communities has also been implemented. This body shall help with organisational as well as legislative and regulatory questions. https://energiegemeinschaften.gv.at/
Date of entry into force	Legislation for both, renewable energy communities and citizen energy communities has been enforced in July 2021.
Status of implementation of alinea 3 of Art.22 of RED II in the territory	The Austrian legislators laid down in EAG §91 (3) that RECs and CECs as well as energy communities within the building border shall be evaluated concerning their current status and development. Moreover, unjustified barriers and limitations of their development shall be detected, and suggestions for improvement and need for adaptation shall be provided.
Status of implementation of alinea 4 of Art.22 of RED II in the territory	This provision is not enacted in the Austrian legislation, but still carried out. In Austria, an official body to support energy communities (called *Österreichische Koordinationsstelle für Energiegemeinschaften* is set up to provide help with organisational and administrative questions, the set-up of energy communities, guidelines and templates and will generally serve as a general point of contact for energy community founders, participants and else. https://energiegemeinschaften.gv.at/
REC definition / Primary purpose of a REC	The primary purpose of a REC is not financial gain, but to provide environmental, economic, or social community benefits to its members or to the areas in which it operates. EAG §79 (2)

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Energy carriers involved	Only renewable energy, but in the electricity and heating sector
Allowed activities	RECs are entitled to generate, consume, store, or sell energy from renewable sources. In addition, RECs are entitled to be active in aggregation and provide other services. EAG §79 (1)
Membership/ control	Members or partners of a REC are natural persons, municipalities, public legal entities in relation to local departments, other legal entities under public law or SMEs. A REC may be organized as an association, cooperative, business partnership, corporation, or similar association with legal personality. EAG §79 (2) Generators that deliver electric energy to a grid in a local or regional area may participate in a REC, provided that they are not controlled by a utility, supplier, or power trader. ElWOG §16c (1)
Geographic limitation	The generation and consumption units within a REC must be connected via the low-voltage grid (local area) or the medium-voltage grid (regional area) in the concession area of a grid operator. The transmission of energy via grid levels 1-4 or through the concession area of other grid operators is not permitted. ElWOG §16c (2)
Process to set up a REC	Grid users must be informed upon request to which part of the distribution grid their consumption or generation facilities are connected. The DSO has to provide this information within 14 days. ElWOG §16c (3) Grid operators must be informed about the establishment of a REC as well as about the following elements and, if necessary, changes to these elements: generation and consumption facilities, metering point numbers, allocation of generated energy, allocation of non-consumed energy per 15 minutes, admission and withdrawal of participating network users, termination of the REC, and dismantling of generation facilities. ElWOG §16d (2) A REC must conclude agreements that include at least the following elements: data management by the grid operator, operation, maintenance and servicing of generation facilities, liability, insurance. ElWOG §16d (3)
Other	Energy communities need to make use of a concessioned grid operator. ElWOG §16d (6)
Infrastructure readiness	
Current status of smart metering roll-out	The status of the smart meter roll-out differs significantly for the federal provinces in Austria. In Upper Austria, the smart meter roll-out is almost completed, whereas most other federal provinces are far behind. For whole Austria, the current plans indicate an objective of 31.3% for 2020 and 74.6% for 2022. This shows that the objectives set out in the IME-VO (Intelligente Messgeräte Verordnung) of at least 80% by the end of 2020 and 95% by the end of 2022 will be missed by far. (https://www.e-control.at/branchen-newsletter/-/asset_publisher/0wTTT16KsQRv/content/im-fokus-smart-meter-rollout-in-osterreich)

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	IME-VO: https://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/20007808/IME-VO%2c%20Fassung%20vom%2027.06.2021.pdf
Timeline for smart metering deployment in the country	For whole Austria, the current plans indicate an objective of 31.3% for 2020 and 74.6% for 2022.
Grid fees, taxes & incentives	
Grid fees (and other types of toll if any)	Grid-usage tariffs for RECs are determined based on which grid levels are used for electricity transfer. If only the low voltage grid is used, grid charges for grid level 7 arise; if the medium voltage grid is used as well, charges for grid levels 5, 6 and 7 are incurred. Costs of higher grid levels do not arise for electricity transfer within RECs. ElWOG § 52 (2a) The exact values of the reduction of grid fees can be found in the SNE-VO (Systemnutzungsentgelte-Verordnung; engl.: System Usage Fees Ordinance; https://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/20010107/SNE-V%c2%a02018%2c%20Fassung%20vom%2004.01.2022.pdf). The per-unit grid-usage charges are reduced by 57% for a local REC (within the low-voltage grid), and, for regional RECs (that also use the medium voltage grid) by 28% for electricity transfer within the low-voltage grid, and by 64% for using the medium-voltage grid.
Taxes (VAT, other taxes)	To date, there is no knowledge that any specific taxes are applied to RECs.
Incentives / Bonus	Besides the reduced grid charges, RECs are incentivised by being exempt from levies such as the renewable promotion contribution (EAG §75 (5)) and the electricity surcharge (for PV electricity only) https://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/10005027/Elektrizit%c3%a4tsabgabegesetz%2c%20Fassung%20vom%2004.01.2022.pdf
Main stakeholders and market actors	
Regulator (electricity and gas if relevant)	The regulator in Austria is called E-control. E-control is responsible for electricity and gas. Establish framework conditions: • Establish market rules for competition • Regulate network tariffs Exercise market supervision: • Identify and remedy competition violations • Monitor and analyse the development of the market Regulation has two components: ex-ante regulation, in which the framework conditions and the rules under which competition takes place, are established beforehand. This includes the task of network tariff

