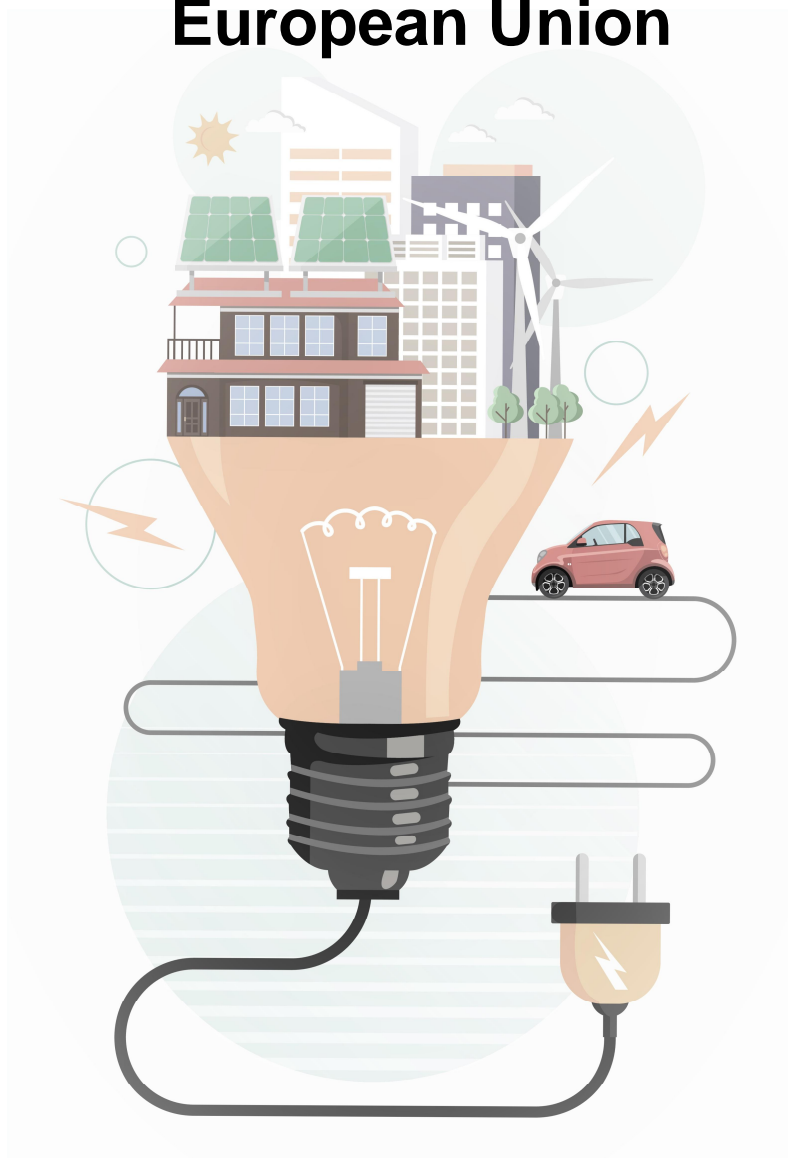




ASSET STUDY on Energy Communities in the European Union



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About the ASSET project

The ASSET Project (Advanced System Studies for Energy Transition) aims at providing studies in support to EU policy making, research and innovation in the field of energy. Studies are in general focussed on the large-scale integration of renewable energy sources in the EU electricity system and consider, in particular, aspects related to consumer choices, demand-response, energy efficiency, smart meters and grids, storage, RES technologies, etc. Furthermore, connections between the electricity grid and other networks (gas, heating and cooling) as well as synergies between these networks are assessed.

The ASSET studies not only summarize the state-of-the-art in these domains, but also comprise detailed qualitative and quantitative analyses on the basis of recognized techniques in view of offering insights from a technology, policy (regulation, market design) and business point of view.

Disclaimer

The study is carried out for the European Commission and expresses the opinion of the organisation having undertaken them. To this end, it does not reflect the views of the European Commission, TSOs, project promoters and other stakeholders involved. The European Commission does not guarantee the accuracy of the information given in the study, nor does it accept responsibility for any use made thereof.

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Table of Content

About the ASSET project	4
Disclaimer	4
Table of Content	5
Introduction	6
Scope and objectives of this study	6
Context	6
State of play	7
What is an energy community?	7
Regulatory framework in the EU	8
Examples of regulatory initiatives on Member State level	14
Market watch	32
Examples of energy communities	33
Assessing key factors driving the value of energy communities	39
Objective	39
Evolution of energy cooperatives	39
The business dimension	41
The regulatory dimension	44
The technical dimension	51
The societal context	54
Value sharing	59
Introduction	59
A simple example of value sharing	60
Value sharing and energy communities	61
Estimation of the value	62
Splitting of the value	65
Shapley value allocation rule	66
Comparing Shapley and rule	66
Conclusion	68
Recommendations regarding using the scalability and replicability potential	70
Stakeholders engagement	72
Individual interviews	72
Member States	75
Stakeholders engagement Workshop	91
Conclusion	95

Introduction

Scope and objectives of this study

Our ambition is to share clear and fact-based insights, using a systematic and analysis-driven approach, to deliver undisputed recommendations for the enabling framework of energy communities in Europe.

Based on the Clean Energy Package initiated by the European Commission, our objectives are to provide regulatory and policy recommendations for the implementation of energy community related provisions as adopted in the relevant EU law (Electricity & Renewable directives).

This general goal has been translated into specific tasks and deliverables, as follows:

1. "State of play" provides an **overview of different types of energy communities** and uses an appropriate **classification of energy communities** defined for this study using relevant returns of experience and experts feedback. Classification criteria will be defined to extract key archetypes from existing national initiatives and use cases found in the EU-28.
2. "Value drivers" performs an assessment of the **technical, regulatory and market factors** enabling the business value and market potential of these key energy community archetypes;
3. "Value sharing" elaborates on the **value (commodity + profits) sharing options** between members of the community;
4. "Replicability & scalability" analyses the **potential for replicability** of these energy communities, their business sustainability to existing trend in energy technology and regulation and finally their ability to be applied on a greater scale (scalability).
5. "Stakeholders engagement" is made of interactions with relevant stakeholders in Europe, materialised into interviews, survey and organisation of an engagement workshop. The goal is to propose our initial regulatory and policy **recommendations with reference to energy community-related provisions proposed in the Clean Energy Package** and ensure their relevance and acceptance for the stakeholders involved.

Context

The Clean Energy Package defines citizens' initiatives that fulfil certain criteria foreseen in the proposal for a revised Directive on the internal market for electricity ("the Electricity Directive" or "the Internal Market Directive")¹ or the proposal for a revised Directive on the promotion of the use of energy from renewable sources ("the Renewables' Directive")² as "energy communities" and vests them within the existing regulatory framework.

¹ The latest texts for the Internal Market Directive are the proposals adopted by the Council and the European Parliament (the General Approach on the Directive for internal market for electricity adopted by the Council on 20 December 2017 and the amendments adopted by the European Parliament on 17 January 2018 respectively.

² The latest text of the proposal for the Renewables' Directive is the one adopted under a political agreement between co-legislators on 21 June 2018.

Introducing a definition of energy communities in the Clean Energy Package has multiple purposes:

- recognizing them as the emerging type of market actors in the MS where they already exist, and
- enabling their creation in the MS where they do not exist;
- providing incentives for communities that locally generate renewable energy.

Adopting EU rules on energy communities may increase legal certainty for investors and replicability potential by removing barriers to their development.

However, the definition of energy community differs depending on the different directive definitions but also the various citizens' initiatives. In the public discourse on the energy communities in the last few years, some notions became associated with this concept, even if they are not an explicit part of the energy community definitions in the directives, such as:

- § Peer-to-peer energy trading, electricity sharing and associated markets
- § Local energy market
- § Offsetting of the electricity meter needed for electricity sharing between its members
- § Community solar and wind
- § Energy Cooperatives and RES crowdfunding

Moreover, even if commercial applications are starting to appear, most Member States do not have a clear regulatory environment for the energy communities. This results in differing value propositions and market up-take.

State of play

The objective of this chapter is to give an overview of the regulatory developments in Europe around the energy communities, to point out interesting market developments and come up with a classification of energy communities making a consistent link between the European provisions and the ongoing initiatives at national level.

What is an energy community?

“Energy community” is an emerging concept for which no widely accepted definition exists and which is applied in various ways. The European Union set out definitions for renewable energy communities and citizen energy communities and thereby started to define the regulatory environment for energy communities in Europe. In the study, we take the EU regulatory proposals as a starting point, but we look at broader developments in the market.

Energy communities as a legal entity can cover various parts of the value chain (incl. generation, distribution, supply, consumption, aggregation etc.). Often, energy communities are focusing on jointly investing in nearby RES projects, thereby participating in the simple investment opportunity and related returns. But there are also energy communities providing more complex solutions to its members, such as

self-consumption combined with storage, p2p-trade, balancing, where management of the distributed energy resources and in some cases even of the distribution grid and trading, becomes increasingly important.

Value propositions related to energy communities may be very diversified and include:

- § Local energy supply
- § Sustainable energy supply
- § (Partial) energy autarky
- § Technology preference for distributed energy sources (over centralised or large-scale RES installations)
- § Independence from national energy policy and large incumbents
- § Active participation of citizens in the shaping of the energy context and other emerging individual solutions, as indicated in *Figure 1*.

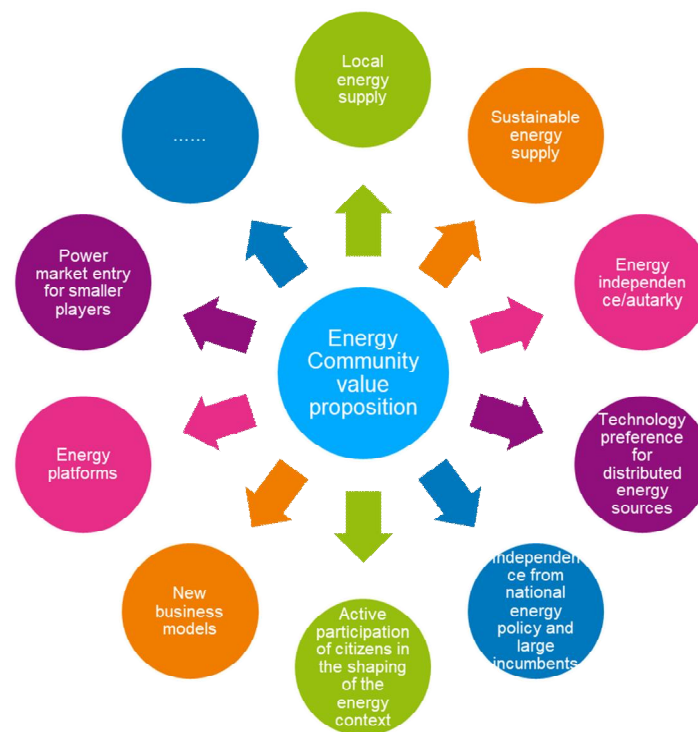


Figure 1: Examples of energy communities value propositions

Regulatory framework in the EU

Despite the emerging nature of the energy community concept, several Member States as well as the EU have taken an attempt to develop regulatory frames for energy communities' operations.

On the EU level, the energy community concept is defined in the Renewable Energy Directive (REDII)³ and the Internal Electricity Market Directive (IEMD)⁴.

Renewable Energy Directive

REDII, defines an energy community and provides the principles of understanding and operating renewable energy communities.

According to REDII, a renewable energy community is a legal entity, which is

- § based on open and voluntary participation
- § autonomous
- § effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity
- § operating based on the applicable national law.

Its shareholders or members are natural persons, SMEs or local authorities, including municipalities. Its primary purpose is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits. In fact, the directive clearly underlines that that participation in an energy community should not constitute the members'/shareholders' primary commercial or professional activity.

Renewable energy communities are entitled to

- § produce, consume, store and sell renewable energy, including through renewables power purchase agreements
- § share, within the renewable energy community, renewable energy that is produced in own units
- § access all suitable energy markets both directly or through aggregation.

The relevant DSO should cooperate with RES communities to facilitate internal energy transfers.

Member States shall facilitate the operation of energy communities via:

- § an assessment of the existing barriers and potential of development of renewable energy communities
- § elimination of the identified barriers
- § enabling tools to facilitate access to finance and information
- § regulatory and capacity-building support to public authorities in enabling and setting up renewable energy communities, and in helping authorities to participate directly

³ 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 sources (Text with EEA relevance.) 767 final/2, https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_1.pdf

⁴ Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast) - Analysis of the, COM(2016) 864 final compromise text with a view to agreement, 2016/0380(COD), Council of the European Union, 11.01.2019/2, https://eur-lex.europa.eu/resource.html?uri=cellar:c7e47f46-faa4-11e6-8a35-01aa75ed71a1.0014.02/DOC_1&format=PDF

- § fair, proportionate and transparent procedures, including registration and licensing procedures, and cost-reflective network charges, as well as relevant charges, levies and taxes, in line with a transparent cost-benefit analysis of distributed energy sources
- § enabling cross-border participation
- § taking into account specificities of renewable energy communities when designing support schemes to allow them to compete for support on an equal footing with other market participants.

Internal Electricity Market Directive

At the point of writing this report, the Internal Electricity Market Directive (IEMD), which will recast Directive 2009/72/EC, had not been approved by the Parliament yet. However, the Council of the European Union already provided a consolidated version on the 11th January 2019⁵. Committee of Permanent Representatives (Coreper) endorsed the agreed text on 18 January 2019. The European Parliament adopted the recast proposal on the 26th March 2019 plenary session⁶. This will be followed by the formal adoption by the Council and publication in the Official Journal⁷.

The IEMD proposal defines the citizen energy community as “a legal entity which is based on voluntary and open participation, effectively controlled by shareholders or member who are natural persons, local authorities, including municipalities, or small enterprises and microenterprises. The primary purpose of a citizen’s energy community is to provide environmental-, economic or social community benefits for its members or the local areas where it operates, rather than financial profits. A citizen’s energy community can be engaged in electricity generation, distribution and supply, consumption, aggregation, storage or energy efficiency services, generation or renewable electricity, charging services for electric vehicles or provide other energy services to its shareholders or members. “

The IEMD proposal obliges Member States to provide an enabling regulatory framework for citizens energy communities. Membership in the citizen energy community is based on the open and voluntary basis.

Members/ shareholders shall not lose their rights and obligations as household customers/active consumers. With regard to self-consumption, citizens energy communities shall be treated like active customers. Where electricity is shared, this shall be in line with a transparent cost-benefit analysis of distributed energy resources developed by the national competent authority.

The range of activities mentioned in the proposal includes generation, supply, distribution network ownership and management (subject to individual Member State decision) and market participation either directly or via aggregation. They are allowed to leave the citizen energy community.

The relevant distribution system operator shall cooperate with citizens energy communities to facilitate electricity transfers within citizens energy communities. These activities shall be subject to fair compensation as assessed by the regulatory

⁵ Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast), <http://data.consilium.europa.eu/doc/document/ST-7506-2018-REV-3/en/pdf>; The analysis will be extended with the consolidated version of the Directive when it is published.

⁶ <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2019-0226+0+DOC+XML+V0//EN&language=EN>

⁷ <http://www.europarl.europa.eu/legislative-train/theme-resilient-energy-union-with-a-climate-change-policy/file-jd-consumers-in-internal-market-in-electricity>

authority. Citizen energy communities will be financially responsible for the imbalances they cause in the electricity system.

Citizen energy communities shall be subject to non-discriminatory fair, proportionate and transparent procedure and charges, including registration and licensing, and transparent and non-discriminatory and cost reflective network charges, ensuring they contribute in an adequate and balanced way to the overall cost sharing of the system.

Member State may allow citizen's energy communities the right to entitled to own, establish, purchase or lease distribution networks and to autonomously manage distribution network in their area of operation. If this is the case, citizen's energy communities may conclude an agreement with a relevant distribution system operator or transmission system operator to which their network is connected on the operation of the citizens energy community's network and are subject to appropriate network charges at the connection points between the community network and the distribution network outside the citizens energy community. Such network charges shall account separately for the electricity fed into distribution network and the electricity consumed from the distribution network outside the citizens energy community

Member States may allow citizens energy communities for cross-border participation.

Comparison of definitions in the Directives

The European Union legislation, as described in this chapter, has been a holistic attempt to provide a definition for energy communities. Both regulatory documents focus on slightly different aspects of energy communities' operations: IEMD defines the role of energy communities in the energy system, including cooperation with grid operators, and its possible activities along the value chain. REDII narrows its attention to renewable energies and pays a lot of attention to policy and regulatory support foundations, to eliminate possible barriers and stimulate exploitation of energy communities' potentials in Member States.

Technological dimension

While the REDII clearly refers to renewable energy projects (referring to "renewable energy communities") only, while IEMD proposal uses the term "citizen energy community", not limiting the scope of technologies to renewable energies. However, it prioritises electricity only. In that sense the REDII is stricter and narrower than IEMD proposal. Both documents also vary slightly in energy communities' roles along the energy value chain, as presented in *Table 1*.

Types of activities	REDII	IEMD
Production of energy		
- Renewable electricity	✓	✓
- Non-renewable electricity		✓
- Renewable heat	✓	
- Renewable transport	✓	
Energy sharing	✓	✓

Types of activities	REDII	IEMD
Distribution		✓
Supply		✓
Balancing responsibility	✓	✓
Consumption of energy	✓	✓
Aggregation		✓
Energy storage	✓	✓
Efficiency services		✓
EV charging		✓
Energy services		✓
Sales of energy	✓	
Market access (direct and via aggregation)	✓	✓
Possibility of cross-border participation	✓	✓

Table 1: Comparison of activities defined for energy communities in REDII and IEMD proposal

Role in the power system and cooperation with grid operators

According to both documents, energy communities shall be subject to procedures and charges, including network charges, ensuring that they contribute in an adequate way to the overall cost sharing of the system, in line with transparent cost-benefit analysis of distributed energy sources, developed by the respective energy regulatory authority. Both documents also underline that DSOs should cooperate with energy communities to facilitate energy transfers within the community. IEMD, however, requests fair compensation to the DSO, assessed by the respective energy regulatory authority. IEMD also imposes the financial imbalance settlement on energy communities.

Possibility of owning, establishing, purchasing, leasing and managing grids is an important differentiator raised by IEMD proposal in the area of energy communities' cooperation with DSOs. Energy communities may be doing it by themselves or enter into an agreement with a DSO/TSO to operate their internal grid.

Legal form and non-commercial profile

Next, REDII provides further specific definition of a renewable energy community, going beyond the IEMD proposal definition of the citizen energy community. According

to REDII, a renewable energy community is an autonomous legal entity. IEMD does not define the citizen energy communities' formal structure.

Both REDII and IEMD emphasise the non-commercial profile of energy communities, underlining that their primary purpose is to provide environmental, economic or social community benefits for their members or local area, rather than financial profits. Both documents underline open and voluntary nature of participation in energy communities. IEMD also clearly mentions that members are allowed to leave energy communities.

Local proximity aspect

Furthermore, REDII requires renewable energy communities to be locally controlled and links renewable energy community activities to RES projects owned and developed by this entity in the proximity of the renewable energy community operations. Such locational restrictions are not subject to IEMD proposal.

Energy community participants

Both REDII and IEMD proposal define energy community participants as natural persons, local authorities, including municipalities, or small enterprises; IEMD also mentions microenterprises. All members shall participate in communities on a voluntary and open basis. REDII further refines that all consumers, including low-income and vulnerable households, are entitled to participate in renewable energy communities. REDII also highlights maintaining the rights and obligations of RES energy community members as final customers. IEMD proposal defines that citizens energy community members will hold rights of either household customers or active customers⁸, especially when consuming own electricity.

Policy and regulatory support

REDII asks Member States to consider specificities of renewable energy communities when designing support schemes, as described in chapter 0., but for practical implementation of the support measures, any proposed national measure must be consistent with the state aid guidelines. Both documents allow Member States to open an opportunity for cross-border cooperation for energy communities.

The table below presents the summary of the key comparison of the two legislative packages.

	REDII	IEMD
Legal entity	Yes	Yes
Voluntary and open Membership	Yes	Yes
Specific governance	Yes (effectively controlled by members/shareholders)	Yes (effectively controlled by members/shareholders)
Collective action in the energy field	Yes	Yes
Members	Natural persons, local authorities,	natural persons, local authorities,

⁸ A final customer or a group of jointly acting final customers who consume or store electricity generated within their premises located within confined boundaries or where allowed by Member States, on other premises, or sell self-generated electricity or participate in flexibility or energy efficiency schemes, provided that these activities do not constitute their primary commercial or professional active, IEMD proposal, article 2

	REDII	IEMD
	including municipalities, SMEs	including municipalities, small enterprises and microenterprises
Locational limitation	Yes (local proximity)	No
Type of energy	All RES	Electricity only
Technology neutral	No (only RES)	Yes
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits
Activities of energy communities	Limited: Producing, consuming, storing and selling renewable energy (also through PPA)	Broad: Electricity generation, distribution and supply, consumption, aggregation, storage, energy efficiency services, generation of renewable electricity, charging services for electric vehicles, other energy services
Electricity sharing	Yes	Yes
Imbalance responsibility	Yes	Yes
Non-discrimination	Yes	Yes
Market Access	Yes	Yes
Consumer protection	Yes	Yes
Support provisions	Tools to facilitate access to finance and information; regulatory and capacity-building support to public authorities in enabling and setting up renewable energy communities; Member States shall consider specificities of RE communities when designing support schemes	n.a.
DSO status	n.a.	Member States may allow the DSO status
Cross-border participation	possible	possible

Table 2: Summary of comparison of REDII and IEMD

Examples of regulatory initiatives on Member State level

As the concepts of energy communities have emerged bottom-up, several Member States have sought to support it and related new business models with regulatory or policy measures. Since the concept of “energy communities” is broad, also the approach and aim of support for energy communities varies immensely between MS: from establishing regulatory exemptions in licencing requirements for new business models (example of Netherlands) to special rules in auction schemes for RES support (example of Germany). Below, we present several interesting examples. Note that not all of these examples comply with the energy community definitions of the REDII and the IEMD, especially for two key features: capital ownership and locality.

Dutch legislative framework to promote new business models

In 2015, the Dutch government implemented a decree in 2015 to gain experiences with new types of legislation - Decree of 28 February 2015, concerning the deviation

by experiment of the Electricity Act 1998 for decentralised generation of renewable electricity (Decree on experiments on sustainable electricity generation)⁹.

Experimentation Decree applies to projects operated by associations, meaning owners' associations and energy associations for the purpose of

- § increased utilizations of renewable energy or combined heat and power (at local level)

- § more efficient use of the available energy-infrastructure;

- § increased involvement of energy-users in their own energy provision.

The applicants are entitled to provide proposals of integrated hybrid solutions, including local grid linking several energy sources, and energy sharing.

The maximum generating capacity for projects is determined in connection with the expected use of the customers participating in those projects.

These associations must be entirely controlled by their members, who decide on the organization, progress and distribution of costs of a project. Additionally, the associations must demonstrate in their application that they possess the necessary organizational, financial, and technical expertise to fulfil all required goals of the planned activities. They also have to finance the entire project.

Projects subject to the regulation must

- § Serve a maximum of 10,000 customers, of which min. 80% must be end consumers

- § Optimise supply and demand when supplying decentralised energy sources (DER) of max. capacity of 5 MW

- § Include construction or maintenance of a part of a network, connection or auxiliary means and the DER supply

- § Prove balancing methods

- § Create or maintain a project network and supplying DER

- § Not jeopardise system security

- § Meet environmental requirements

- § Assure safety of consumers.

Members are entitled to set their own internal tariffs for supply, subject to the energy regulatory office approval.

The Decree provides a definition what types of networks are eligible for the decree:

- § not being the national high-voltage grid

- § A single connection is connected to a network that is managed by a network operator

- § Lies within a geographically defined location or location with shared services

- § To which a maximum of 500 customers are connected

⁹ <https://www.rvo.nl/subsidies-regelingen/experimenten-elektriciteitswet/stand-van-zaken/besluiten-ontheffingen-experimenten-elektriciteitswet>; the decree can be found at: <https://wetten.overheid.nl/BWBR0036385/2015-04-01>

§ Primarily supplies consumers with the electricity.

All participants must be generator and supplier to the members of the association and are connected (or will be within 6 months) to the same medium or low-voltage network of the grid operator to which the application relates.

So far, 17 projects were awarded to the exemption, following a tendering procedure, as presented in Table 3.

no	Year of the award	Name	Location	Main stakeholder	Technologies
1.	2015	Zvijsen Veghel	Veghel	Starlight BV	§ PV panels (200 kWp) § CHP (20 kWe) § Energy management via ITC § Dynamic electricity tariffs
2.	2015	Endona	Heeten and Raalte	Energy association Escozon	§ 7200 PV panels § Biodigester § P2P § Energy management via ITC
3.	2015	Greenparq	Reeuwijk	Real estate company Green Real Estate BV	§ PV panels on the roofs of common facilities § Heat pumps § P2P
4.	2016	Schoonship	Amsterdam	Research Centre CWI	§ PV panels § Heat pumps § Solar thermal collectors § Home batteries § P2P § Energy management via ITC
5.	2016	Nordstraat 11 Tilburg	Tilburg	Stalight BV	§ PV panels (3000 Wp) § Solar thermal collectors § Energy management via ICT
6.	2016	Villa de Verademing	The Hague	Energy cooperation Villa de Verademing	§ Heat pumps § Solar thermal collectors

no	Year of the award	Name	Location	Main stakeholder	Technologies
					§ PV panels § Residential wind turbines § Batteries § Energy management via ICT § P2P
7.	2016	Aardehousen	Olst	Owners Association Aardehousen Olst	§ PV panels § Energy management via ICT § Collective battery § P2P § Dynamic electricity tariffs
8.	2016	Kringloopgemeenschap	Bodegraven and Reeuwijk	Energy Cooperation de Windvogel	§ 2,3 MW wind turbine § 16 000 PV panels § Dynamic electricity tariffs
9.	2017	Republica Papaverweg	Buiksloterham	Coöperatie Republica Papaverweg UA	§ 302 kWe PV generation § EV charging § heat pumps § use of the central battery system
10.	2017	Micro Energy Trading Eemnes	Eemnes	Energi Coöperatie Eemnes	§ 100-200 prosumers connected to a smart grid § Planned up to 1500 members (by 2030)
11.	2017	Micro Energy Trading Amersfoort	Energiecoöperatie gemeente Amersfoort U.A.	Amersfoort	§ 820 houses and a sports complex connected to a smart grid §
12.	2018	Duurzame Wijkenergiecentrale Trudo	Energiecoöperatie Trudo U.A.	Trudo	§ Roof PV § Two small wind turbines § Supported by ENEXIS – a DSO- for grid management

no	Year of the award	Name	Location	Main stakeholder	Technologies
13.	2018	Smart Grid Groene Mient	Vve Groene Mient	Mient	§ 33 zero energy buildings § 400 PV panels, solar heaters and heat pumps § Storage § EV charging
14.	2018	Zeuden heuvels Wezep	Energiecoöperatie Woonwijk Zeuden Heuvels Wezep U.A.	Wezep	§ 57 zero carbon houses § PV panels (forecast production 377 MWh/a)
15.	2018	Smart energy grid Bajeskwartier	Coöperatie Bajeskwartier U.A.	Bajeskwartier	§ 950 zero carbon apartments § PV and wind power for electricity § Storage § EV charging § Heat pumps § Regional grid operator Liander fulfills legal duties as network operator
16.	2019	Kleine Duinvallei Katwijk	Coöperatieve Vereniging Gave Buren U.A.	Buren	§ 80 low energy studios
17.	2019	Shared energy-mobility community Amersfoort	Energiecoöperatie gemeente Amersfoort U.A.	Amersfoort	§ Share use of EV § Smart grid connecting 400-800 houses § Internal energy trading

Table 3: Overview of projects awarded under the Experimentation Decree

Source: Lamers I, Diestelmeier L, Experimenting with Law and Governance for Decentralised Electricity Systems, Sustainability, 05.02.2017, https://www.rug.nl/research/portal/files/39591245/sustainability_09_00212.pdf;
 RVO: <https://www.rvo.nl/subsidies-regelingen/experimenten-elektriciteitswet/stand-van-zaken/besluiten-ontheffingen-experimenten-elektriciteitswet>

To sum up, the Dutch initiative focuses around microgrids and small-scale RES generation, within a certain geographic proximity. Most projects subject to the

regulation are project related to RES implementation in the built environment, combined with smart grid, sometimes EV charging and storage. In principle, the projects are delivered by energy cooperatives (often set up by developers) but in 2019, a trend of engaging DSOs into internal grid management is observed. Energy communities subject to the Crown Decree regulation can include both CHP- and RES sources, as well as microgrid (and even internal tariffs) they are closer to the IEMD definition than the one represented by REDII.

The first evaluation of the programme effectiveness is foreseen in 2019 so it is still too early to draw conclusions its effectiveness.

The table below presents the comparison of the Dutch initiative to the EU regulations.

	REDII	IEMD	The Dutch royal decree
Legal entity	Yes	Yes	Yes
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	Limited membership: owners' associations, energy associations
Locational limitation	Yes (local proximity)	No	Yes
Type of energy	All RES	Electricity only	Renewable electricity and CHP with capped capacity
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	Producing, consuming, storing and selling energy
Electricity sharing	Yes	Yes	Yes
Imbalance responsibility	Yes	Yes	Yes
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes
Consumer protection	Yes	Yes	Yes
DSO status	n.a.	Member States may allow the DSO status	Energy communities are allowed to own and manage the local grid

Table 4: Comparison of the Dutch initiative to REDII and IEMD

Regulatory sandboxes in UK to support new business models and innovation¹⁰

Ofgem has introduced a "regulatory sandbox" service with the aim that innovators trial innovative business products, services and business models that cannot currently operate under the existing regulations. Experiences with the proposed solutions will further contribute to the Future Retail Market Design project¹¹.

Projects need to meet certain eligibility criteria:

- § The proposal needs to be genuinely innovative
- § The innovation will deliver consumer benefits and consumers will be protected during the trial
- § A regulatory barrier inhibits innovation
- § The proposal can be trialled

Trials run for a set period of time (up to 24 months) with a limited number of customers. The trial needs to produce explicit learning objectives to test the viability of the business model. At the end of the trial, all rules will apply as normal. Ofgem intends to consider the results during future policy development. Where national regulation prevents the launch of a product or service that could benefit consumers, Ofgem looks at granting a regulatory sandbox to enable a trial. The regulatory sandbox depends upon individual talk for each project (including elements like duration of the trial, protection for consumers and agreement with third parties).

So far, two application rounds have been run¹². The approaches we have agreed are specific to the controlled environments of the trials, and the views expressed should not otherwise be taken as Ofgem's interpretation of the rules.

The licensed supplier in each trial will continue to fulfil their legal, license and code obligations towards the customers on the trial.

The following sandboxes have been granted.¹³:

- § A consortium led by EDF Energy R&D UK and including Electron, PassivSystems, Repowering London and University College London are trialling a peer-to-peer local energy trading platform. The platform aims to allow residents in urban areas to source their energy from local renewables and trade that energy with their

¹⁰ Sources:
https://www.ofgem.gov.uk/system/files/docs/2018/09/what_is_a_regulatory_sandbox.pdf,
<https://www.theade.co.uk/news/policy-and-regulation/ofgem-regulatory-sandbox-now-open>,

¹¹ <https://www.ofgem.gov.uk/publications-and-updates/future-supply-market-arrangements-response-our-call-evidence>

¹²
¹³ Source:
https://www.ofgem.gov.uk/system/files/docs/2018/09/outcome_of_sandbox_window_1.pdf

neighbours, increasing self-consumption of low carbon energy and reducing overall energy costs.

- § Empowered: Trialling a local peer-to-peer energy trading scheme. The trial aims to enable consumers to trade electricity directly with each other and yield benefits for the local community and the wider electricity system.
- § OVO: Trialling an innovative tariff supported by smart home technology. The trial product is designed to enable lower bills and warmer homes for customers with storage heaters who are currently limited to economy 7 / economy 10 tariff options, whilst also enabling grid balancing capabilities.
- § Green Energy Networks (GEN), SmartKlub and SIG are working in partnership and together will run two separate trials, one in Cannock Chase, Staffordshire and another in Trent Basin, Nottingham. Each trial also has additional local partners.
- § Chase Community Solar, a community benefit society, has fitted photovoltaic (PV) solar panels to homes owned by Cannock Chase District Council. GEN and SmartKlub want to test a new arrangement that maximises the benefit from local PV generation, new battery storage and digital control technologies, putting a community Energy Services Company (ESCO) at the centre of the relationship with residents. Digital technologies provided by SIG will switch customers' electricity supply between local solar, battery storage and the grid. It will also send generation and consumption data to a central software platform. GEN and SmartKlub will establish the ESCO, which will partner with a licensed supplier to provide each home with all its energy needs. The ESCO will take on the regulatory obligations of an exempt supplier on behalf of Chase Community Solar. The ESCO will send a single consolidated bill to each customer with separate lines showing their local energy and their normal tariff passed through from the licensed supplier. The project aims to automate time-of-use-tariff selection, balancing community solar and storage and lowering costs by prioritising how and when power is imported from, or exported to, the grid. By partnering with an aggregator, the ESCO is also seeking to sell local residential balancing and flexibility services to National Grid and the Distribution Network Operator.
- § Trent Basin is a brownfield site in Nottingham being developed by Blueprint, a joint venture between Nottingham City Council and 'purpose-driven' property developer, Igloo. It is part of Project SCENe (Sustainable Community Energy Networks), which looks to develop different ways of generating and supplying locally-generated heat and electricity to homes and commercial buildings. PV solar panels and a community battery have been installed at the site and a community ESCO has been set up. As with Cannock Chase, the ESCO will provide a single bill for both local energy and the tariff of the licensed supplier. SmartKlub will run the ESCO, also acting as the exempt supplier. The University of Nottingham will provide algorithms on behalf of SmartKlub. SIG will provide digital technologies to switch customers' electricity supply between local solar, batteries and the grid and send generation and consumption data to a central software platform. Limejump will act as both the licensed supplier for electricity supplied from the grid and as the aggregator offering flexibility to National Grid as part of their Virtual Power Plant.
- § Repowering London, a community benefit society, has worked with local residents and Hackney Council to create Banister House Solar. To help residents access the environmental and financial benefits of renewable energy, solar panels have been fitted to the roof of Banister House. However, at the moment the solar panels only power the communal areas and so residents benefit only indirectly. This trial aims to allow residents to benefit more directly from the solar by reducing the cost of their electricity. Verv and British Gas will trial a new arrangement that maximises the benefits from local generation and tests peer-to-peer electricity trading across a

distributed ledger platform. Energy supplied by Banister House Solar will be traded on a software platform developed by Verv. Verv Home Hubs in the flats of participating residents will monitor electricity consumption. The trial allows Verv to test practical applications of their technology, including how consumers respond to it. Verv will take on the regulator obligations of an exempt supplier on behalf of Banister House Solar. Powervault will provide battery storage.