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	regulation and the creation of market rules in cooperation with market participants. If these rules or general competition rules are violated, the regulatory authorities can also intervene in an ex-post regulatory manner, identify competition violations and put a stop to them. A key aspect of this is market monitoring. The instrument of market monitoring can be used to track and analyse developments on the market. (https://www.e-control.at/econtrol/unternehmen/unser-auftrag)
Network operators (DSO, TSO for electricity and gas if relevant)	There are currently 122 electricity distribution system operators and 21 gas distribution system operators in Austria, each of which is responsible for the distribution of electrical energy and natural gas in its grid area, i.e. a geographically specified part of Austria. Around 7,000 km of power lines in APG's transmission grid and around 260,000 km of grid at several grid levels of the distribution grid operators ensure electricity supply. Households using natural gas do so via a long-distance pipeline network of around 3,000 km and a distribution network of around 43,000 km. (https://www.e-control.at/konsumenten/netz-und-netzbetreiber-in-oesterreich) Concerning DSOs, there is the APG (Austrian Power Grid) and the Vorarlberger Übertragungsnetz GmbH (https://austria-forum.org/af/AustriaWiki/Elektrizit%C3%A4tswirtschaft_in_%C3%96sterreich)
Retailers	The legislative provisions in Austria foresee that each participant of a REC is still free to choose their own retailer (The free choice of supplier remains. ElWOG §16b (1)). Therefore, each retailer is required to deal with energy communities if a custormer is part of a community. It is also expected that multiple retailers will offer third-party services for RECs and CECs to set foot in this new field. Deriving from the efforts that were conducted in the field of implementing energy communities within multi-apartment buildings (which is possible since 2017) retailers such as WIR Energie, Wien Energie, Energie Steiermark and Salzburg AG can be named.
Providers of IT solution	Currently, there are no specific IT providers for RECs, however, in the course of a research project, an 'innovation lab' was brought to life. This innovation lab is called *act.4energy* and will provide infrastructure for billing and accounting via a platform.
Energy markets targeted by the REC	No specific energy markets can be considered to be targeted by a REC. It is rather to be expected that RECs will remain on the "end-customer-side" than that they will try to play on a market.
Key takeaways	
Main differences to RED II Art. 22	NA
Enablers & facilitators for the uptake of RECs	Österreichische Koordinationsstelle für Energiegemeinschaften, Conventional energy suppliersl

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Barriers to the uptake of RECs	There are certain barriers to the actual uptake of RECs. Barriers are detailed in a recently published article, see B. Fina and H. Fechner, 2021
Future opportunities / what is likely to change in the near future	By the end of the first quarter of 2024, the regulator must publish a cost-benefit analysis to determine whether appropriate and balanced participation of RECs and CECs in the system costs is ensured. EAG §79 (3). If not, legislators might alter grid tariff reductions for RECs from 2024 onwards.

8.2 Finland

Topic	National context
Regulation	
Name/reference of national regulation	1145/2020. Law on authorization procedures for renewable energy production facilities and some other administrative procedures. https://www.finlex.fi/fi/laki/alkup/2020/20201145#Lidp445758176
Status	adopted
Date of entry into force	30.6.2021
Status of implementation of alinea 3 of Art.22 of RED II in the territory	Legislation enabling RECs in the same property or cross border via separate lines is already in force.
Status of implementation of alinea 4 of Art.22 of RED II in the territory	An assessment of cross property border RECs without the need to build separate distribution lines is being carried out by the government officials.
REC definition / Primary purpose of a REC	Member States shall ensure that end-users, and in particular household customers, have the right to participate in the Renewable Energy Community, while retaining their rights or obligations as end-users and without being subject to unjustified or discriminatory conditions or procedures that prevent them from participating in the Renewable Energy Community, provided that in the case of private entities, their participation does not form their commercial or professional main source of livelihood.
Energy carriers involved	Wind and solar, geothermal energy, ambient energy, tidal and wave energy, ocean energy, hydropower, biomass, and non-fossil gas produced in sewage treatment plants and landfills.
Allowed activities	Generation, consumption, storage and sales of renewable energy.
Membership/ control	participation in renewable energy communities is possible for all consumers, including those who live in low-income or vulnerable households.