- § British Gas will be the licensed electricity supplier during the trial. Participants will receive a consolidated bill or statement from British Gas with separate lines for the electricity supplied by Banister House Solar that is traded on the Verv platform, and power provided by British Gas. Customers will pay British Gas for energy supplied by them and for energy supplied by the Verv platform as trades take place.

The British regulatory sandbox approach, like the following one in Poland (see below) is aimed at testing new regulatory solutions and provide advice on regulatory developments in the power market space, within the scope of responsibility of Ofgem. It requires advanced projects, ready to implement and test their effectiveness on a short notice. All but one of the trials seek to maximise the benefits of locally-produced (and sometimes stored) electricity for local consumers. Some of the trials also plan to explore the use of platforms to facilitate peer-to-peer energy trading. Trials must be completed within two years of approval. The two rounds run so far cover a wide array of projects, mainly run by large organisations and testing new tariffs and application of local RES solutions.

So far, Ofgem has drawn the following conclusions¹⁴:

- § It is not always clear to innovators what they can and can't do. Innovators commonly need advice, not a sandbox.
- § When a proposition isn't possible today it is usually because of a complex mix of requirements including industry norms, systems, charging arrangements, codes and licences.
- § Innovators are focused on launching businesses, not trials.
- § Start-ups want to signal low regulatory risk to investors.
- § Innovators have to operate within existing structures.
- § Innovation is happening across the sector, with local electricity supply featuring strongly.

The broad scope of the eligibility criteria makes the British regulatory sandbox solution closer to the IEMD proposal, rather than REDII.

The table below presents the comparison of the UK sandbox initiative to the EU regulations

	REDII	IEMD	UK sandbox
Legal entity	Yes	Yes	Not specified
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	Not limited

¹⁴ <https://www.ofgem.gov.uk/publications-and-updates/insights-running-regulatory-sandbox>

Locational limitation	Yes (local proximity)	No	No
Type of energy	All RES	Electricity only	Electricity
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	Test regulatory barriers for innovative solutions
Electricity sharing	Yes	Yes	Not specified
Imbalance responsibility	Yes	Yes	Yes
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes
Consumer protection	Yes	Yes	Yes
DSO status	n.a.	Member States may allow the DSO status	Not specified

Table 5: Comparison of the UK sandboxes initiative to REDII and IEMD

The Energy Cluster concept in Poland¹⁵

The Polish concept of Energy Clusters can be described as agreements between locally active entities involved in the production, consumption, storage and sales of electricity, heat, cold and electricity in transport (or fuels).

The cluster formula is flexible enough to allow participants to build an individualised business model for cluster operations and optimise the legal form of their operations. Cluster members do not have to give up their existing businesses, but through collaboration - where it brings benefits to them and the rest of the cluster, they add value to the local community.

The concept of energy cluster was introduced into the Polish legal order by the Act of 22 June 2016 amending the Act on Renewable Energy Sources and some other acts (Journal of Laws, item 925). Formally, energy clusters define a civil law agreement, that is, a contract concluded by its participants. Such a contract can be concluded by natural persons, legal persons, scientific units, research institutes and local self-government units. Its subject is the generation and balancing of demand, distribution, trading of energy (including renewable sources) or individual elements selected by the members of the cluster. Cluster activity is within the distribution network with a rated voltage lower than 110 kV. The area of the cluster's activity should not exceed the boundaries of the economic area, most often a district in Poland. Energy clusters are

¹⁵ Source: Department of Renewable – and Distributed Energy, Polish Ministry of Energy, written material and supporting interview

represented by coordinators, being any member of the energy cluster or a specially designated cooperative, association, foundation, etc.

Cluster operations can be described as energy production in the local area in a way that is as coordinated as possible with the current demand.

Clusters are local initiatives. The local nature of energy clusters is since the energy is not transmitted over long distances, as high-voltage lines would be needed. Geographical distribution of energy sources in the cluster improves security of energy supply, because, in the event of any damage to the distribution network, the "cut off" group of users can be supplied from a nearby source to some extent.

In practical terms, certified energy clusters receive preferential treatment while applying for structural funds and the Ministry of Energy is working on a set of derogations to test various solutions for distributed power generation. The aim of the initiative is to find ways to commercialise RES.

Examples of Polish energy cooperatives include:

- § Friendly Energy, Energy Cluster in the Gliwice District – development of post-industrial areas - municipality of Gierałtowice, located in the Gliwice district, established an energy cluster, which involved, among others, Jastrzębska Spółka Węglowa SA. The planned energy generation from renewable sources is to be supplemented, in this case, by the cogeneration of the methane recovered from the nearby mine. The plans include, among others, the construction of photovoltaic power plants, biogas plants, energy storage and charging infrastructure for electric cars, but also cogeneration sources based on the methane recovered from mines. Cluster members also have large power consumers with a controlled work profile, which shall allow the use of the consumers' regulation to improve clustering and regulatory services. In the cluster, it is also planned to implement the, already tested, interventional island operation and the supply of the municipal critical infrastructure in isolation from the network of the external distributor.
- § Virtual Green Ochotnica Power Station Energy Cluster – involvement of individual and local authorities - The Virtual Green Ochotnica Power Station Energy Cluster was founded as the initiative of self-government authorities and scientific circles. Its main goal is to balance energy, aiming at achieving the greatest possible energy self-sufficiency and monitor the quality of electricity supply in the Municipality of Ochotnica Dolna. As part of the cluster's activities, it is planned that each energy source in the municipality should be equipped with an individual AMI counter with the possibility of communication with the central energy balancing system. This will create a virtual power plant that will form a group of jointly managed generating units, energy storage facilities and consumers with variable electricity consumption. In this group, due to the use of control systems and regulatory mechanisms for generation and consumption, the forecasting risk resulting from the variable generation of renewable energy will be minimised. Over the past few years, in the area of the Municipality of Ochotnica Dolna, self-governmental authorities and residents have conducted a large-scale campaign involving the installation of renewable energy sources to reduce electricity consumption and improve the quality and reliability of electricity supply/ So far, 120 units of "island" photovoltaic power plants of 2 kWp each belonging to households have been established in the municipality. At present, an investment of around 600 photovoltaic micro-installations for water heating (with the possibility of surplus generation of electricity produced for the grid) is carried out with a power of 2.0 kWp each.

§ Baligród Renewable Energy Micro-cluster- The goal of the energy cluster is to provide a stable supply of heat generated from the renewable sources of energy - biomass, at an affordable price. The main members of the cluster are primarily the local authorities.

The Polish Ministry of Energy, as in the UK example, is using the concept to test possibilities of new regulatory developments, based on the energy community concept. Therefore, various parties are engaged in the developed energy communities: industry, individuals and municipalities.

The Polish energy communities strongly highlight the locality aspect, similar to the REDII definition, but cover a broad scope of parties and energy sources (renewables but also coal bed methane) and therefore go beyond the REDII definition of the energy community.

The table below presents the comparison of the Polish energy clusters to the EU regulations

	REDII	IEMD	Polish energy clusters
Legal entity	Yes	Yes	Not specified
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	Open for various members
Locational limitation	Yes (local proximity)	No	No
Type of energy	All RES	Electricity only	All RES and waste (gases)
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	produce, consume, store and sell energy, limit emissions
Electricity sharing	Yes	Yes	Yes
Imbalance responsibility	Yes	Yes	Yes
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes
Consumer protection	Yes	Yes	Yes
DSO status	n.a.	Member States may allow the DSO status	Yes

Table 6: Comparison of the Polish energy clusters initiative to REDII and IEMD

Denmark: community participation rules for renewable energy projects¹⁶

Denmark has a long- and well-established renewable energy cooperatives tradition. The Danish government supports community participation in renewable energy projects through four measures:

1. The "option-to-purchase" scheme
2. The "value-loss" scheme
3. The Green Scheme
4. The Guarantee Fund

The "option-to-purchase" scheme obliges wind energy project developers to offer financial shares in new wind energy projects to local citizens (both onshore and near-to shore wind projects). Local citizens have the right to purchase shares corresponding to at least 20% of total investments. Citizen over 18 year of age who live in a radius of up to 4.5 km from the project can buy up to 50 shares in a new project (share size: the price of 1000 kWh). If any shares are left after applying this first priority rule, project developers have to offer shares to the rest of the municipality (second priority). In case of nearshore installations, this second priority right applies to up to 16 km. Local co-investors share the same rights, obligations, risks and benefits as other investors.

The "value-loss" scheme obliges RES project developers/owners to compensate local citizens for any lost property value linked to the realization of the project. The lost value is determined by an independent competent authority. Property owners are compensated if the lost value amounts to more than 1 % of property value.

The Green Scheme is a support scheme targeting municipalities. It aims to improve the municipalities' incentives for renewable energy development. Municipalities who approve new wind energy projects can apply for funding of recreational projects that improve life (e.g. recreational or nature conservation projects) or benefit the local citizens in other ways (e.g. educational projects). Payments are meant as compensation for the negative environmental impact and are linked to the number and size of installations. The funds come from the state budget.

The Guarantee Fund provides financial guarantees of up to 67,000 EUR guarantee to the financial institutions that lend money to local wind energy cooperatives. In case the project is not realised, the guarantee fund covers the loss. Cooperatives must have at least 10 natural persons with co-decision rights as members. The majority of the members shall be residents in the municipality of the site or live within 4.5 kilometres distance.

All these measures are currently under review by the government, but it is likely that they will be prolonged. The most commonly used schemes are the "option-to-purchase" scheme and the Guarantee Fund. The first three schemes aim at increasing local added value and local acceptance. The Guarantee Fund aims to reduce planning

¹⁶ Source: Based on presentation by and interview with Rasmus Tengvad and Tina Knudsen-Leerbeck, Danish Energy Agency

barriers for wind projects with community participation (financial risk at early planning stage).

With the exemption of the guarantee fund, none of the presented schemes is tied to any specific legal construct or profit regulation. The focus is on community participation and/or compensation with the aim to increase local acceptance. Projects with community participation have the same rights and obligations as any other market participant, they are not privileged as such. According to the Danish Energy Agency, the main driver for establishing energy cooperatives in Denmark are economic benefits for its members.

While the Danish approach has been very successful in promoting renewable energy cooperatives and community participation in renewable energy projects, it does not match the renewable energy community definition provided in RED II, at least not fully: It does not require full cooperative ownership of RES projects, and projects are allowed to be fully commercial and for profit. However, the measures do strengthen local involvement and local added value.

The table below presents the comparison of the Danish community rules to the EU regulations

	RED II	IEMD	Danish community rules
Legal entity	Yes	Yes	No
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	municipalities and local cooperatives
Locational limitation	Yes (local proximity)	No	Yes
Type of energy	All RES	Electricity only	Wind power
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	Provide additional compensation to communities where wind power is developed
Electricity sharing	Yes	Yes	Yes
Imbalance responsibility	Yes	Yes	n.a.
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes
Consumer protection	Yes	Yes	Yes
DSO status	n.a.	Member States may allow the DSO status	no

Table 7: Comparison of the Danish community rules to REDII and IEMD

Germany: privileges for local renewable energy communities in wind onshore auctions

Renewable energy communities play a relevant role in the German renewable energy sector (see section “market watch”). The German government recognises actor diversity as an important pillar of the “Energiewende” (however, actor diversity refers to a variety of actors, not only energy communities).

In the past, RE communities used the low-risk investment environment of the feed-in tariff/premium scheme to develop community projects. With the introduction of RE auctions, concerns were raised that small project developers and community energy stakeholders would not be able to compete in the auctions, especially in the wind onshore auctions that require substantial predevelopment for participating in the auction¹⁷.

To ensure participation of local communities in the national auctions, the German Renewable Energy Act 2017 introduced special rules for community wind power that applied to the first three onshore wind auction rounds held in 2017. The preferential participation rules applied to so called “citizen energy communities”, i.e. companies consisting of at least 10 natural persons who are members or shareholders eligible to vote. Furthermore, the majority of voting rights needs to be held by individuals living since at least one year in the same district in which the wind installations is planned to be built. Those who fulfil these criteria benefit from the following privileges:

- § Lower material qualification requirements (this rule has been revoked by now): while other bidders must present a permit according to the Federal Emission Control Act (which is a lengthy and expensive step which stops many projects), energy communities can participate without this permit but have to present it at a later stage. At the time of the auction, they also benefit from lower financial guarantees (bid bonds) than regular projects (15€/MW instead of 30€/MW at the time of the auction). However, once the permit has been issued, they have 2 months to present it to the body in charge of carrying out the auction and to submit the second part of the financial guarantee (15€/MW).
- § Longer realisation period: reflecting that community projects without permit are much less developed at the time of the auction, their realisation period is two years longer than the regular one which lasts for thirty months.
- § Preferential price rule: while other bidders get the price they bid (“pay as bid”), community projects get the clearing price (“pay as cleared”). The clearing price is the price of the highest successful bid of an auction round and therefore usually higher than the individual bid. This rule is supposed to reflect that energy community bidders might have more difficulty to judge the competition and determine an adequate mark-up for their bids.

The intention behind these privileges was to lower the entry barriers for local renewable energy communities and ensure that they can participate in the new wind onshore auctions. The intention to privilege a specific segment of bidders was linked to

¹⁷ RES installations <750kW can still be developed under a feed-in premium or tariff regime, which creates a window for household or community PV development, while wind onshore projects are generally too large to fall under this threshold.

the challenge of finding an appropriate legal definition. In practice, the way “citizen’s energy company” had been defined in the Renewable Energy Act (§ 3 No. 15 EEG) triggered the emergence of new companies, fulfilling the legal requirements, but not reflecting the spirit of the definition, i.e. the segment of locally engaged citizens as originally intended. The results of the first three auction rounds displayed participation rates of “citizen’s energy company”, ranging between 66% to 81% while making 90% to 98% of the successful bidders. The high win rate of citizen energy projects can be explained by the low qualification requirements and long realization period, which provided a substantial economic benefit compared to other bidders. Against this background, these preferential rules were stopped as of 2018. Since then, citizen energy projects also must provide a permit and are subject to the same realization period as other bidders.

The reason for stopping these privileges was on the one hand the market distortion for other bidders, on the other hand the fact that a few professional project developers engaged in creating citizen energy projects to benefit from the advantages. E.g. they asked their employees or other “natural persons” to create citizen energy communities for whom they would then develop the wind energy projects.

Since 2018 citizen’s energy companies can only participate like all other bidders with a permit. However, they still benefit from preferential pricing rules and have now 2 months after publication of the auction results to submit the second half of the financial guarantee. With these initiated changes, the participation rate of citizen’s energy companies dropped significantly below 20% in the auction rounds of 2018.

The German experience showed that it is not only very complex (if not impossible) to find the right legal definition to privilege a certain group of actors, but it also distorts the auction results, when substantially different participation rules apply. Citizen’s energy companies participating without permit had up to 54 months of time to realise their wind projects, allowing them to place lower price bids already reflecting the lower costs of new generation of wind turbines. The price bids of bidders with permits reflected the currently available, more costly wind turbines. Auction results are very sensitive to the choice of parameters.

Another consequence of participating without permit is the uncertainty regarding the realisation of the wind projects. It can easily take 5 years between the development of the project and the issuance of the permit. It is not unusual that a permit is not issued at all (environmental impact, species protection, weather radar, military zone, etc.) or the application is withdrawn due to difficulties arising along the process. In addition, citizen’s energy companies have only provided 15 EUR/ kW as financial guarantee. If the price development in forthcoming wind auction is expected to go upward, it might be of financial interest for those companies to not realise their projects for which they had already been awarded with a (lower) support entitlement, but to participate with the project in another auction with the expectation of winning a higher support level. The auction scheme in the EEG does not ban already successful bidders from participating in different rounds. It is expected that an important share of the auctioned capacity to citizen’s energy companies in 2017 will not be realised, mainly because no permit has been issued or because they participated with their

issued permit in another wind auction where the support level awarded has been higher.

As citizens tend to be rather risk-averse, it is considered important to ensure stable investment conditions to trigger their investments in local renewable projects. Citizen might benefit more from a sound and stable auction design than from privileges which are then being removed due to undesired results.

Currently the government is thinking of reducing the entry barriers for citizen's energy communities to participate in wind auctions through the introduction of investment grants. These grants are to be understood as financial support for successfully undergoing the lengthy and costly permitting process for wind installations, which is a prerequisite for participating in the wind onshore auction. Once the permit has been delivered and a support entitlement successfully awarded in an auction procedure, then the grant would need to be paid back.

When comparing the German energy community provisions to REDII and IEMD, it becomes apparent that the German citizen energy community definition is in line with REDII, despite its obvious loopholes. Furthermore, in line with REDII, Germany did reflect the specificities of renewable energy communities in support scheme design, but with unintended consequences. This proves that too generous energy community privileges bear the risk to lead to market distortions. As of 2018, the provisions have been more balanced.

The table below presents the comparison of the German energy community auctions to the EU regulations

	REDII	IEMD	German energy community auctions
Legal entity	Yes	Yes	Yes
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	Only local citizens
Locational limitation	Yes (local proximity)	No	Yes
Type of energy	All RES	Electricity only	Wind power
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	Provide preferential treatment for energy communities
Electricity sharing	Yes	Yes	Yes

	REDII	IEMD	German energy community auctions
Imbalance responsibility	Yes	Yes	Yes
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes
Consumer protection	Yes	Yes	Yes
DSO status	n.a.	Member States may allow the DSO status	No

Table 8: Comparison of the German community auction to REDII and IEMD

Conclusions

There are two major trends observed in energy community regulations:

1. Supporting more “classical” local renewable energy community business models, where local investors get access to and support for developing innovative renewable energy projects. This is the case for Germany and Denmark.
2. Supporting innovative solutions and experimenting with new business models and possible regulatory developments. This is the case for the United Kingdom, Netherlands and Poland.

The countries representing the first trend, focus on a narrower scope of technologies for energy communities, closer to the REDII approach. These two countries have put historically a lot of attention to supporting local energy communities as well as local communities and authorities is developing RES projects. However, their approaches differ substantially. Denmark has pushed for local participation and compensation but not for cooperative governance. It also did not introduce economic privileges for cooperative RES projects (with the exemption of the guarantee fund). Germany introduced economic privileges for local cooperatives. However, the difficulty to find a legally robust definition for such cooperatives combined with the initially excessive privileges led to unintended consequences and market distortions. This illustrates the difficulty to protect a certain market segment within RES auctions. A lesson learnt is that support provisions for renewable energy communities aimed at reducing market entry barriers should be designed with care and not overly generous. Contrary to the REDII provisions, neither Denmark nor Germany prescribe any (non-for-) profit requirements for renewable energy communities.

The second approach – represented by UK, NL, Poland and closer to the IEMD proposal – does not provide specific policy support to certain types of energy communities. It also does not focus on local operations but rather offers an enabling framework for testing new electricity market solutions and business models, even though it does not become fully clear which particular benefit energy communities provide in this respect. The provided examples for the second trend allow for experimenting with new business solutions within the existing regulatory environment. Although there is no unity among them regarding the scope of market actors allowed

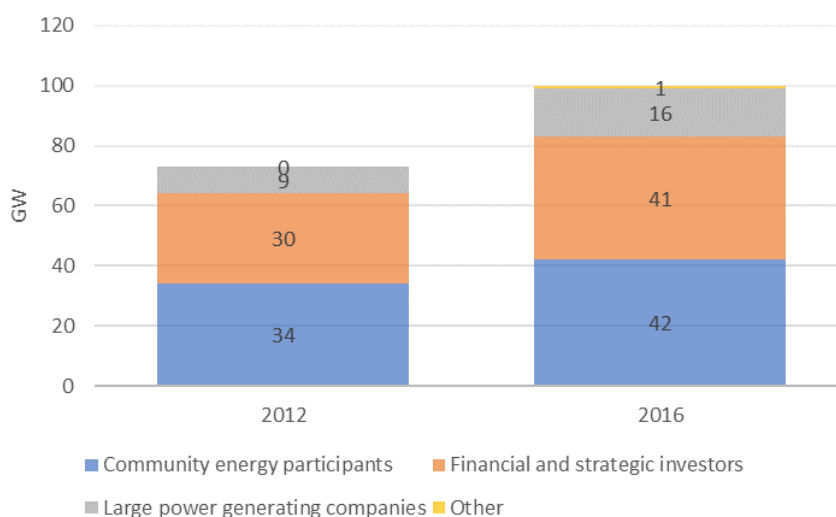
to participate in the energy community initiatives (ex. Netherlands limits this participation to individuals and housing associations, while Poland and UK do not pose any limits in that area), these regulatory developments focus on for-profit organisations and advanced technology solutions.

Market watch

Energy communities represent – by definition – a very decentralised type of energy activity. Therefore, it is difficult to capture the complete size of this segment from the macroeconomic perspective.

RESCOOP – an organisation focused on energy communities – has 1500 members and estimates that these energy communities have currently ca. 1 million participating citizens in 2019¹⁸.

According to the above sources, the interest in energy communities' business model is gradually growing. For examples, Energy Atlas 2018 estimates for Germany that energy community investment in renewable energy grew from 34 GW in 2012 to 42 GW in 2016, as presented in the graph below. However, this source uses a broad definition of community energy.



Community energy participants include

- Citizen participation (e.g. fund investment, minority interest in operating companies)
- Community-owned producers (e.g. regional energy cooperatives and majority interest in operators)
- Individual owners (e.g. individual, farmers and cooperatives)

Figure 2: Renewable energy community growth in Germany 2012-2016; source: Energy Atlas, 2018, Facts and figures about renewables in Europe¹⁹

¹⁸ <https://www.rescoop.eu/federation>

According to the “Opinion of the European Economic and Social Committee”, the main aim of cooperatives is to provide economic assistance and support to their members. Ca. 25% cooperatives were financed solely from members’ contributions. In the case of the remaining cooperatives, two thirds of the funding were obtained from cooperative banks. Every member has one vote, regardless of the amount of his/her financial contribution. And if a cooperative makes losses, members’ liability is limited to the amount of their investment. The proportion of bankruptcies in this sector (about 0,1 % of all bankruptcies in Germany) is almost negligible. Initially dividends averaging 5-6 % were paid; currently they average 2-3 %, which indicates, they are usually operated effectively²⁰.

Energy communities evolve and may represent many functions across the energy value chain.

Examples of energy communities

Below, we present some examples of energy communities, existing in the market.

Cooperative investment: Middelgrunden in Denmark

In 1996, a group of wind turbine enthusiasts got together to create a new wind turbine cooperative, following the success of the establishment of Lynetten Windpower²¹. Middlegrunden is a private partnership formed in May 1997, by the Working Group for wind turbines at Middelgrunden, with the aim to produce electricity through the establishment and management of wind turbines on Middelgrunden shoal. The Cooperative was established as were the 20 turbines, with Ørsted owning the 10 northern turbines and Middelgrunden Wind Turbine Cooperative the remaining 10.

The Turbine Cooperative is established as a partnership. Shareholders own a share corresponding to 1/40500 of the partnership per share. 40,500 Shares are sold out, which corresponds to an annual output of 1000 kWh. The shares are being held by individual people but also housing associations. Every year on April 1, dividend is paid to owners. The amount is finally determined by management, but normally the shareholders can expect that the distribution follows the budget adopted at the annual meeting. The wind farm produces ca. 44 180 MWh/a. It benefitted from an R&D funding and the support scheme for renewable energy.

The operator supervises the daily operation of the wind farm. All operational and renovation tasks of more than DKK 20,000 require approval by the board of directors. This means that the execution of major tasks always requires the conclusion of prior written agreement with the management of the pool.

¹⁹

http://www.foeeurope.org/sites/default/files/renewable_energy/2018/energy_atlas.pdf

²⁰ Opinion of the European Economic and Social Committee on ‘Prosumer Energy and Prosumer Power Cooperatives: opportunities and challenges in the EU countries’, Official Journal of the European Union, 2017/C 034/07, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016IE1190&from=FR>

²¹ www.lynettenvind.dk

The table below presents the comparison of Middelgrunden to the EU regulations

	REDII	IEMD	Middelgrunden
Legal entity	Yes	Yes	Yes
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	individuals, companies and housing associations
Locational limitation	Yes (local proximity)	No	No
Type of energy	All RES	Electricity only	Wind power
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	Produce wind power from an offshore project
Electricity sharing	Yes	Yes	No
Imbalance responsibility	Yes	Yes	Yes
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes
Consumer protection	Yes	Yes	Yes
DSO status	n.a.	Member States may allow the DSO status	No

Table 9: Comparison of Middelgrunden to REDII and IEMD

Aggregator: Next Kraftwerke

Founded in 2009, Next Kraftwerke (NK) is the operator of one of the largest Virtual Power Plants in Europe. Next Kraftwerke created a virtual power plant (VPP) that aggregates different types of renewables, e.g. wind, biogas, and solar, as well as industrial and commercial power consumers and power-storage units. Thanks to the digital networking of electricity producers and consumers in Next Kraftwerke's Next Pool virtual power plant and their access to various European electricity and balancing power markets, NK coordinates electricity production and consumption. The flexibility

and electricity of the power plants connected to the Next Pool is traded on the different energy markets or is directly used in real time to support the grid operator through reserve power and to reduce imbalance costs. By acting jointly inside the portfolio, each single plant of the Next Pool benefits from the economies of scale created and can increase the value of its flexibility. The revenues are fairly distributed to the plant owners considering the service provisions in the pool.

Next Kraftwerke offers member's electricity at the day-ahead and intraday markets of the EPEX Spot power exchange, the balancing energy market and other international electricity markets such as EXAA in Austria. They also offer balancing group management and portfolio management.

Next Kraftwerke currently represents 6,412 units of the total capacity of 5,406 MW and operates in six countries: Belgium, Netherlands, Germany, France, Poland and Austria. In 2016, the annual volume trade was 10,2 TWh. Next Kraftwerke trades mainly electricity, but also guarantees of origin.

The participating installations do benefit from existing support schemes and the community business model offers guarantees of origin trading.

The table below presents the comparison of Next Kraftwerke to the EU regulations

	RED II	IEMD	Next Kraftwerke
Legal entity	Yes	Yes	Yes
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	Open to anyone
Locational limitation	Yes (local proximity)	No	No
Type of energy	All RES	Electricity only	Electricity, CHP
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	Sell power, balancing, energy sharing
Electricity sharing	Yes	Yes	Yes
Imbalance responsibility	Yes	Yes	Yes
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes

	REDII	IEMD	Next Kraftwerke
Consumer protection	Yes	Yes	n.a.
DSO status	n.a.	Member States may allow the DSO status	No

Table 10: Comparison of Next Kraftwerke to REDII and IEMD

Micro-grid: Stadtwerke Schönau

Stadtwerke Schönau is one of the examples very close to the micro-grid definition. It was founded in 1994 by Netzkauf Schönau GbR (with participation of 650 citizens). Currently, it has 6172 members and is registered as a cooperative.

Stadtwerke Schönau is also an energy supplier and distribution grid operator that does not offer electricity that stems from installations that have nuclear or coal power companies as shareholders. 70% of electricity stems from new installations (according to the criteria of Öko-Institut). Stadtwerke Schönau portfolio consists of wind onshore (Austria, Germany), hydro (Norway, Sweden) and PV (Germany). To date, about 2,700 units were supported by the company's funding programme (in 2017 worth 1,657 mill EUR), ranging from rooftop photovoltaic systems and cogeneration units to biogas and small hydropower plants.

The cooperative EWS with its five subsidiaries cover all components of services for a decentralised and ecological energy supply - from energy distribution, grid operation and energy services, through the construction of ecological generation plants and heating networks, to cooperation. The organizational structure includes the following companies:

- § EWS Elektrizitätswerke Schönau eG provides its affiliated companies with central functions such as bookkeeping and IT services, as well as other services such as facility management and a vehicle fleet for the subsidiaries.
- § EWS Netze GmbH operates and upgrades power grids in Schönau and eight surrounding communities. Added to this is the operation of two gas grids in Schönau and Wembach as well as the takeover of services for the network operation of the associated companies.
- § EWS Vertriebs GmbH is one of the largest independent green electricity providers in Germany and offers nationwide services in the areas of electricity and gas sales, energy procurement and meter accounting.
- § EWS Energie GmbH plans, builds and operates its own and third party solar power, combined heat and power and wind turbines. It works out energy recovery concepts for municipalities; In addition, it builds and operates its own and foreign heat networks.
- § EWS Wind park Rohrenkopf GmbH built five wind turbines near Gersbach in the Black Forest. The wind farm produces climate-friendly energy for up to 15,000 households.

In addition to the subsidiaries in Schönau, EWS eG holds a stake of more than 20% in three companies:

- § The power supply company Titisee-Neustadt GmbH builds and operates energy supply networks, provides services in the energy sector and distributes electricity and gas to consumers, businesses and the industry.
- § Stadtwerke Stuttgart Vertriebsgesellschaft mbH supplies its customers with climate-friendly energy and provides energy-related services, including advice to end customers.
- § Kraftwerk Köhlgartenwiese GmbH operates energy, heat supply and telecommunications networks; The energy services are provided by the EWS Group.
- § Further participations of less than 20% in numerous cooperatives and civil societies with sustainable corporate orientation, such as GLS Gemeinschaftsbank eG, Volksbank Freiburg eG, EnergieNetz Hamburg eG or BürgerEnergie Berlin eG. In the field of energy generation, EWS eG is involved in various wind power and photovoltaic projects.

Key data of the cooperative are provided in the table below.

	2017
Electricity sales to end customers	664 GWh
Gas supplies to end consumers	430 GWh
Heat supply to end consumers	9 987 MWh
Number of power consumers served	174 937
Number of gas consumers served	14 246
Number of heat consumers served	143
Installed power capacity	22 MW
Installed heat capacity	4 MW
Total power generation	48,8 GWh
Number of power grid connections	1 560
Length of the power grid	175 km
Number of gas connections	430
Length of the gas grid	20 km

Table 11: Key Stadtwerke Schönau operational data

As of 1 January 2018, EWS Vertriebs GmbH is introducing a reduced green electricity tariff for members of EWS Elektrizitätswerke Schönau eG. In the member tariff the basic price in the electricity tariff is reduced by one euro gross per month, comparing to all other consumers supplied by EWS. Additionally, members choose the monthly subsidy for the solar investment programme: between 0.5 ct, 1.0 ct, or 2.0 ct net. The solar cent flows into our support program, as described above.

The cooperative has a very well-developed organizational structure and international reach out. Investing in RES technologies, the cooperative combines own funding with available support schemes.

The table below presents the comparison of Next Kraftwerke to the EU regulations

	RED II	I EMD	Stadtwerke Schönau
Legal entity	Yes	Yes	Yes
Members	Natural persons, local authorities, including municipalities, SMEs	natural persons, local authorities, including municipalities, small enterprises and microenterprises	natural persons, local authorities, including municipalities, small enterprises and microenterprises

	REDII	IEMD	Stadtwerke Schönau
Locational limitation	Yes (local proximity)	No	No
Type of energy	All RES	Electricity only	Electricity, heating and gas
Purpose	provide environmental, economic or social community benefits for its shareholders/ members or the local areas where it operates rather than financial profits	provide environmental, economic or social community benefits for its members or the local areas where it operates rather than financial profits	Produce, provide and sell energy
Electricity sharing	Yes	Yes	Yes
Imbalance responsibility	Yes	Yes	Yes
Non-discrimination	Yes	Yes	Yes
Market Access	Yes	Yes	Yes
Consumer protection	Yes	Yes	n.a.
DSO status	n.a.	Member States may allow the DSO status	Yes

Table 12: Comparison of Stadtwerke Schönau to REDII and IEMD

Assessing key factors driving the value of energy communities

Objective

To facilitate further development of energy communities in European Member States, the first step in this chapter will be devoted to defining more precisely their scope of application. Evolution of energy cooperatives will be briefly assessed for industrialised countries, serving as an introduction to capture the intent behind the Clean Energy Package provisions related to energy communities. Ownership models as well as the relevant markets will be identified, introducing the need for community-friendly market models.

At the core of the chapter, the dynamics of value creation for energy communities will be investigated. Starting from the European energy communities' archetypes developed in the previous chapter, an in-depth analysis of the business models will be performed alongside the identification of the related market roles and the relationships the community must have with the rest of the energy system to be able to function. In a second step, the inner relationships within the community will be analysed: how do their members allocate costs, benefits, risks and responsibilities to achieve their goal.

Finally, the assessment of the energy communities' archetypes based on the insights developed in this chapter will be performed, by applying complementary perspectives (business, regulatory, technical and societal). In doing so, we intend to unveil the key factors influencing the value driving energy communities and promote best practices to endure their success over time.

Evolution of energy cooperatives

Energy communities, in the form of energy cooperatives, exist in industrialised countries for a long time and their actual presence is primarily influenced by the specifics of national history. For instance, the tradition of energy cooperatives in Denmark and Germany has translated into a significant share of the RES production capacity being owned by cooperatives.

The German landscape for energy community provides an interesting combination of physical persons and local authorities. Bürgerenergie – translated as citizens' energy – can be understood in a strict sense as defined by the law in Germany (with the presence of cooperatives and local interests being able to exercise effective control) or in a broader sense, meaning wider than the current legal definition (without local interest and/or whose cooperative and local members have less than 50% ownership rights).

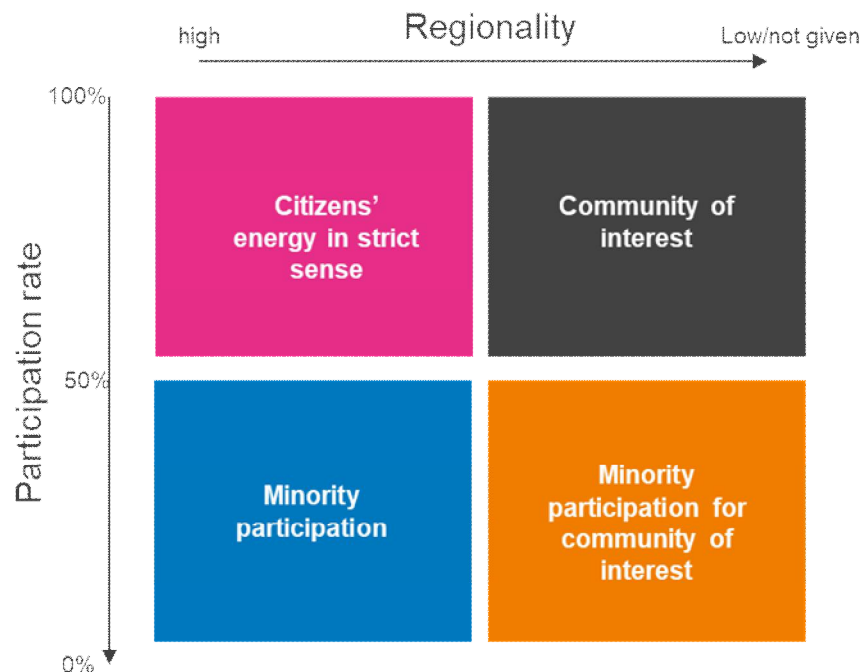


Figure 3: German landscape of energy communities. Top left: renewable energy community, top left and right: citizens energy community, bottom: no community in the EU sense since no effective control.