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Geographic limitation	Participating countries can agree whether cross border participation to REC is possible or not.
Process to set up a REC	At the moment, declaration to DSO is required and it needs to be approved by the DSO.
Other	A regulation change where REC would not need a permission from the DSO, and only the declaration would suffice is underway. https://lahienergia.org/elenia-julkaisi-vttn-kanssa-kasikirjan-energiayhteisojen-perustamisesta/
Infrastructure readiness	
Current status of smart metering roll-out	Rollout finished. https://lutpub.lut.fi/bitstream/handle/10024/149256/kandidaatinty%C3%B6_niinikoski_2018.pdf?sequence=1&isAllowed=y
Timeline for smart metering deployment in the country	First meters installed in the early 2000's. Smart metering regulation came into force in 2009, mass rollout during 2011-2013, ~80% rollout by 2013 and practically 100% by 2019.
Grid fees, taxes & incentives	
Grid fees (and other types of toll if any)	New grid fee and taxes for cross border RECs are yet to be determined. As of now, normal transmission fees would need to be paid if the distributions grid is used. In the case of REC inter-property REC, the distribution fees do not apply. https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161119/Liite_TEM_33_2018.pdf
Taxes (VAT, other taxes)	Electricity tax needs to be paid according to the current practise.
Incentives / Bonus	The Ministry of Economic Affairs and Employment of Finland currently hands out Energy Aid of 20% of eligible costs for projects that; promote the production or use of renewable energy; promote energy savings or increase the efficiency of energy generation or use; or otherwise promote the transition towards a low-carbon energy system. https://tem.fi/en/energy-aid The Housing Finance and development Center of Finland hands out energy subsidies that include procuring solar energy systems for example. https://www.ara.fi/fi-FI/Lainat_ja_avustukset/Energiaavustus In Åland, the municipal government supports the energy efficiency and renewable energy projects with a separate fund, that can cover up to 25% of the investment costs.
Main stakeholders and market actors	
Regulator (electricity and gas if relevant)	The Energy Authority of Finland is a licensing and regulatory authority that regulates and promotes operation of the electricity and gas markets, emission reductions, energy efficiency and the use of renewable energy. They enforce Finnish and European energy and climate policies. Their goal

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	is to promote cost efficient achievement of climate goals and efficient operation of the energy market. In the autonomous province of Åland islands, the operative entity that represents Energy Authority is the Minister of Development Aid, Alfons Rödblom.
Network operators	Fingrid – Finnish TSO Kraftnät Åland – Ålandic TSO Ålands Elandelslag – Ålandic DSO Mariehamns Energi – Ålandic DSO
Providers of IT solution	Virtual Global Trading AG
Energy markets targeted by the REC	Nordpool, SE3
Key takeaways	
Main differences to RED II Art. 22	NA
Enablers & facilitators for the uptake of RECs	Some DSOs and groups of active citizens
Barriers to the uptake of RECs	Current regulation does not allow cross-property RECs to be implemented feasibly due to the unavailability of the distribution grid. Currently, the RECs in rural areas would need to build extensive parallel lines to the distribution grid, which would be very expensive. Therefore, the RE generation equipment could not be placed there where they are most productive and the feasibility to join/create a REC is lower than in more densely populated regions.
Future opportunities / what is likely to change in the near future	An energy-based compensation fee model for DSOs would enable cross-border RECs in rural areas to utilize the distribution grid, thus minimizing the need to build separate parallel lines unnecessarily. In future, the housing companies with multiple buildings with own separate connection points that are in the same property could possibly share a RE generation facility.

8.3 Italy

Topic	National context
Regulation	
Name/reference of national regulation	LEGISLATIVE DECREE No. 199 of 8 November 2021 Implementing Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable

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	sources. (21G00214) (OJ General Series n.285 of 30-11-2021 - Ordinary Supplement n. 42).
Status	Adopted
Date of entry into force	15/12/2021
Status of implementation of alinea 3 of Art.22 of RED II in the territory	**On December 15, 2021, the Legislative Decree that definitively transposes the two directives RED II (2018/2001) and EMI (2019/944) came into force**. With this step, Italy is finally going to conclude the path of adaptation of the legislation on renewable energy resources and energy communities. In particular, there are 2 main elements that enable this step: • increase in the power limit of plants eligible for incentive mechanisms, which goes from 200 kW to 1 MW; • removal of the secondary cabin limit, which allows the establishment of CERs with members connected to the primary cabin. While representing an important step for the development of energy communities, the boundaries of the energy communities provided by the national decree determine some limitations, like bureaucratic and administrative barriers: 3.b) Authorization procedure is handled by GSE 3.c) The DSO controls the last mile but not in a transparent way, therefore it is necessary to have its own adequate measurement and monitoring system (suitable for the grid) 3.d) When operating a microgrid, in Italy energy communities can operate only in virtual configuration. Therefore, it is not allowed to establish private networks, but they need to use the public electric grid. The figure of Prosumer does not exist yet in Italy, end users can produce energy only for their own self consumption but they cannot sell it and the surplus energy produced is released in the grid.
Status of implementation of alinea 4 of Art.22 of RED II in the territory	There are specific incentive mechanisms provided by the Ministry of Economic Development (MiSE) that bring benefits to the participating parties to stimulate and incentivise the establishment and functioning of the energy communities. They are described in the lower section specifically dedicated to the incentives in Italy. Additionally, some Italian regions have already issued a legislation on energy communities and allocated funds to define expressions of interest for the formation of energy communities on their territory. • Piedmont Regional Law 3 August 2018, n. 12. "Promotion of the establishment of energy communities". PIEDMONT REGION BU32S3 09/08/2018 & Resolution of the Regional Council 8 March 2019, n. 18-8520. Regional law 3 August 2018, n. 12 "Promotion of the

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	establishment of energy communities". Implementing provisions and approval, for the year 2019, of the criteria for financial support. PIEDMONT REGION BU11S1 14/03/2019 • Puglia Regional Law 9 August 2019, n. 45 "Promotion of the institution of energy communities". Official Bulletin of the Puglia Region - n. 91 of 8-9-2019
REC definition / Primary purpose of a REC	Two configurations are possible: **1)** in the case of **Renewable Energy Communities**, the shareholders or members are natural persons, small and medium-sized enterprises, territorial bodies or local authorities, including municipalities, and participation in the renewable energy community cannot constitute the main commercial and industrial activity; **2)** in the case of **Renewable energy self-consumers acting collectively**, subjects other than households are associated only if the energy production and electricity exchanges activities (referred to in letters a) and b) of paragraph 4) do not constitute the main commercial or professional activity. Their primary purposes are : • to produce energy for own consumption from renewable sources power of less than 1 MW (raising the power limit for plants eligible for incentives previously set at 200 kW - Law 8 of February 28, 2020) that will come into operation after the entry into force of the Red II Decree and will be recognized only on the share of shared energy; • to share the energy produced using the distribution network of the participating parties, specifying that the energy shared is equal to the minimum, in each hourly period, between the electricity produced and fed into the network by the renewable source plants and the electricity withdrawn by all the associated end customers; • to store energy through storage systems built around the perimeter of the community; • in the case of **1) Renewable Energy Communities**, the points of withdrawal of consumers and the points of input of production plants must be located on low voltage electrical networks subtended, at the date of creation of the association, to the same medium voltage/low voltage transformation cabin; • in the case of **2) Renewable energy self-consumers acting collectively**, the same must be located in the same building or condominium.
Energy carriers involved	Electricity and heat
Allowed activities	End users can produce and store energy only for their own self consumption but the surplus energy produced is released in the grid. They cannot sell the energy produced, they can only receive compensation for

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	the surplus energy released in the grid according to specific incentive mechanisms (Feed-in-tariff).
Membership/ control	ARERA: implementation and maintenance of the system GSE: monitoring Ministry of Economic Development: establishes the incentive rate
Geographic limitation	• in the case of **1) Renewable Energy Communities**, there are no geographic limitations; • in the case of **2) Renewable energy self-consumers acting collectively**, the same must be located in the same building or condominium.
Process to set up a REC (e.g. declaration to be made to DSO or other entities)	• Regarding **self-consumers**, their representative (which is one of the producers) submits an official request to the GSE (an Italian firm focused on incentivising and developing renewable energy and that will manage the provision of the incentivisation model) and provides information regarding the subjects that participate to self-consumption, the identifying codes of the points of delivery for electric energy of the same building or condominium and the plants that generate energy. • Regarding **energy communities**, one of the energy producers of the EC submits an official request to the GSE and provides information regarding the subjects that participate to the EC, the identifying codes of the points of delivery for electric energy related to the members of the EC and the plants that generate energy.
Infrastructure readiness	
Current status of smart metering roll-out	The 2nd generation of smart meters is being rolled out by e-Distribuzione.
Grid fees, taxes & incentives	
Grid fees (and other types of toll if any)	• For both Renewable Energy Communities and for Renewable energy self-consumers acting collectively on all energy produced and shared among members there is a discount on electricity tariff (distribution tariff) around 8-10 €/MWh[24]. • For Renewable energy self-consumers acting collectively (same building) on all energy produced and shared among members there is a discount on transmission tariff and avoided losses on the grid around 1.00 €/MWh[25].

[24] Each kWh of shared electricity, the GSE recognized for a period of 20 years a unit fee (sum of the transmission tariff for low voltage users, equal to 7.61 €/MWh for the year 2020, and the higher value of the variable distribution component for users other low-voltage uses, equal to 0.61 €/MWh for the year 2020)
[25] Contribution due to avoided grid losses (variable according to the voltage level and the Hourly Zone Price of electricity. Taking as a reference, purely by way of example, the average Single National Price of 2019 would have a value equal to around 1.3 €/MWh for low voltage and around 0.6 €/MWh for medium voltage).

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Incentives / Bonus	In the Italian regulation there are specific incentive mechanisms provided by the Ministry of Economic Development: • For both Renewable Energy Communities and for Renewable energy self-consumers acting collectively on all the energy PRODUCED and fed into the network, the Dedicated Withdrawal (Ritiro Dedicato) of the GSE[26] or the sale on the market about 40-50 € / MWh is applied. • For both Renewable Energy Communities and for Renewable energy self-consumers acting collectively on all energy produced and shared among members the incentive amounts to € 100-110 / MWh for 20 years. Additionally, these incentives can be cumulated with: • Ecobonus[27]: Energy communities may benefit from the tax deductions provided for by article 16-bis, paragraph 1, letter h), of the consolidated income tax law, pursuant to the decree of the President of the Republic no. 917. • Superbonus 110%: If the Superbonus 110% incentive is used for a photovoltaic plant up to 20 kw, the incentive dedicated to energy communities is not recognized. For the part of energy exceeding 20 kw, the incentive for energy communities is instead recognized. • Can be combined with 50% tax deductions from Ecobonus • Tax deduction 110% cumulative only with ARERA refund
Main stakeholders and market actors	

[26] GSE (Gestore Servizi Energetici) is a public company, wholly owned by the Ministry of Economy and Finance, which promotes sustainable development in Italy by encouraging energy production from renewable sources and with information actions aimed at spreading culture energy compatible with the environment.
The main activities of the GSE are:

- technical-engineering qualification, verification of renewable source and high-efficiency cogeneration plants and management of the incentive mechanisms envisaged by the regulations for these plants;
- the withdrawal from the producers and the placement on the Energy Exchange of the electricity produced and fed into the grid by the plants using renewable sources;
- the assessment and certification of the savings achieved by energy efficiency projects within the white certificate mechanism (TEE) and the encouragement of the production of thermal energy from renewable sources (Thermal Account);
- support to institutions for the implementation of energy policies with the provision of studies, data and technical advice
- monitoring the development of renewable energies to achieve the EU objectives.