According to the EU definition introduced in the first section of this report, only the top two categories would surely comply with the “effective control” criteria, while the third category could comply if voting rights of all small enterprises, local authorities and physical persons in the entity sum above 50%. It is important to note that the local control of the energy community can be outsourced to a third party.

An interesting fact is that common citizens investment concentrate on technologies with higher initial investment, such as onshore wind, which highlights the very reason why citizens gather to invest in large-scale RES technology: overcome economic barriers.²²

Another striking example are the USA, where 11% of the total kWh sold in the country and 13% of connections are managed by cooperatives (so called electric co-ops). The electric co-ops played a fundamental role in achieving rural electrification in the early years of industrialisation in the US and are typically serving low density areas.²³

Next to this state of play partly explained by cultural and historical reasons, we also witness a pattern of evolution for energy communities in Western countries, as the previous chapter highlighted. The cost decline in decentralised energy resources,

²² Großteil der Erneuerbaren Energien kommt aus Bürgerhand; Ryotaro Kajimura, Nils Boenigk (2014); *Renews Kompakt*

²³ America's Electric Cooperatives: 2017 Fact Sheet; NRECA (2017; Available from: <https://www.electric.coop/electric-cooperative-fact-sheet/> Last Accessed: 02/01/2019

including generation and storage means, has changed the game in community design. It is not only about bringing together financial assets and mobilise enough capital to overcome the investment barriers that characterised the highly centralised power system and to own a wind turbine or a distribution area. It becomes more and more about bringing flexibility assets together that can provide more value if combined into a decentralised system.

Having this trend - of energy cooperatives becoming market actors - in mind, we will take a renewed look at the legal European provisions and attempt to define more precisely the underlying business models and identify what kind of assets and activities energy communities are likely to manage.

The following table illustrates the required market role for each of the archetype identified during the preliminary state of play.

	Cooperative investment	Energy sharing	Aggregator	Microgrid
RES producer	X			
Retailer		X		
Balancing Service Provider			X	
Distribution System Operator				X

Table 13: Required market roles for each identified energy community archetype.

Real life energy communities will rarely show a strict compliance the required market roles identified in the table above. Their business model can indeed be based on a combination of archetypes (example of energy sharing enabled by RES production assets owned by a cooperative) or simply, their ambitions for the future might exceed their actual scope of application. The use of the archetypes will remain valid if it is taken into consideration that actual barriers and challenges faced by energy communities are very different in their nature depending on the type of market roles they are conducting.

The business dimension

The previous chapter identified four energy community archetypes: cooperative investment, energy platform, aggregator and microgrid. This chapter will dig further into those models, describe their key relationships before discussing their ability to be sustained over time from a technical and regulatory point of view.

Energy communities may pursue non-profit goals, they still need to achieve a successful business model for their shareholders and lenders to get back their initial investment. For instance, cooperatives might decide to reinvest their economic surplus into other activities as long as those activities are consistent with their strategic goals.

However, the business sustainability of their primary activities should not be put in danger, otherwise it might jeopardise their ability to reach their strategic goals. This is the reason why, in this chapter, we will look at EU energy communities as classical economic entities and forget for a while their specific characteristics, which mostly relate to the effective control by its members (physical persons, local authorities and small enterprises).

Cooperative investment

In cooperative investment, community members fulfil the role of renewable energy investors. By paying a fixed membership fee or a variable stake, consumers will become effective member of a community that will act as an energy producer, being thus part of the system but not necessarily taking up BRP responsibilities.

As illustrated by *Figure 4*, energy community members act as RES investors. Economic ties with the rest of the system will be contractualised into a Power Purchase Agreement (PPA). It will include the produced energy but also the related financial products – like green certificates or guarantees of origin. If the production units are not only feeding the grid but also self-consuming part of the locally produced energy, an additional contract will be needed for the self-consumed energy, linking the renewable energy community to the related retailer. In most case, the entity signing the PPA is also the supplier responsible for the off-takers, but it might differ depending on the national regulation.

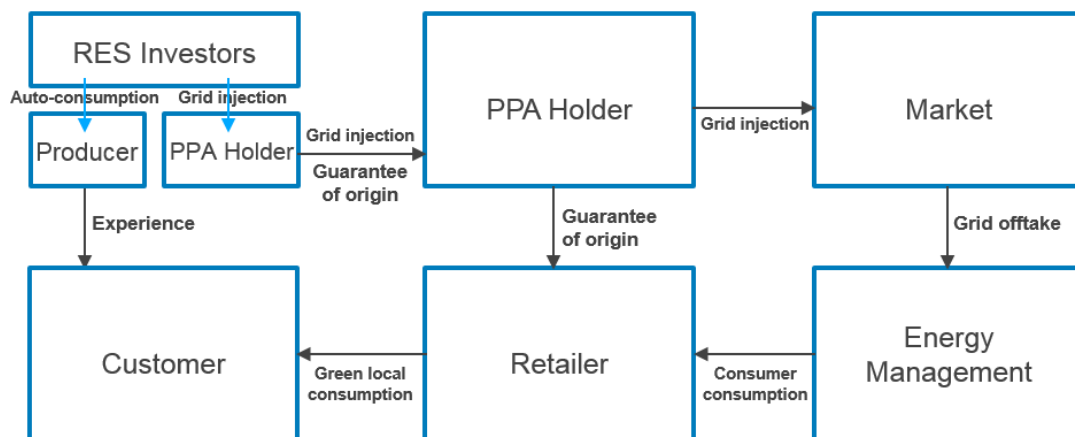


Figure 4: The business model of cooperative investments.

Energy sharing

Energy sharing archetype is an extension of the classical supplier business. This means that it goes beyond providing grid access and thus links consumers and producers in the same area. Those models are highly sensitive to national regulation, as the value creation dynamics will be deeply affected by the ability of the members to sell their electricity to other community members or make use of off-setting mechanisms of the electricity meters. A relevant example is given by the model

applied in the Netherlands by Powerpeers, which is a start-up from Vattenfall, as illustrated below. ²⁴350,000 residential customers are making use of this energy sharing platform (data from 2016). ²⁵ The value proposition for its customers is that the customers can choose themselves who supply their electricity, with a maximum of 5 PV and 5 wind suppliers, with the rest coming from bigger wind farms, selected by Powerpeers. Some business model dimensions are:

In the consultant's understanding, the support scheme is based upon guarantees of origin. This scheme is applied at European level, provides details of the sourcing of each supplier and is conducted on a yearly basis.

Key characteristics:

- § Participation fee: 6.99 €/months
- § Electricity price for producers: 0.11 €/kWh
- § Geographical context: National
- § Online platform to purchase and sell electricity. It displays who supplies the customers electricity.

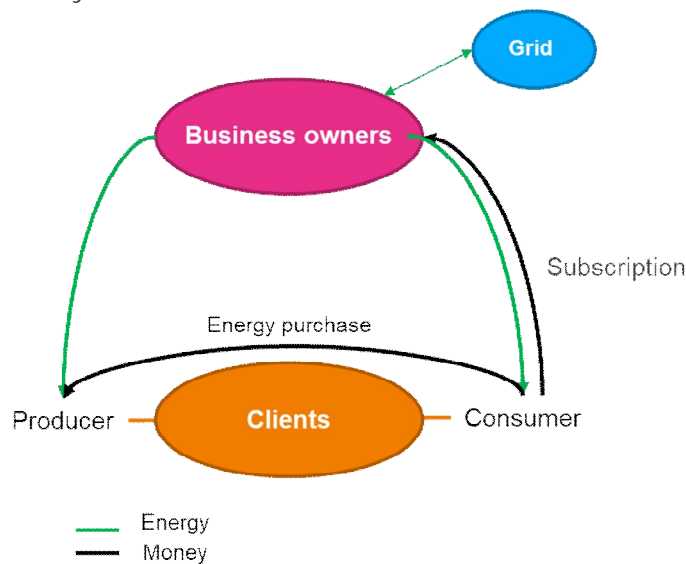


Figure 5: Business model of Powerpeers.

Aggregator

Aggregator business models are about providing flexibility from decentralised energy resources to various possible requestors in the power system. As developed by the USEF initiative, the existence of a contract requirement with the supplier and the

²⁴ Powerpeers; Available from: <https://www.powerpeers.nl/> ; Last Accessed: 02/01/2019

²⁵ Powerpeers: deel je opgewekte energie met anderen; Pieter Pau van Oerle (2016); Available from: <https://www.emerce.nl/interviews/powerpeers-deel-opgewekte-energie-andere> ; Last Accessed: 02/01/2019

aggregator is a critical aspect, as well as the obligation for the aggregator to appoint the related BRP.²⁶

In terms of value streams, the following figures summarises how the flexibility sources can be valorised by the aggregator, using USEF terminology:

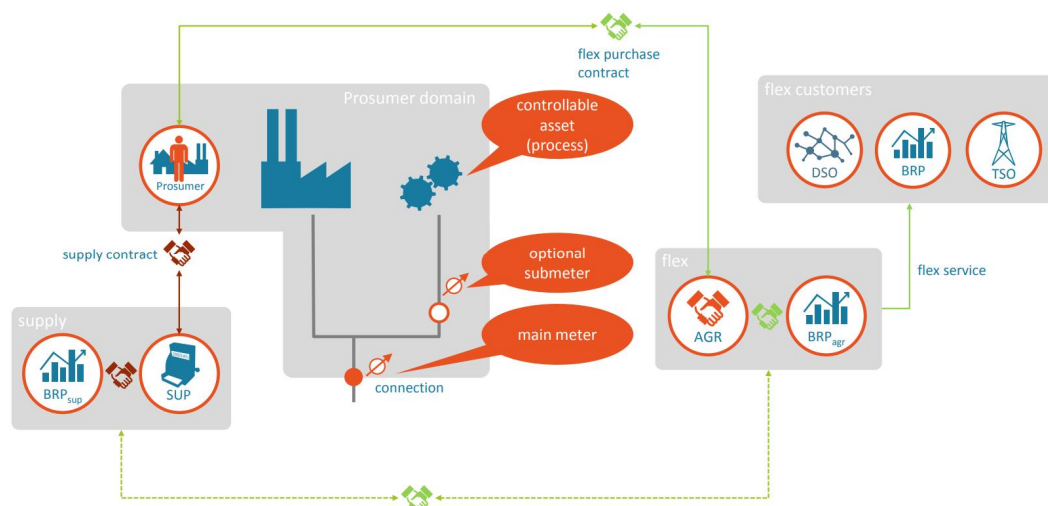


Figure 6: Valorisation of flexibility sources by the aggregator.²⁷

From the other business models, the main difference is on the more intense level of interaction with grid and market operators of the power system.

The regulatory dimension

In this section, the importance of regulations for energy communities will be investigated. First, the different market roles for energy communities will be identified, followed by the relationship of energy communities with the DSO and how DSO tariffs would possibly need to evolve in the future once the energy communities become more present in Member States.

Market roles for energy communities

As presented in chapter 0, energy communities can fulfil different market roles, as suggested by the definition of an “energy community”. Energy communities can be engaged in electricity generation, distribution and supply, consumption, aggregation, storage, energy efficiency services, generation of renewable electricity, electro-mobility and provide others energy services to its members.

Understanding what market roles energy communities are allowed to fulfil is critical to assess their ability to develop successfully and consistently with the energy system:

²⁶ USEF: Work stream on Aggregator Implementation Models; de Heer H., van der Laan M. (2016); USEF

²⁷ USEF: Work stream on Aggregator Implementation Models; de Heer H., van der Laan M. (2016); USEF

- § From inside the community, roles and responsibilities will be allocated to its members to secure the required resources: additional financing needs, capacity building of community members, outsourcing of technical expertise with external partners, ...
- § From an energy system perspective, energy communities should be properly recognised in the internal electricity market, at both commercial (supplier) and network (DSO) levels.

Market roles related to energy community archetypes

The following table describes the different roles related to energy communities and highlights which roles are of importance for the identified energy community archetypes and on which roles energy communities have a certain possible impact.

Market role	Description	Cooperative Investment	Energy sharing	Aggregator	Microgrid
Consumer	Is connected to the grid and consumes electricity				
Producer	Is connected to the grid and produces electricity				
Prosumer	A prosumer can be regarded as an end user that no longer only consumes energy, but also produces energy. Residential end users, small and medium-sized enterprises, or industrial users; they are all referred to as Prosumers. Some might have controllable assets and are thereby capable of offering flexibility.				
Investor					
Power purchase agreement holder					
Balancing responsible party	Is responsible for the imbalances in the grid caused by his customers, maintaining a partial balance between production and consumption in real time. The BRP will settle imbalances with the connecting TSO. This results in a financial safety for recovering the costs of balancing in the system.				
Transit (transmission & distribution) cost recovery	Responsible for the payments of the transit costs. A distinction between distribution and transmission transit costs can be made.				
Distribution grid operator	Manages one or multiple distribution grids and ensure its capacity meets the reasonable needs of its users.				
Supplier	The suppliers will have bilateral agreements with electricity producers and will sell this				

Market role	Description	Cooperative investment	Energy sharing	Aggregator	Microgrid
	electricity to consumers connected to the distribution or transmission network. There might be more than one supplier per connection point.				
Transmission grid operator	Manages one or multiple transmission grids and ensure its capacity meets the reasonable needs of its users.				
System operator	Responsible for maintaining a physical stable electricity system in a certain geographical area. The system operator will guarantee the cross-border capacity and energy exchanges.				
Energy community manager	Responsible for managing the daily operations of decentralised energy resources and optimise its use as well as sharing the benefits between the community members as a result of the optimisation.				
Energy management system provider	Responsible for providing the management system used by the energy community manager and tailor the system to its need.				
Meter manager	Responsible for the installation, maintenance, testing, approval and putting out of service of official meters. It generally includes the activities related to metering data management.				
Sub-meter manager	Responsible for the installation and maintenance of sensors located behind the official meters. It also includes the activities related to sub-metering data management.				
Energy service company (ESCO)	Energy service company that offers energy-related services to end users. These services include insight services, energy optimisation services, and services such as the remote maintenance of energy assets. If the Supplier or DSO is applying implicit demand response through (for example) time-of-use or kW_{\max} tariffs, the ESCO can provide energy optimisation services based on these tariffs. Unlike the (role of) Aggregator, the ESCO is not active (nor exposed) on wholesale or balancing markets				

Table 14: Market roles of the different energy community archetypes.
 Colour code: | : Role is part of energy community | : The energy community has an impact on the market role.

Relationship with the DSO

DSO perspective on energy communities

Our interviews and workshop activities have shown a recurrent pattern when it came to the responsibilities of and interactions with Distribution System Operators.

System users are requesting the “grid” to meet their changing needs, since those needs were seen as reasonable and justified from the user perspective. However, due to technological progress those needs are changing more and more rapidly, which makes the job of DSO more and more challenging. The following paragraphs take the DSO perspective and explain how grid is planned to meet future system needs, as adopted for decades by most DSOs in Europe. This policy is characterised by a “fit and forget²⁸” approach for network sizing and development.

The underlying activities, from early network planning to daily operations are the following:

§ Network Planning and Development:

- Very conservative assumptions are considered as most network elements (lines, transformers, cables, etc.) are designed to last for many years (up to 30 years). A typical design criterion used in this policy is to ensure that even if one key element in the network is unavailable, grid users will not suffer any power outage after a reasonable delay. This meant most transformers were doubled to cope with this “N-1” capacity criteria.

§ Connection Requests:

- Connection requests are considered as soon as possible to avoid appearance of bottlenecks in the grid. Remaining security margins are evaluated from time to time to ensure that a new connection request or the projected growth of grid user’s consumption would not jeopardise the distribution network.
- This network management policy is based on a deterministic approach. Extreme historical values (adjusted by new connection requests and growth in power consumption) are considered trustworthy predictions of the worst possible case scenario. Those values are compared to the N-1 capacity criteria which is the trigger for network reinforcement.

§ Operation:

- Unplanned interruptions may occur because of severe weather conditions affecting overhead lines, for instance. Operations of the distribution network occurring in response to those exceptional events are triggered in most case by grid users’ phone calls. Distribution network elements provide very low observability as monitoring capability is mostly based on binary information related to the status of protection devices. Metering information is provided with a high delay and is mostly used to allocate the distributed energy to the different

²⁸ Eurelectric identifies the “Fit and forget” approach – or copperplate scenario – as entailing heavy investments in additional distribution lines in order to prepare distribution grids for a large intake of RES electricity. This means over-sizing the distribution grid to avoid congestion during the period of strong wind or sunshine – comparable to building four or five-lane automobile highways to avoid potential congestion hours.

grid users, including others Transmission or Distribution System Operators, for billing purposes.

This traditional policy proved to be effective for a long time as the behaviour of grid users remained very stable and predictable. For instance, distribution system operators developed “Synthetic Load Profiles” for allocating a yearly consumption into the ¼ hourly values to the market players, needed to perform their balancing responsibilities.

Even though the unbundling process introduced some discrepancies in the value chain, the DSO's planning policy remained unchanged, because their major assumption, namely high predictability and low correlation of user behaviour, was still valid.

However, the uptake of decentralised energy resources, and decentralised generation units in particular, makes this passive network management policy no longer economically efficient. And energy communities have the potential to accelerate this trend and make it more intense at local level.