[27] "Ecobonus DECREE OF THE PRESIDENT OF THE REPUBLIC 22 December 1986, n. 917. Approval of the consolidated income tax law (and subsequent amendments) - Budget Law n.178 30 December 2020": Tax deduction for EE interventions of the envelope, smart systems and replacement of small-sized RES plants. The deduction concerns income tax (Irpef, for private citizens and IRES, for companies).

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Regulator (electricity and gas if relevant)	Autorità di Regolazione per Energia Reti e Ambiente (ARERA) is an independent regulatory authority whose role is to protect the interests of consumers as well as promoting competition and efficiency between all actors involved in the electricity market. ARERA sets tariffs for the use of electricity infrastructure, both transmission and distribution, and ensures equal access for all market operators.
Network operators (DSO, TSO for electricity and gas if relevant)	Key actors in the Generation segment of Italy's electricity market: Enel, Eni, Edison, A2A, EPH, Iren and several others. (Liberalised structure set by the market) Only actor in the Transmission segment of Italy's electricity market: Terna SpA (Regulated monopoly set by the Italian Regulator). Key actors in the Distribution segment of Italy's electricity market: E-Distribuzione, Unareti, Areti, Ireti, Edyna and several smaller local actors (Local regulated monopoly set by the Italian Regulator). *(DSO manages the last mile, it does not allow a "smart" use of the grid but only under the configuration of VPP.)* Key actors in the Supply segment of Italy's electricity market: Enel, Edison, Hera, A2A, Axpo Group and several others (Liberalised structure set by the market). Key actors in the Trading segment of Italy's electricity market: Enel Energia, Acquirente Unico, Gestore Servizi energetici, and several others often linked to generation companies.
Retailers	Energy4Com Regalgrid EnergyCentre ènostra ForGreen
Providers of IT solution	Gridability/Nesosnet/Prosume Evolvere *Regalgrid MapsGroup HigecoEnergy
Key takeaways	
Main differences to RED II Art. 22	NA
Enablers & facilitators for the uptake of RECs	1) Financial incentives - Incentives mechanisms provided by the Ministry of Economic Development (see prior answers). - National incentives (EcoBonus, SuperEcobonus…) - Allocated funds from local authorities 2) Local Authorities support: - Legislative decree 48/2020 transposes the directive (EU) 2018/844 on the energy performance of buildings in article 8 paragraph 2 provides

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	for the establishment of the one-stop shop to provide assistance and information to citizens and Public Administrations. In addition to article 7 provides that ENEA and GSE provide, in collaboration with the Municipalities, tools and consultancy services that are accessible and transparent, such as one-stop shops to support consumers, called "one-stop-shops", on the subject of building renovations and financial instruments for the energy efficiency in buildings. For the municipalities adhering to the Covenant of Mayors, the activation of PECC energy (Energy and Climate Point for Municipalities) is also envisaged. One-stop shop at national level and at local level might have an important role in fostering the creations and development of Energy Communities.
Barriers to the uptake of RECs	- Authorization procedure is handled by GSE (and is constantly evolving due to the fact that every 6 months the regulation is updated). - The figure of Prosumer does not exist yet in Italy, end users can produce energy only for their own self consumption and the surplus energy produced is released in the grid for which they receive a compensation but they cannot sell it.
Future opportunities / what is likely to change in the near future	The legislation in Italy at the time being is up to date with RED II directive in EU so no changes are foreseen in the near future. .

8.4 Spain

Topic	National context
Regulation	
Name/reference of national regulation	Real Decreto-ley 23/2020 (RD-Ley 23/2020): Approves measures in the field of energy and other areas for economic reactivation. https://www.boe.es/eli/es/rdl/2020/06/23/23 Real Decreto 244/2019: Regulates the administrative, technical and economic conditions of the self-consumption of electrical energy. https://www.boe.es/eli/es/rd/2019/04/05/244 Plan National Integrado de Energía y Clima (PNIEC): Spanish Integrated National Plan for Energy and Climate. https://www.miteco.gob.es/images/es/pnieccompleto_tcm30-508410.pdf
Status	Real Decreto-ley 23/2020: Entered into force but missing regulations. Real Decreto 244/2019: Entered into force PNIEC: Draft

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Date of entry into force (if known)	Real Decreto-ley 23/2020: 25/06/2020 Real Decreto 144/2019: 07/04/2019 PNIEC: 2021-2030
Status of implementation of alinea 3 of Art.22 of RED II in the territory	In the Integrated National Plan for Energy and Climate 2021-2030 (PNIEC 2021-2030), developed by the Spanish Government to meet the objectives and goals of the European Union in the framework of energy and climate policy, part of the barriers and potentials for Local Energy Communities are mentioned. https://www.boe.es/boe/dias/2021/01/11/pdfs/BOE-A-2021-421.pdf A study, published by IDAE (Institute for Diversification and Energy Saving) in 2019, describes barriers and potential for REC development. https://www.idae.es/sites/default/files/documentos/publicaciones_idae/guia_para-desarrollo-instrumentos-fomento_comunidades_energeticas_locales_20032019_0.pdf
Status of implementation of alinea 4 of Art.22 of RED II in the territory	The actual state of the framework to promote REC is limited. However, in the PNIEC 2021-2030, measures to promote and facilitate REC are considered. The national regulation is in process.
REC definition / Primary purpose of a REC	In part III of the RD-ley refers to the Directive 2018/2001 and says that a REC "*aims at the participation of citizens and local authorities in renewable energy projects, which will allow a greater local acceptance of these energies and a greater participation of citizens in the energy transition*". In Article 4 j) it is given the description of what a REC is: "*legal entities based on open and voluntary participation, autonomous and effectively controlled by partners or members that are located in the vicinity of renewable energy projects that are owned by said legal entities and that they have developed, whose partners or members are individuals physical, SMEs or local authorities, including municipalities and whose primary purpose is to provide environmental, economic or social benefits to their partners or members or to the local areas where they operate, instead of financial gains*". These definitions are in line with the Art.22 of the REDII, nevertheless, the regulation does not fully describe the REC.
Energy carriers involved	The regulation does not specify
Allowed activities	The regulation does not specify only mentioning renewable energy projects. However, in the Recovery, Transformation and Resilience Plan (PRTR) it says that: "[...] *actors such as energy communities that will promote self-consumption, storage and demand aggregators* [...]". There is also energy Storage Strategy where it mentions that the REC can be the proprietary of an energy storage installation. Therefore, it is extrapolated that the allowed activities will extend to the full range of RE generation and energy efficiency projects.

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	https://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/160621-Plan_Recuperacion_Transformacion_Resiliencia.pdf https://www.miteco.gob.es/es/prensa/estrategiaalmacenamiento_tcm30-522655.pdf Today, there is only a detailed regulation, RD 244/2019, on shared RE installations for self-consumption which can be interpreted as a way to start a REC, but it also allows other kind of unions between consumers to be put in place, such as neighbours' associations.
Membership/ control	Members or partners in the REC
Geographic limitation	Limited by the vicinity of the Renewable Energy-projects property of the REC. If REC is constituted according to the self-consumption regulation, the generation needs to be around 500 m or under the same connection point.
Process to set up a REC	No process is described. In Article 4 j) it is given the description of what a REC is: *"legal entities based on open and voluntary participation, autonomous and effectively controlled by partners or members that are located in the vicinity of renewable energy projects that are owned by said legal entities and that they have developed, whose partners or members are individuals physical, SMEs or local authorities, including municipalities and whose primary purpose is to provide environmental, economic or social benefits to their partners or members or to the local areas where they operate, instead of financial gains".*
Infrastructure readiness	
Current status of smart metering roll-out	~99% (2018) (Source: ACER)
Grid fees, taxes & incentives	
Grid fees (and other types of toll if any)	Grid fees are a very important part of the Spanish electricity tariff. They are applied both to contracted power and to the electricity used, and together with other regulated charges, they usually make up to 50% of the total electricity costs for domestic users. Last tariff reform in June 2021, has reduced these grid fees, particularly for those users who can reduce the contracted power and the energy use during peak hours. *At the moment RECs do not have any special regulation on grid fees. However, for REC which can make use of the new conditions for "shared self-consumption" described in the* RD 244/2019, there could be an opportunity to reduce contracted power and energy use, and therefore indirectly reduce grid fees and regulatory charges.
Taxes (VAT, other taxes)	There is an Electricity Tax of 5,11% which applies both to electricity use and contracted power.

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	VAT is normally 21%, although due to scalation of electricity prices in summer 2021, it has been temporarily reduced to 10%. There are no special taxes at the moment for RECs.
Incentives / Bonus	PREE program for building energy rehabilitation includes RECs as one of the recipients of the funds. (https://www.idae.es/en/support-and-funding/renovation-buildings/pree-program-building-energy-rehabilitation) The Basque Energy Agency who manages PREE funds in the Basque Country, details that projects developed within a REC would get an additional 15% funding, beside the 35% base funding for the different measures covered under the programme (building refurbishment, and different types of energy efficient and renewable energy installations).
Main stakeholders and market actors	
Regulator (electricity and gas if relevant)	Comisión Nacional de los Mercados y la Competencia (CNMC) Website: https://www.cnmc.es/ Role: independent regulatory body responsible for ensuring effective competition in energy markets, and for its objectivity and transparency for the benefit of all subjects that operate in the system, including consumers.
Network operators (DSO, TSO for electricity and gas if relevant)	**DSO**: I-DE, Redes Eléctricas Inteligentes, Grupo Iberdrola (in Ispaster, in the Basque Country) Website: https://www.i-de.es/ Role of the DSO: operator of the electricity distribution grid **TSO**: Red Electrica de España (REE) Website: https://www.ree.es/es Role of the TSO: operator of the electricity transmission grid (Gas no relevant)
Retailers	As mentioned above, gas is not relevant for the Ispaster demo site so that the information provided below focuses in electricity. In Spain, there are two types retailers: • Reference retailer (regulated activity) • Market trader List if Reference retailers: • Energia XXI (https://www.energiaxxi.com/) • Comercializador de Último Recurso (Grupo Iberdrola) (https://www.curenergia.es/) • Comercializadora Regulada (Grupo Naturgy) (https://www.comercializadoraregulada.es/regulada) • IIBASER (https://www.basercor.es/es/) • Regsiti (https://tuoficinaonline.regsiti.com/login) • Comercializador de referencia energético (Grupo chc) (https://www.corenergetico.es/es/) List of main marker traders: • Endesa Energía S.A. (https://www.endesa.com/)