Grid operators have the responsibility to meet user needs under a regulatory constraint of cost effectiveness. To ensure cost effective investment for the future, DSOs could also introduce economic incentives for energy community to better cope with connection of new loads, especially EV, and production units. DSOs could for example provide reduced connection costs if they are allowed to limit access to the distribution grids during critical and unplanned events. In the long run however, the proper investment should be made for the grid to meet its users' reasonable needs. It is also likely that some DSOs, like in examples seen in France, Greece or Belgium, will take a more active role in energy communities and see the uptake of energy community as an opportunity to provide additional services, especially in their role of smart metering data manager.

Evolution of DSO tariffs

Present DSO tariffs

Let's take for an example the following tariff structure, that is applied today for end users connected to the distribution grid in Flanders, Belgium.

- 1) Grid tariffs for the use of the distribution grid
 - a) Base tariff for the use of the distribution grid:
 - i) The cost includes: the grid studies, the general management costs, excluding the grid management, the depreciation of assets, including the meters, the financing costs and the maintenance costs.
 - ii) This tariff depends on the subscribed power connection [€/kVA] the active energy consumed [€/kWh] and the period of the tariff (normal hours, off-peak hours, exclusive night tariff)
 - b) Tariff for the grid management
 - i) The cost includes: the grid management, the depreciation and financing of the assets for the management of the grid
 - ii) The tariff is in function of the active energy injected or consumer by the grid used of the distribution grid [€/kWh]
 - c) Tariff for the metering activity
 - i) The cost includes: the metering activities, including the collection of data, the validation and transmission of measured data

- ii) The tariff exists of a fixed value [€/year] and is in function of the measurement system (continuous readings (AMR), monthly readings, or yearly readings). The tariff is independent of the direction of the energy.
- 2) Grid tariff for public service obligations
 - i) The cost includes: public service obligations, such as fuel poverty supplier, supplier of last resort, rational energy consumption, public lighting, green certificates and cogeneration certificates
 - ii) The tariff is in function of the active energy consumed by grid user and possible also in function of the tariff period. [€/kWh]
- 3) Tariff for supporting services
 - a) Tariff for the voltage and reactive power control
 - i) The tariff is in function excess of reactive energy [€/kVArh]
 - b) Tariff for the compensation of grid losses
 - i) The cost includes: costs for the energy losses during distribution
 - ii) The tariff is in function of the active energy consumed or injected by grid user. [€/kWh]
- 4) Tariff related to the use of the transmission grid
 - i) The tariff is in function of the tariffs the TSO applies to the DSO and are based upon the consumed subscribed power and active energy consumed by the grid user. [€/kVA], [€/kWh]
- 5) Supplementary capacity tariff for prosumers with an electromechanical running meter
 - i) The cost includes: the residual costs of all of the above tariffs, except the one related to the metering activity. This tariff is introduced in some Member States for fairness, where no smart meters are yet installed.

A significant part of the tariffs is influenced by the electricity volume consumed, with differentiated time period to incentivise consumption shifting from peak to non-peak hours. Besides this incentive, actual tariffs do not provide much room for optimisation for the energy community manager.

Possible evolution of DSO tariff design

An interesting example from France considers the presence of energy community, acting as a “energy sharing” business model. In this case, the French regulation agency – CRE – introduced a dedicated tariff scheme to be applied to community members, meaning the end-users involved in collective self-consumption.

The ordinance of 27 July 2016 on consumptions, already allows consumers and producers connected downstream to the same medium to low voltage transformer, to exchange locally produced electricity without the need to go through the framework of a supplier offer. Users participating to such a scheme however do keep a supplier, to provide the additional electricity, not produced by the participants.²⁹ [1]

²⁹ DÉLIBÉRATION N°2018-115 Délibération de la Commission de régulation de l'énergie du 7 juin 2018 portant décision sur la tarification de l'autoconsommation, et modification de la délibération de la CRE du 17 novembre 2016 portant décision sur

The system operator is responsible for the metering of consumptions at 30-minute intervals and assigning them to production linked to the self-consumption operation or to the supplier. A decree of April 28, 2017 related to self-consumption, specifies the specific method of allocation of the electricity flows. Two types of allocation can be identified:

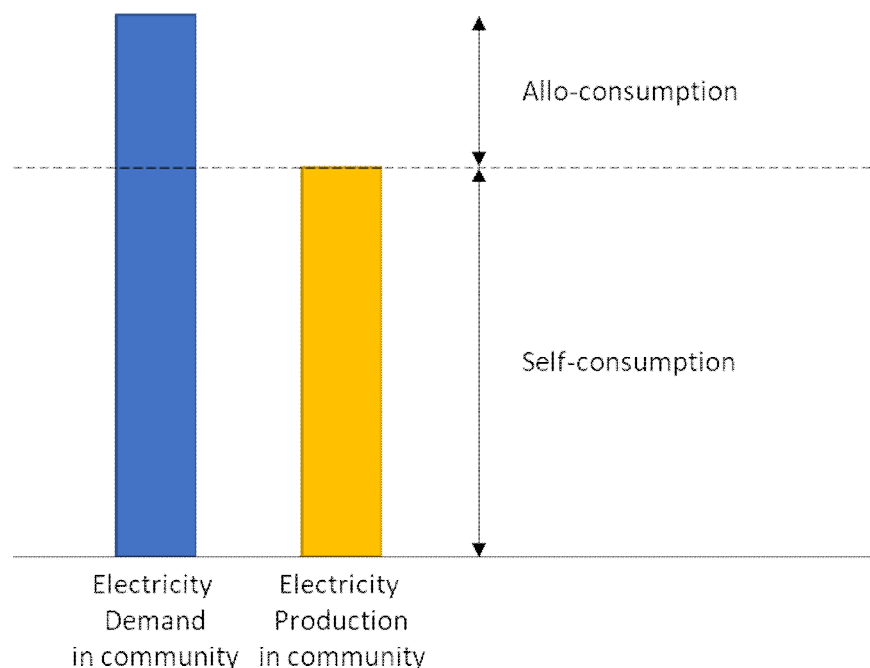


Figure 7: Two different types of allocation, defined by the French regulation in the 'Deliberation n 2018-115' [1]

1. Self-consumption: corresponding to the energy generated by the production facilities in the community
2. 'Allo'-consumption: corresponding to the energy supplied by the suppliers and fulfilling the remaining balancing responsibility

CRE has indicated in its public consultation that it planned to create an annual withdrawal component, exclusively for collective self-consumption operations, to make it possible to take advantage of the difference between self-consumption and 'allo'-consumption by refining the tariff signal. This change in tariffs will encourage consumers to maximise their self-consumption at critical periods in the network and to encourage them to decrease their 'allo'-consumption in general and specifically during such periods. The tariff change would include a lower tariff (tariff 1a and 1b) than the average tariff for the self-consumption and a higher than average tariff for the allo-

consumption, to guarantee a tariff equilibrium and cost recovery for the DSO. CRE has stated that it will review the new tariffs on the horizon of TURPE 6.³⁰

This results in the following tariffs:

TURPE > 36kVA (c€/kWh, partial)	Peak hours, high season	Non-peak, high season	Peak hours, low season	Non-peak, low season
Allo-produced offtake	4,99	3,55	3,15	0,75
Self-produced offtake	2,87	2,14	1,51	0,12
Normal offtake	4,78	2,93	2,17	1,78

Table 15: TURPE 5 tariffs for self-consumption and allo-consumption ³¹

A key assumption is taken below from the CRE official publication:

« Dans l'attente de retour d'expérience, et au vu des éléments apportés par certains répondants, indiquant qu'une part significative des projets pourrait avoir des installations de production dimensionnées de telle sorte que le phénomène de *net-metering* au pas demi-horaire sera limité, la CRE choisit de retenir un taux de participation des flux autoconsommés à la HTA de 30 %. »

The technical dimension

The technological dimension includes the readiness, availability and cost of distributed energy resources in a country. This impacts the success and uptake of energy communities in a country. Three different layers of technology needed for energy communities are identified, see *Figure 8*.

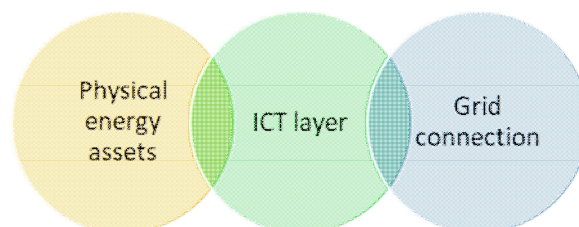


Figure 8: Three different layers of technology important for the value driving of energy communities

³⁰ DÉLIBÉRATION N°2018-115 Délibération de la Commission de régulation de l'énergie du 7 juin 2018 portant décision sur la tarification de l'autoconsommation, et modification de la délibération de la CRE du 17 novembre 2016 portant décision sur les tarifs d'utilisation des réseaux publics d'électricité dans les domaines de tension HTA et BT ; Commission de Régulation de l'Énergie

³¹ DÉLIBÉRATION N°2018-115 Délibération de la Commission de régulation de l'énergie du 7 juin 2018 portant décision sur la tarification de l'autoconsommation, et modification de la délibération de la CRE du 17 novembre 2016 portant décision sur les tarifs d'utilisation des réseaux publics d'électricité dans les domaines de tension HTA et BT ; Commission de Régulation de l'Énergie

The technical dimension is of higher importance to the aggregator and microgrid archetypes. The reason is that for both a certain level of managing and controlling the energy assets is needed, since both provide the supply of energy and balancing services. The microgrid-type of energy communities can also be in control of the distribution system operation. Both of these archetypes bring the additional value of resolving (partly) resilience, congestion and balancing problems in the grid, even with possible limited grid capacity and making households more self-sufficient and less dependent from utility companies, therefore improving their security of supply.

However, it is assumed that in the first stages of the deployment of energy communities in Europe, aggregator and more especially microgrid archetype energy communities will be more rare and therefore the management of the distribution grid will not be a common technical barrier for energy communities. There are therefore also technical barriers for the other types of energy communities, such as cooperative investment, including the investment in decentralised power units and the often expensive and lengthy grid connection.

On that account, three different levels of possible technical barriers and technical value drivers have been identified, which will be clarified in the rest of this section:

- 1) Physical energy assets, such as PV, wind, biogas assets, storage units, hydro, ...
- 2) Information and communication technologies, such as blockchain, needed for the effective control of an energy community
- 3) Grid connection of the physical energy assets, that can be costly and lengthy in time

The physical energy assets

The physical energy assets include distributed energy resources, such as solar panels, cogeneration, wind turbines, batteries, electric vehicles, EV charging stations and more. The availability, spread and a relatively low cost of some of these technologies all play an important role for the creation of the aggregator and microgrid archetypes.

The investment costs of these energy assets are perceived and are of lower risk for the participants of the energy community than in case of an individual purchase of energy assets, but only if the investment cost, the related risks and consequences are fairly distributed fairly among all its participants. Therefore, more important investments can be achieved with energy communities.

Continuous technological improvements of the renewable technologies combined with an increase in number of installations, has resulted in a decrease of the costs of renewables. Several renewable assets today have reached low enough investment costs and levelized cost of electricity (LCOE) of the shared energy assets, that little to no additional support is needed. Some examples are:

- § PV panels investment costs are below 2,000 €/kW³² and reach levelized cost of electricity for residential PV systems below 20 c€/kWh in Europe³³. [2]
- § Recent auctions in Germany have resulted in onshore wind power with an LCOE as low as 4 to 5 c€/kWh³³

³² Including inverter, cabling, grid connection, monitoring, mounting, installation and soft costs.

³³ Renewable Power Generation Costs in 2017, IRENA, 2018

For the aggregator and microgrid type of energy community, as shown in the example given in sections 0 and 0, the difficulty exists in the higher number of different types of often decentralised and distributed of energy assets. For Next Kraftwerke for example, they operate wind, biogas, and solar, as well as industrial and commercial power consumers and power-storage units. To maintain a balanced system, aggregator and microgrid type of energy communities often have to oversize their energy assets, increasing the investment costs. Also they possibly need include some back-up systems, such as still highly expensive batteries, in case they want be 100 % green.

Therefore, for both of these types of energy communities, the information and communication technology layer of the community is of high importance to operate and manage these energy communities, where the number of energy assets are higher, as well as connected consumers.

The Information and communication technologies ICT layer

In this section we discuss the technological layer that is a prerequisite for an energy community. Interaction with the surrounding distribution system, production, consumption and eventually EVs and storage is of high importance for the aggregator and microgrid archetypes. Consequently, the introduction and spread of smart meters in the Member States is of critical importance for both archetypes. Several Member States have started with the roll-out of smart meters, which is an important part of an ICT platform and that allows consumers and energy community managers to closely monitor their consumption and production and to let them become themselves suppliers on the grid. The smart metering roll-out in the Member States is at different levels of maturity, resulting in different metering schemes and standards.

Secure data handling and protection is also of importance for participants of energy communities, since there will be an exchange of a significant amount of data related to energy consumption and production. ³⁴

For microgrids, that also controls the distribution network, the fluctuating electricity from renewable resources, require additional voltage control and congestion management for the community manager. Therefore, near real-time consumption and production information is needed. However, there exist technical challenges for microgrids that do not need to be underestimated, such as the switch from grid-connected microgrid to the decoupling of microgrids from the grid, called island mode. This is followed after a certain amount of time to recoupling to the grid. The entire sequence is technologically wise very challenging requiring high level of control of voltage and frequency. ³⁴

The grid connection

If in a Member State the grid connection for energy communities is lengthy, costly and complicated, this can become a true barrier for the creation of energy communities. This is today the case more specifically for cooperatives, due to its higher spread throughout the EU. Therefore, for energy communities not fail in the development and construction phase of their project, where the grid access permit and connection to the grid needs to occur respectively, it would be advisable that all types of energy

communities have positive discrimination regarding the grid connection in the Member States by having the possibility to receive easy and prioritised grid access.

For example, in the UK, a large deposit is required to secure a grid connection with the DSO, that are privatised. This should be done ahead of consent, otherwise the energy communities lose their place on the waiting list. In Spain on the other hand, they implemented the regulation of priority access for RES to the grid, but quickly issues have arisen. When priority access for the RES was validated legally, this could be done in a preliminary stage of the project, before permitting and without obligations to effectively build the plant. The grid was therefore virtually occupied, creating a barrier of access to the grid for other applications.³⁵

The societal context

The evolution from a traditional energy model to a new energy model where the decentralised and local energy production, supply and demand are fundamental features, have considerable societal repercussions. These societal changes can be seen on organizational level, where the collective decision making is crucial, environmental level, since more green and renewable technology become more easily accessible and acceptable to citizens, and finally at societal level, including fuel poverty and the general public awareness of citizens on the existence of energy communities. The societal context has been found to be more important for the energy community archetype that relates on cooperative investment.

Organizational

Literature research has been done to find the best set of principles for energy communities regarding their organizational structure, policies and rules in place. Two sets of design principles for energy communities were analysed, being the design principles of Elinor Ostrom and of the International Co-operative Alliance and the best practice principles for organizations by REScoop.

Elinor Ostrom's design principles of common-pool resources

In view of this author, an energy community is the collective management of energy resources based on commons, where the concept of self-governance amongst the participants is the most important aspect of energy communities. Elinor Ostrom's theories, published in the book 'Governing the Commons', are applicable to energy communities, where she states that open access governance by the participants of a community should not and does not lead to overuse of the shared resources. According to Ostrom, there are eight design principles that can be followed in order to provide energy communities a higher chance a success:

1. Define clear group boundaries.
2. Match rules governing use of common goods to local needs and conditions.
3. Ensure that those affected by the rules can participate in modifying the rules.
4. Make sure the rule-making rights of community members are respected by outside authorities.

³⁴ Local energy market : Opportunities, Benefits and Barriers, Gonalo MENDES ; Jere NYLUND, Salla ANNALA, CIRED Workshop 2018

³⁵ Report on financial barriers and existing solutions, REScoop 20-20-20

5. Develop a system, carried out by community members, for monitoring members' behavior.
6. Use graduated sanctions for rule violators.
7. Provide accessible, low-cost means for dispute resolution.
8. Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.

International Co-operative Alliance's cooperative principles

Most energy communities in Europe existing today do not start with a clear organisational structure, with it evolving and developing during the formation of the energy community. For start-up cooperatives, good practice shows that to decrease the organizational complexity, having a small number of participants works best. Most energy communities in Europe do follow the seven cooperative principles, established by the International Co-operative Alliance (ICA) in 1995.

Environment

The Not In My Backyard (NIMBY) phenomenon is more easily solved when energy communities that are local control the project and are twice more likely to be accepted by the local residents than with external stakeholders³⁶, which was confirmed during interviews held with expert on energy communities. Local resistance to typically wind turbine energy projects decrease when citizens can invest and co-own the production installations.³⁷

Several Member States have realised the impact of energy communities in meeting energy targets for a low-carbon future. An example is Ireland, which has published a National Energy White Paper in 2015 and National Mitigation Plan in 2017. In those publications, the role of citizens and energy communities were emphasised to reach indeed a low-carbon future.³⁸

Also in Greece, a new law on energy communities was voted in January 2018, that defined the role of citizens and energy communities in the energy sector. The law gives them the possibility to become electricity producer, including production, supply, storage, self-consumption and sale of electricity or heating and cooling from renewables or high efficiency combined heat and power.³⁹ These examples represent the importance that energy communities have as an impact on the environment since Member States legislation give additional benefits to energy communities that use renewable energy.