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	• Repsol LNG Holding, S.A. (https://www.repsol.com/es/index.cshtml) • Iberdrola Clientes S.A.U. (https://www.iberdrola.es/) • EDP Energía S.A. (https://www.edpenergia.es/es/hogares/) • Naturgy Iberia S.A. (https://www.naturgy.es/hogar) List of the main REScoops: • GoiEner (https://www.goiener.com/) • Som Energia (https://www.somenergia.coop/es/) • EnergÉtica (https://www.energetica.coop/) • Nosa Enerxia (https://www.nosaenerxia.gal/index.php/gl/) • Megara energía (https://www.megaraenergia.com/) • La Corriente (https://lacorrientecoop.es/) List of all the retailers in Spain (more than 650 in total): https://sede.cnmc.gob.es/listado/censo/2
Providers of IT solution	-
Key takeaways	
Main differences to RED II Art. 22	There is actually not a proper regulation for RECs in place in Spain, however there is the PNIEC, which is determined in RED II Art. 22 point 5, that each country member must present to the EU. In this plan, all the article points, except for the 6, are defined in the Local Energy Communities measure, which also cover the Directive 2019/944 requirements. On the other hand, the RD 244/2019, promotes shared PV installations and specifies that there are distribution coefficients that will be provided to the electric distribution and utility company. If "simplified compensation" is used (no surplus), the injected energy will be compensated in the electrical bill proportionally. The compensation, however, will only affect the energy cost until reaching zero. In case the injection is higher than the electricity usage, the electricity cost will remain zero and the customer will pay the taxes and the fix values of the services. In case the option "with surplus" is used, the producer can sell the surplus energy on the market. The self-consumption PV installation is limited to a diameter area of 500 m or can be shared between electricity user that are in buildings with the same 14 first number of the land register or have the same low-power transformer connection. In a way this Directive is following part of the RED II Art. 22, since an energy community can be created to project the installation and for the contract with the utility and distribution company. This directive, therefore, fulfils with the points 2b, 4.a y 4.c.

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Enablers & facilitators for the uptake of RECs	- Project demonstration promotion - Dissemination of the results, both earnings and problems - Financial incentives - Ethical banks and crowdfunding financing - Tools that help citizens to create their RECs in an intuitive way - Incentive in Legal and Administration support - Training and awareness to citizens and early awareness in schools
Barriers to the uptake of RECs	- No clear framework in place - Lack of confidence in regulatory stability - Five utility companies monopolise the generation and distribution of electricity - Electricity injection tariff from REC producer determined by the utility company - Complex administrative procedures - Multiple and complex legal options to create a REC - Complexity in establishing ownership of the assets associated with the REC, as well as the obligations and rights of the members (legal, administrative aspects, mainly) - Low social acceptation due to previous issues with Renewable Energy laws and regulations - Complex social acceptance for creating communities - Expensive legal and technical conditions to form a REC and build a RE installation - Limited space in cities for the installations - Some ordinances in townhalls also limit the height of PV installations (e.g. 3.75 meters in Valencia), which hinders the possibilities of creating a REC - Refurbishment required in most buildings to share thermal energy
Future opportunities / what is likely to change in the near future	IDAE and MITECO Ministry for the Ecological Transition and the Demographic Challenge) have are developing the new framework that will be following the EU Directives 2018/944 and 2018/2001. When the framework will enter into force, in combination with the already available incentives defined in the RD 477/2021, the Renewable Energy Communities will thrive. These incentives come from the Next Generation EU plan and will be distributed between six different programs that provide the opportunity to make RE installation, include storage to already existing installations for both industrial and services sector. For the residential sector only thermal RE installations are incentivised, which can be due to the already existing incentives for PV installations.

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9 Annex 2 - Detailed analysis of regulations relevant for District Heating in Spain

- Current **building requirements**:
  - **Technical Building Code** (CTE)
  - **RITE** (Regulation of Thermal Installations in Buildings (Royal Decree 1027/2007, of July 20): its General Provisions and Technical Instructions.)
    - At the regional level: Order of 3 May 1999, on the procedure for the action of the installation companies of the inspection and control entities and the owners, installations regulated by the Regulation of thermal installations in the buildings (RITE and its Supplementary IT Technical Instructions).
    - Comments on RITE 2007 (November 2007)
  - **HE2** (Performance of thermal installations) - RITE
  - **UNE-EN 15316**: Heating systems in buildings.
  - **UNE-EN 15316-4-5: 2008.** Heating systems in buildings. (referring to district heating and cooling systems).
  - **prEN 15603.** Energy efficiency in buildings. Average energy used and definition of energy systems.
  - **prEN 15315:** Heating systems in buildings. Energy performance of buildings. Global energy needs, primary energy and CO2 emissions.
  - **prEN 15203.** Energy efficiency in buildings. Evaluation of the energy used and definition of efficiency indices.
  - **RD 47/2007** - of 19 January approving the Basic Procedure for the certification of energy efficiency of newly built buildings.
  - **DECREE. 21/2006, of 14 February**, which regulates the adoption of environmental and eco-efficiency criteria in buildings.
  - Directive 2002/91 / EC. Future building requirements (EPBD).
  - Municipal regulations and plans:
    - Barcelona Energy Improvement Plan