³⁶ Roberts, J, Bodman, F and Rybski, R (2014). Community Power: Model Legal Frameworks for Citizen-owned Renewable Energy. (ClientEarth: London)

³⁷ The Benefits of Community Ownership; REScoop, 2016

³⁸ Gancheva, M, O'Brien, S, Crook, N, Monteiro, Catarina, M (2018). *Models of Local Energy Ownership and the Role of Local Energy Communities in Energy Transition in Europe*. Milieu LTd, Belgium, European Committee of the Regions.

³⁹ Todorovic Symeonides, M., 2018, Electricity, Greek Law Digest, Available from: <http://www.greeklawdigest.gr/topics/energy-minerals/item/91-electricity> Last Accessed: 19/12/2018

Fuel poverty

Fuel poverty is a complex issue where a household is vulnerable due to its lower income, resulting in a household that has to spend 10% or more of his income to energy services. Through energy communities, such as aggregators, low-cost or even free electricity allowances are given to their members.

An example is the Brixton Solar project in London.⁴⁰ Repowering London, which is a non-profit organisation, has three individual projects in Brixton, where PV were successfully installed on different council estates in Brixton. Residents of the estates could buy shares of £50. This amount is much less than the usual shareholding amount of £250, decreasing the threshold for the participants. 20 % of the profits of the energy communities in Brixton are allocated to the Community Energy Savings Programme (CEEF). The CEEF used these profits to directly assist vulnerable members of the community, such as renovating houses with better insulation, energy efficiency improvements or education initiatives.⁴¹ The replicability potential of this type of project is high, the founders of Brixton Solar project have launched Repowering London, which is a community benefit society to help other districts replicate the model of Brixton.

Also, the new law on energy communities in Greece, as discussed in the previous section, tries to address fuel poverty through the principles of solidarity. Greece wants to help vulnerable consumers to become prosumers and give them access to green energy, instead of giving them subsidies. The available funds should be therefore used for programs that promote civic participations incorporating principles of energy democracy. Actual and concrete policies are yet to be adopted, but there are already examples of municipalities planning to use virtual net metering in collaboration with Greenpeace. These plans include the setting up of energy communities that provide free solar energy to local vulnerable households.⁴² An example is the municipality of Larissa, that will install a PV system of at least 200 kW on the roofs of public buildings. They plan to use the renewable electricity produced by offsetting the electricity meters of vulnerable households and giving them access to free electricity.⁴³

Conclusion

We have assessed the techno-economic feasibility of energy communities and identified critical success factors that relate to the four dimensions illustrated in the following figure.

⁴⁰ The Benefits of Community Ownership; REScoop, 2016

⁴¹ Roberts, J, Bodman, F and Rybski, R (2014). Community Power: Model Legal Frameworks for Citizen-owned Renewable Energy. (ClientEarth: London)

⁴² Greenpeace Greece & REScoop.eu (2018). Energy communities in Greece: new legislation. Available from: <https://www.rescoop.eu/blog/energy-communities-in-greece-new-legislation> Last accessed: 19/12/2018

⁴³ Greenpeace Greece (2018). Larisa and Greenpeace are investing in solar social policy. Available from: <https://www.greenpeace.org/greece/issues/klima/2454/larisa-kai-greenpeace/> Last accessed: 19/12/2018.

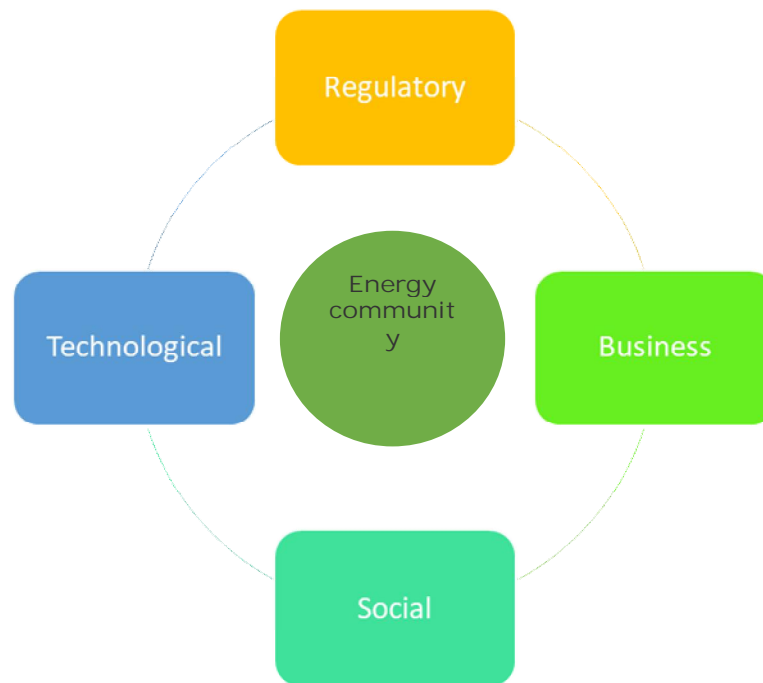


Figure 9: 4 main dimensions, driving the success and value of energy communities

Those dimension apply differently depending on the primary business model the energy community is conducting. We make the link with the energy communities archetypes defined thanks to our state of play analysis and assess how each dimension affects those archetypes, as illustrated by the following table.

Archetype Dimension	Cooperative investment	Energy platform	Aggregator	Microgrid
Technical			+	++
Societal	++	+		+
Regulatory		++	+	
Business	+	++	+	

Table 16: Critical success factors for energy communities – What dimensions on the identified energy community archetypes.

This table shows what dimensions are critical for the establishment of new energy communities and to sustain its further development. Each dimension has an impact but some dimensions are more critical for certain energy community archetypes than others. For example, the relationship with the DSO is of higher importance for the aggregator archetype than for the cooperative investment or energy platform, while

the business dimension is of higher importance for the cooperative investment than for the aggregator or microgrid archetypes.

Following main conclusions and recommendations can be made regarding the organisation of each community:

- § Clearly defined rules of the energy community should be set in place, where the participants of the energy community can all participate to the creation and decision making of the rules and policies, thus resulting in an open and democratic collective decision-making community. These defined rules should include:
 - Rules regarding the control of the capital of the community and how to share the benefits, see the following chapters for recommendations on value sharing between the members of a community.
 - Rules regarding the monitoring and controlling of the shared energy assets
 - Rules about how to sanction energy community participants that do not abide to the rules. It is recommended to include warnings and fines before taking legal steps, that are often expensive and time consuming
 - Rules about the monitoring of the rules set in place
- § The community needs to be in balance with existing legislations and regulations, where the higher levels authorities recognise the right for self-governance of the energy communities.
- § A continuous communication campaign should be set in place, where focus is given to the status of the energy communities, its organizational structure and future plans. The communication campaign is also the opportunity to educate and give training opportunities for its members.
- § If the size of a community is very large, it is recommended to organise it with nested enterprises, on local and regional level. However, attention should be given to not overcomplicate matters of value sharing and capital investment by doing so.

Value sharing

Introduction

This chapter will take a closer look at the inner functioning of energy communities, namely how they share the benefits amongst their members. There is growing evidence that local energy communities create some value for their members, sometimes as side benefits of an energy community. Such value can have different drivers for the community itself, such as:

- § A decrease of emissions motivated by environmental concerns,
- § A financial gain in the form of reduced electricity bills,
- § Willingness to become energetically independent
- § Be part of a community

Two challenges then emerge: first, non- financial values can be difficult to estimate from the point of view of a community. As an example, if a community is driven by environmental concerns with a corresponding utility function, externalities with respect to the overall power system make it difficult to estimate the real reduction of CO₂ emissions due to the formation of the community. Second, when it is possible to estimate a financial value (reduction of the electricity bill for instance), it can become tricky to assess how this value will have to be redistributed among the members of the energy community. The most intuitive way to do it is to split the value equally over its members. However, there is no guarantee that this will be fair in the case of an energy community. As an example, in the case of shared PV in France, the regulation advocates a sharing of this value proportionally to the consumption of members. However, many other sharing rules can be used: ranging from simple ones (equal, pro-rata of capacity/volume) to more complex ones inspired by economic concepts (marginal pricing) or game theory concepts (the Shapley value). To simplify the exposition, we here focus only on the value that can be easily estimated: namely the financial one.

Fairness and stability of energy communities

There is growing concern among economists that despite the creation of some value, inadequate sharing schemes might harm the stability of energy communities. Inadequate sharing might make a group of members unsatisfied. Because by regulation, no one can impose to a consumer to belong to an energy community, an unsatisfied coalition of members always has the choice to opt out from a community and consume electricity from the grid or even form a smaller community of their own. The stability of a community might then also depend on the way the value is shared among its members. Therefore, a suitable allocation rule should ensure both equity and stability of an energy community.

Method

Following method for the analysis of value sharing in energy communities will be performed in this chapter:

1. Elaborate on the question of stability in the value sharing of an energy community.
2. Give a simple example to motivate the need to look for nice allocation rules.
3. Review standard allocations rules: Simple and intuitive inspired from economics and more complex ones inspired from game theory.
4. Application of these allocations to two standard energy communities inspired from the German case and show which ones ensure stability and equity.
5. Recommendations on the implementability of a stable allocation rule and extended reflection to the role of the Distribution System Operator in his tariff schemes and his interaction with energy communities.

A simple example of value sharing

To explain value sharing in a clear manner, the example of sharing the cost of a taxi ride will be used. If two people, A and B decide to take a taxi to go to their places, there are the following possibilities:

- § If A takes a taxi alone, he will pay 4€.
- § If B takes a taxi alone, he will pay 8€.
- § Together, they can share a taxi at the cost of 10€.

Acting together as one customer, A and B can save on the cost of the ride and create a value of 2€. How should this value be shared? In other words, how much should each person concretely pay for the joint ride? The first allocation rule, in the most intuitive way, is to split the cost equally 5€ each. This means that A pays 5€ and B pays 5€ for the ride. A will then be unsatisfied: it is preferable for him to leave B and take a taxi on his own. Thus, equal splitting is not a stable allocation rule in this case.

If there is a third person C interested in the taxi ride, then the same reasoning applies: because no one has to share his taxi, then A, B and C should pay less when sharing the taxi than when they do not. Besides, A and B together should pay less than what they pay if they shared the taxi on their own (10€). Same applies for A and C, and B and C. A stable allocation rule should satisfy all possible coalitions. In that case, A, B and C can share the cost of the taxi by respecting the following: A pays less than what he would have paid if he took a taxi alone (same for B and C), the sum of what A and B pay should be less than what they would have paid if they took a taxi together without C (the same for the pairs A and C, B and C). Formally, a splitting of the cost that satisfies these conditions is said to be in the core (see below). As an example:

- § If A takes a taxi alone, he will pay 4€.
 - § If B takes a taxi alone, he will pay 8€.
 - § If C takes a taxi alone, he will pay 10€.
 - § Together, A and B can share a taxi at the cost of 10€.
 - § Together, A and C can share a taxi at the cost of 12€.
 - § Together, B and C can share a taxi at the cost of 16€.
 - § When they all share the taxi, A, B and C pay 18€.
- When A pays 3€, B pays 6€ and C pays 9€ is a stable allocation rule.

When A pays 4€, B pays 7€ and C pays 9€ is NOT a stable allocation rule: A and B can always argue that they will pay less if they take a taxi without C.

Value sharing and energy communities

In the context of this study, the German case of collective auto-consumption is used as example throughout this chapter, inspired by the recent German Mieterstromgesetz review that aims at the development of PV panels on the roofs of collective buildings.

⁴⁴

The law allows the owners or tenants of apartments in a collective building to self-consume the electricity produced locally without using the public network. Self-consumed electricity allows the consumer to not pay fees that are usually collected with the network charges. For the analysis, a case of a building where households want to jointly invest in a PV panel and locally consume electricity is considered. Households are heterogeneous showing different consumption profiles. However, they will invest in a common PV panel. Value sharing can quickly become an issue.

Regarding value sharing, many sources of value creation actually exist for the energy communities:

- § A decrease of emissions motivated by environmental concerns
 - § A financial gain in the form of reduced electricity bills,
 - § Willingness to become energetically independent, to gather into a community etc.
- To simplify the exposition, we consider that even though the main driver to create a community is often not financial, there is still some inherent financial benefits:
- § Reduced network connection fees (only one meter to install, peak reduction, demand reduction)
 - § Reduced electricity bills
 - § A remuneration of the surplus of PV production that is injected in the grid (feed-in tariff or spot price), if any.

Because retail tariffs are usually higher than the spot price, it is often more profitable to consume the electricity that is produced from the PV than inject it in the grid. Therefore, a consumer will create more value if he consumes in his flat when the PV panel produces, as compared to a consumer working all day and having a peak of consumption around 8 pm. Such a heterogeneity raises the question of equity and stability: a consumer helping the community (and therefore creating more value) should receive a higher share than the others.

⁴⁴ Bundesministerium für Wirtschaft und Energie (2017). Gesetzentwurf der Bundesregierung: Entwurf eines Gesetzes zur Förderung von Mieterstrom und zur Änderung weiterer Vorschriften des Erneuerbare-Energien-Gesetzes. Available from: https://www.bmwi.de/Redaktion/DE/Downloads/E/entwurf-mmmieterstrom.pdf?__blob=publicationFile&v=8 Last accessed: 03/01/2019

In the US, the Solar Energy Industries claims that 108 MW of community solar were installed through 2016, showing a strong momentum for joint investment in solar projects. However, not all solar community support programs have been successful. In California, the Green Tariff Shared Renewables program includes an “Enhanced Community Renewables” providing support for shared auto-consumption. While voted in 2013, the program has so far proved unsuccessful with little enrolment. Even though this may be due to regulation uncertainty or the attractiveness of other programs, many experts believe that the difficulty to create stable and satisfied communities may also explain this poor attractiveness.

Estimation of the value

We will consider a typical year with an hourly granularity. Following parameters are used:

- § I : set of households of the community, indexed by i
 - § T : time, indexed by t
 - § S : an arbitrary group of households, S is part of I
 - § $f_i(t)$: consumption profile of household i (kWh)
 - § $g(t)$: PV production profile (kWh per kW). This parameter is optimised for all coalitions S .
 - § $K(S)$: installed PV capacity (kW) of coalition S if it created a community of its own
 - § c : PV investment cost as a function of capacity (€/kW)
 - § α : variable part of the grid tariff (€/kW)
 - § δ : fixed part of the grid tariff (€)
 - § $\beta(t)$: electricity retail price (€/kWh)
 - § $\gamma(t)$: electricity wholesale price or feed-in tariff (€/kWh)
- Let us consider a coalition of households S that invests in a PV panel of capacity $K(S)$.
- § The PV production at hour t is then $K(S)g(t)$.
 - § Auto-consumption occurs before injection in the grid. Hence, PV is injected in the grid when $K(S)g(t) > \sum_{i \in S} f_i(t)$.
 - § A consumer having a profile $f_i(t)$ will pay to the DSO an annual fee (this is not the most general tariff scheme):
 - § $\alpha \text{Max}(f_i(t)) + \delta$
 - § The net demand of coalition S at hour t if PV production does not cover all the demand is $\sum_{i \in S} f_i(t) - K(S)g(t)$.
 - § The net injection of coalition S at hour t if PV production exceeds that demand is $K(S)g(t) - \sum_{i \in S} f_i(t)$.
 - § The value of coalition S is the side benefit from gathering into a community.

$$v(S) = \alpha [\sum_{i \in S} \text{Max}_t (f_i(t)) - \text{Max}_t (\sum_{i \in S} f_i(t))] + \delta(s-1) + \sum_{t=1}^T \beta(t) (\sum_{i \in S} f_i(t) - (\sum_{i \in S} f_i(t) - K(S)g(t))^+) + \sum_{t=1}^T \gamma(t) (K(S)g(t) - \sum_{i \in S} f_i(t))^+ - cK(S)$$

- 1st term on the right side: Reduction of the capacity fee. This is the so-called **aggregation benefit**. This is induced by the fact that in the winter package, the DSO is supposed to treat an energy community as if it were one consumer (Article 21 of the Renewable Energy Directive)⁴⁵.
- 2^d term on the right side: Reduction of the fixed fee. There is only one meter to install by the DSO. This is induced by the fact that in the winter package, the DSO is supposed to treat an energy community as if it were one consumer.
- 3rd term on the right side: Reduction of the electricity bill due to auto-consumption
- 4th term on the right side: Benefit from the injection in the grid
- 5th term on the right side: Cost to install the PV panel

We have calculated the value created by two energy communities in Germany. All data are taken from public sources and are for year 2018.

Building 1 (Mixed household)				Building 2 (Homogeneous household)		
Household number	Type	Annual demand (kWh)	Peak demand (kW)	Type	Annual demand (kWh)	Peak demand (kW)
1	Couple, working	2623	10.1	Retired adult	1101	5.4

⁴⁵ Article 21 of the Renewable Energy Directive: 1. Member States shall ensure that renewable self-consumers, individually or through aggregators: (a) are entitled to carry out self-consumption and sell, including through power purchase agreements, their excess production of renewable electricity without being subject to disproportionate procedures and charges that are not cost-reflective; (b) maintain their rights as consumers; (c) are not considered as energy suppliers according to Union or national legislation in relation to the renewable electricity they feed into the grid not exceeding 10 MWh for households and 500 MWh for legal persons on an annual basis; and (d) receive a remuneration for the self-generated renewable electricity they feed into the grid which reflects the market value of the electricity fed in. Member States may set a higher threshold than the one set out in point (c). 2. Member States shall ensure that renewable self-consumers living in the same multiapartment block, or located in the same commercial, or shared services, site or closed distribution system, are allowed to jointly engage in self-consumption as if they were an individual renewable self-consumer. In this case, the threshold set out in paragraph 1(c) shall apply to each renewable self-consumer concerned. 3. The renewable self-consumer's installation may be managed by a third party for installation, operation, including metering, and maintenance. 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 sources (Text with EEA relevance.)