- Regulations for **engine rooms**:
  - UNE 100020 / 1M: 1999 Air conditioning. Engine room.
  - UNE 60601 / 1M: 2001 Installation of gas boilers for heating and / or hot water with nominal heat consumption (nominal power) greater than 70 kW.
  - UNE 123001 / 2M: 2003 Chimneys. Calculation and design.
  - UNE 100155: 1988 IN Air conditioning. Calculation of expansion vessels.
  - UNE 100156: 1989 Air conditioning. Dilators. Design criteria.
  - UNE 100011: 1991 Air conditioning. Ventilation for acceptable air quality in the air conditioning of the premises.

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- DGCSI Instruction 3/2003 regulating the ventilation requirements of premises where liquid fuel boilers are installed for heating and / or domestic hot water with a rated thermal input of less than or equal to 70 kW.
- Resolution of 6 May 1994 authorizing the use of air conditioning equipment for the absorption cycle.
- Royal Decree 3099/1977, of 8 September, approving the Safety Regulations for Refrigeration Plants and Installations, as well as the orders amending it.
- Order of 21 June 2000 amending the annex to the Order of 10 February 1983 on technical standards for the types of radiators and convectors for heating by means of fluids and their approval by the Ministry of Industry and Energy.
- Royal Decree 363/1984, of 22 February, which complements the technical standards for the types of radiators and convectors for heating by means of fluids and their approval by the Ministry of Industry and Energy.
- Royal Decree 3089/1982, of 15 October, which establishes the subjection to technical standards of the types of radiators and convectors for heating by means of fluids and their approval by the Ministry of Industry and Energy.
- Royal Decree 3099/1977, of 8 September, approving the Safety Regulations for Refrigeration Plants and Installations, as well as the orders amending it.

- **Cogeneration**:
  - ROYAL DECREE 616/2007, of 11 May, on the promotion of cogeneration.
  - COMMISSION DECISION of 21 December 2006 establishing harmonized efficiency benchmarks for the separate production of electricity and heat in accordance with Directive 2004/8 / EC of the European Parliament and the Council.

- **Legionella:**
  - UNE 100030: 2001 IN Guide for the prevention, control of the proliferation and dissemination of legionella in the facilities.
  - Royal Decree 865/2003, of 4 July, which establishes the general hygienic-sanitary criteria for the prevention and control of legionellosis.
  - Decree 352/2004, of 27 July, which establishes the hygienic-sanitary conditions for the prevention and control of legionellosis.

- **Others:**
  - Regulation (EC) No 2037/2000 by the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer.
  - CO2 emissions. ROYAL DECREE 1370/2006, of 24 November, approving the National Plan for the Allocation of Greenhouse Gas Emission Rights 2008-2012.

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- LAW 1/2005, which regulates the regime of trade in greenhouse gas emission rights. (BOE 59, 10-3-2005.)
- Royal Decree 1627/1997, of 24 October, which establishes the minimum safety and health provisions for construction works.
- Low Voltage Electrotechnical Regulations (Royal Decree 842 of 02/08/2002), as well as its complementary instructions.
- Materials regulations.
- Directive 1997/23 / EC on pressure equipment. Directive 2004/22 / EC on measuring instruments.
- Directive 2006/42 / EC on machinery.
- Directive 2006/32 / EC on energy services.
- Directive 2005/32 / EC on eco-design.
- EN 253 Preinsulated bonded pipe systems for directly buried hot water networks. Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene
- EN 448 Preinsulated bonded pipe systems for directly buried hot water networks. Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene
- EN 488 Preinsulated bonded pipe systems for directly buried hot water networks - Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene
- EN 489 Preinsulated bonded pipe systems for directly buried hot water networks. Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene
- Directive 92/42 / EEC of the Council of the European Union (Royal Decree 275/1995 of 24 February): minimum requirements for heat generators.
- Basic rules for the indoor water supply facilities of the "Ministry of Industry and Energy" 1975.
- Decree 18/1996, of 8 February, approving the Regulations for Classified Activities
- Regulation of Electrical Checks and Regulation of Energy Supply (Decree 12/03/54) and Royal Decrees amending it.
- Decree 20/87, of 30 April, against pollution due to Noise and Vibration.
- Regulation of Annoying, Unhealthy, Harmful and Dangerous Activities (Decree 2414/61 of 30 November) and Rules governing it (Order of 15/03/63) and Decree 05/10/64.
- Pressure Vessel Regulation (RAP)
- Energy cost regulations. Tolls and rates. Both electric and gas.
- Municipal planning regulations.
- Other municipal regulations.

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