Building 1 (Mixed household)				Building 2 (Homogeneous household)		
2	Family, working, 1 child	21613	6.7	Retired adult	1016	5.1
3	Adult, work	1601	2.1	Retired couple	2680	8.2
4	Student	1563	5.4	Retired couple	2088	7.3
5	Storekeeper	4003	1.4	Retired couple	1747	7.0
6	Retired couple	1747	7.0	Retired couple	1747	7.0
	Whole building	14150	32.7	Whole building	10379	40.0

Table 17: The households considered in two energy communities in Germany.

	Couple working	Family, working, one child	Man, work from home	Student	Storekeeper	Retired couple	Total
Individual value	40.9	23.2	15.2	26.6	196.7	32	334.6
Total value	495.3				Installed PV (no coalition): 3.7 kW Installed PV (grand coalition): 4.7 kW		

Table 18: Building composed of various consumers

	Retired man	Retired woman	Retired couple	Retired couple	Retired couple	Retired couple	Total
Individual value	21.5	20.5	50.7	40.5	32	32	196.8
Total value	343.1				Installed PV (no coalition): 2.5 kW Installed PV (grand coalition): 3.6 kW		

Table 19: Building composed of retired persons

Observations:

- § There definitely is some (financial) value to gather into an energy community.
- § Mixed buildings composed of heterogeneous households create more value (the aggregation benefit is much higher). More value can be extracted for the PV capacity.
- § The value is even higher than the sum of the individual values of potential prosumers
- § Energy communities favour the development of roof PV.

Splitting of the value

Community core

The value of an energy community materialises into reduced bills or even payments from the DSO for injection in the grid. How should the community manager redistribute this value? Since a group of households can never be forced to join the whole community, the splitting should be done in a way such that:

§ Any household should receive more than what he gets if he becomes an individual prosumer.

§ Any coalition S should receive more than what it gets if it creates an energy community of its own.

These considerations lead to the notion of core of the community, that is inspired from cooperative game theory.

Stability condition

An allocation (or sharing) of the value stabilises the community if each household i receives a share x_i such that:

$$\forall S \subset I, \quad \sum_{i \in S} x_i \geq v(S) \quad \leftarrow \text{All coalitions are happy to stay with the energy comm}$$

$$\sum_{i=1}^n x_i = v(I) \quad \leftarrow \text{All the value generated is shared}$$

A stable allocation rule ensures that all members are satisfied with staying in the whole energy community.

Simple allocations rules are not stable, as illustrated by the following tables:

	Couple working	Family, working, one child	Man, work from home	Student	Storekeeper	Retired couple	Total	Stable?
Per capita allocation	82.5	82.5	82.5	82.5	82.5	82.5	495.3	No
Per volume allocation	91.8	91.5	56	54.7	140.1	61.1	495.3	No
Per capacity allocation	108.4	112.4	55.9	83.3	41.2	94.1	495.3	no
Total value	495.3							

Table 20: Building composed of various consumers, splitting of value.

	Retired man	Retired woman	Retired couple	Retired couple	Retired couple	Retired couple	Total	Stable?
Per capita allocation	57.2	57.2	57.2	57.2	57.2	57.2	343.1	No

	Retired man	Retired woman	Retired couple	Retired couple	Retired couple	Retired couple	Total	Stable?
Per volume allocation	36.4	33.6	88.6	69.0	57.8	57.8	343.1	No
Per capacity allocation	50.3	32.1	68.0	74.3	59.2	59.2	343.1	no
Total value	343.1							

Table 21: Building composed of retired persons, splitting of value.

Observations:

- § Simple allocation rules fail to ensure stability. A group of households might want to form a smaller community on their own.
- § Recall that the French regulation mandates to use the per volume allocation rule: by default the splitting should be done based on consumption, but the law allows energy managers to come up with their own allocation rule

Marginal value allocation rule

To ensure stability of the community, one has then to look for slightly more elaborate allocations rules, but simple enough to be easily and quickly implemented by community managers. We exploit the notion of marginal contribution of a member of the community that is defined as follows:

The marginal contribution of member i to coalition S is the additional value he brings to the other members of S .

$$MC(i, S) = v(S) - v(S - \{i\}).$$

The marginal contribution of member i to the whole community I is defined as follows:

$$MC(i, I) = v(I) - v(I - \{i\}).$$

The marginal value allocation rule gives a share of the whole value of the energy community to each member i proportionally to his marginal contribution $MC(i, I)$.

Shapley value allocation rule

The Shapley value is the allocation rule that gives to each member i a share of the whole value that is proportional to the average of all his marginal contributions $MC(i, S)$ to all possible coalitions: $\frac{\sum_{i \in S \subset I} MC(i, S)}{\#(i \in S \subset I)}$.

Comparing Shapley and rule

Both allocations are fair because they do not split according to the level of demand that can be decorrelated from the drivers of the value creation. They split according to the real value brought by each member. As an example, a household consuming during PV production generates more value and therefore will receive more than the others.

The remaining question is: Are these allocations stable? The following tables provide a comparison of each method of benefit allocation.

	Couple working	Family, working, one child	Man, work from home	Student	Storekeeper	Retired couple	Total	Stable?
Per capita allocation	82.5	82.5	82.5	82.5	82.5	82.5	495.3	No
Per volume allocation	91.8	91.5	56	54.7	140.1	61.1	495.3	No
Per capacity allocation	108.4	112.4	55.9	83.3	41.2	94.1	495.3	No
Shapley	63.2	58.0	33.5	38.7	231.8	70.1	495.3	Yes
Marginal	63.0	65.9	36.2	36.6	217.7	75.6	495.3	Yes
Total value	495.3							

Table 22: Building composed of various consumers, Shapley and marginal allocation rules.

	Retired man	Retired woman	Retired couple	Retired couple	Retired couple	Retired couple	Total	Stable?
Per capita allocation	57.2	57.2	57.2	57.2	57.2	57.2	343.1	No
Per volume allocation	36.4	33.6	88.6	69.0	57.8	57.8	343.1	No
Per capacity allocation	50.3	32.1	68.0	74.3	59.2	59.2	343.1	no
Shapley	48.6	34.1	83.7	71.8	52.4	52.4	343.1	Yes
Marginal	52.2	33.4	85.2	74.0	49.0	49.0	343.1	Yes
Total value	343.1							

Table 23: Building composed of retired persons, Shapley and marginal allocation rules.

Observations

- § The Shapley value and the marginal contribution allocation rules ensure stability. All households and group of households are satisfied with staying in the whole community.
- § The subtle allocation rules are fairer: they give more to the ones who create more value (here the storekeeper consumes mainly when PV produces).
- § The subtle allocation rules sometimes do not lead to very different allocations as compared with the simple ones.

Shapley or marginal contribution?

The marginal contribution allocation value is much more intuitive and simpler to compute than the Shapley value. One calculation per member. From a theoretical point of view, the Shapley value has nice properties that the marginal contribution allocation rule lacks (additivity, separability). But this lies beyond the interest of stability we are looking for.

Therefore, we recommend the implementation of the marginal contribution allocation rule for energy communities.

Practical implementation

The splitting of the value could be done by the energy manager at the end of each year once the data of consumption is known. This allows to accommodate any change of consumption profiles of the households or change in the structure of the energy community (people joining or leaving the community). The splitting can be done following these steps:

1. **Data collection:** the manager will need the consumption profiles of all households and the PV production that are automatically metered. He also needs the figure of the annuity of investment, the values of grid charges and the feed-in/spot prices that are reported in the electricity bill.
2. Each household i receives from the benefit a share proportional to:

$$\begin{aligned} & \alpha \left[\text{Max}_t (f_i(t)) - \text{Max}_t \left(\sum_{j \in I} (f_j(t)) \right) + \text{Max}_t \left(\sum_{j \neq i} (f_j(t)) \right) \right] + \delta \\ & + \sum_{t=1}^T \beta(t) \left(f_i(t) - \left(f_i(t) - \frac{\sum_t f_i(t)}{\sum_{j \in I} f_j(t)} K g(t) \right)^+ \right) \\ & + \sum_{t=1}^T \gamma(t) \left(\frac{\sum_t f_i(t)}{\sum_{j \in I} f_j(t)} K g(t) - f_i(t) \right)^+ \\ & - cK \end{aligned}$$

3. The sharing process can be delegated to a dedicated software that does the calculation in seconds. Such a tool could be a commercial software, or an online platform set up by governments where the community manager would only have to plug in the data of his community. Similar tools are already used by building committees to split operations costs among households (refurbishment works costs, electricity and water bills, etc.).

Conclusion

Role of National authorities:

National authorities should be careful when designing their enabling framework for energy communities: a balance between fairness and stability needs to be achieved: Energy communities should be allowed to reap the benefits they create but should not distort existing schemes, especially grid cost recovery). An adequate level of proportionality should also allow community manager to define value sharing rules that will enhance the stability of the energy community by design.

Some side benefits of energy communities can materialise in the form of the creation of a financial benefit: reduced grid charges, reduced electricity bills and income from injection in the grid if any.

Our theoretical and empirical research shows that a proper allocation rule should be found to fully reap such a value. Otherwise, the community might not be stable in the long-term. Standard and simple allocation rules, like the one that is proposed in France, do not offer such a stability. A smaller coalition of the community might find it better to form a community on their own.

We show that the marginal contribution allocation rule is stable and still easily computable by a community manager who might not be not familiar with complex mathematical or economic concepts.

Policy makers willing to promote the development of shared PV could then create entities that could be in charge of educating community managers on the issues of stability, fairness and equity and on the various (but simple) allocation rules that are available. These entities could also suggest appropriate sharing rules, thereby facilitating the long-term stability of energy communities.

Role of DSO:

The emergence of energy communities will naturally facilitate the development of decentralised production and auto-consumption. Therefore, members of an energy community will naturally contribute less to the grid charges because they can aggregate their profiles (and reduce thereby the level and peak of their consumption). However, the DSO incurs some grid costs (maintenance, investments, etc.) that he must recover from his grid charges. If the number of energy communities increase, the DSO will then have to increase his tariffs to still recoup his costs. Therefore, despite some positive externalities of the formation of energy communities (reduced investments in centralised production, etc.), there exists some negative externalities that might need to be accounted for.

If charges are non-discriminatory, then an increase in grid charges could decrease the social welfare. Besides, the DSO has many levers to recover costs: a capacity charge, a volume charge or a fixed charge and all combination of these. Such a tariff design could also have an impact on the structure of energy communities that might emerge in the system.

The formation of some energy communities might lead the DSO to increase his tariffs to recover his cost. However, this could also incentivise other members to join into communities. There could be some risk to create a snowball effect or a death spiral.

One solution to avoid this is to discriminate in the pricing policy. In that vein the French regulation is proposing to add a charge specific to energy communities. How should this charge be designed to recover the cost for the DSO? The question should be treated from the system point of view. The challenge will be if there exists an "optimal" tariff structure of the DSO that could limit the magnitude of the snowball effect and bring the system close to the perfect one in terms of PV and grid investments.

Recommendations regarding using the scalability and replicability potential

Creating an enabling regulatory environment will be driving the development of new energy communities further.

As presented in chapter Error! Reference source not found., there are various regulatory regimes being developed for embracing energy community concepts. The approaches vary substantially

- § facilitating operations by providing basic regulatory definitions and rights for energy communities (REDII, IEMD)
- § supporting them via local participation rules (DK),
- § providing specific support regimes for energy communities, like guarantee funds for community wind projects (DK) or specific RES auction rules for energy communities (D, PL) to
- § opening for experimentation (UK, NL, PL).

Following key regulatory elements may further facilitate growth on various energy community type business models:

- § Both EU directives define energy communities as a collective action in the energy field that shall have fair and non-discriminatory access to the market without giving up market responsibilities, including the balancing responsibility. While both directives stress that Member States shall provide an enabling regulatory framework for energy communities, REDII also asks Member States to proactively reduce market barriers and consider energy communities in RES support scheme design. Obviously, providing non-discriminatory market access is more scalable than specific support provisions, at least if the latter include financial support.
- § Dedicated support provisions for local renewable energy communities rather aim at protecting a niche market segment, like in Germany. With the increasing maturity and market risk exposure of the renewables sector, the role of this market segment can be expected to decrease, especially for larger RES projects that need to compete in auctions or – in the future – as fully merchant projects. Nevertheless, provisions for ensuring local added value and community involvement may substantially increase the acceptance of renewable energy development and therefore be scalable, particularly for onshore wind, as the Danish example shows, even though they may not necessarily fall under the RE community definition provided by REDII.
- § A novum of REDII is that RE communities are explicitly recognised as relevant market actors that may be specifically promoted by Member States, as long as they keep their market responsibilities. The question arises what are justified and replicable support provisions. The limited experience so far suggests that support provisions may try to limit risks that affect energy communities more severely than other market participants (e.g. sunk costs for project development) but need to avoid substantial economic privileges compared to other market actors, as the latter may distort and disrupt the market (as in Germany 2017).

- § IEMD does not refer to specific support provisions but defines general rights and responsibility of energy communities. These are neither limited to local communities nor to renewables.

- § Broad technology- and value chain coverage (proposed in IEMD and applied national experimental regulations in UK, NL and PL) allows for development and testing of new technology solutions in a close-to-market environment, for example by combining vRES with balancing solutions and sector-coupling on a local level (for example PV- storage-EV charging). As renewable energy moves to the core of the European energy market, it will require further integration in the power system and therefore, a broader set of hardware and software applications as well as a broader set of activities. Whether these activities will be performed by energy communities remains to be seen, but energy communities might be motivated and well placed to develop them. Examples are already provided in the market: Next Kraftwerke, Schönau, Dutch experimental communities, etc.

- § Allowing many legal forms brings flexibility that is needed in developing innovative business models; some countries (UK, NL, PL) use their draft regulations for experimenting with new business models (NL, PL) and for necessary regulatory developments to eliminate regulatory gaps that create barriers for innovative solutions (UK). Most energy communities work for-profit, despite the fact that most individual members most likely do not participate in energy communities mainly for pure commercial purposes and potential revenues are most often not the core driver of joining an energy community. Therefore, it seems natural to gradually eliminate any special treatment for energy communities and allow them to operate in the open energy market in future.

- § In principle, REDII and IEMD proposals offer a relatively large group of actors to be involved in energy communities; this flexibility, similarly to technology- and value chain flexibility may stimulate developments of new market-oriented solutions. It is worth noting, however, that energy communities consisting mainly of individual members may need professional support, for example in form of a managing agent or a DSO building and managing the grids.

- § Additionally, there is an open topic of value sharing in energy communities: some experts express concern that actual participation of large corporate players in energy communities may create imbalance in value sharing and actual impact on the decision-making power within the energy community itself. However, participation of big players guarantees easier access to capital and thus easier investments. Additionally, it is important to protect consumers participating in energy communities so that they can maintain their rights in the market.

- § Although the local dimension is raised explicitly in REDII and IEMD, it is continuously important only to some business models present in the European markets, mainly related to local RE power generation (the most classical energy community examples). With technology development and market integration, there is a growing number of energy community business models, who operate without clear link to a specific geography; Stadtwerke Schönau is a good example of an energy community who grew from a locally focused initiative to an internationally operating organisation. Therefore, with time the local proximity aspect may be

losing importance. Opening cross-border cooperation opportunities may bring additional opportunities on the local level in cross-border regions. It may also further facilitate development of aggregators, such as for example Next Kraftwerke.

To sum up, the EU regulatory development creates a platform to facilitate development of energy communities and further activation of energy consumers. In the ideal case, energy communities may act as any other legal entity in the energy market and as such not require any special treatment. It is therefore recommended to monitor the developments of energy community phenomenon and the impact of the newly established regulations on their attractiveness for consumers.

Stakeholders engagement

Interviews and online surveys were performed with national authorities, energy community cooperatives and other stakeholders of energy communities to have their visions, their lessons learnt or obstacles they still view regarding the introduction of energy communities in the European Union related to the Clean Energy Package. Finally a dedicated workshop was held during the course of the project, further collecting insights and suggestions to enhance this modest contribution to the future implementation of the Clean Energy Package.

Individual interviews

This chapter presents the interview performed and the synthetic insights collected. Interviews were performed with the advocacy officer from REScoop, the president of Coopernico and finally the economic advisor from the Finnish Ministry of Economic Affairs and Employment in charge of energy communities.

Josh Roberts, Advocacy Officer at REScoop

The first interview performed was with Josh Roberts, who is an advocacy officer at REScoop, the European federation of renewable energy cooperatives with already 1250 energy cooperatives as members. According to him, the main values of energy communities are the following:

- § The local acceptance of renewable projects will greatly increase when given the opportunity to be part of an energy community. The co-ownership is key for the success of local renewable energy projects.
- § Social economic benefits related to the profits of energy communities is an important aspect. People with fuel poverty can be helped in their electricity bill or by investing part of the profits in renovating their homes (insulation, ...) but also part of the profits can also be invested in local buildings, such as schools and playground fields.
- § Participants of energy communities often feel empowered by being given democratic control of the energy community, where the higher amounts of money invested in the energy community doesn't give you more rights.

REScoop believes that today the primary market segments for energy communities should mainly be households and small and micro enterprises, with an increasing focus on local authorities. The technical challenges that often arises for energy communities are the following:

- § The grid connection of the renewable technology is often too technical and long for community volunteers that don't have a technical background.
- § The matching of load and production, also called local balancing, for the aggregation and microgrid type of communities, will also be difficult. Possibly a contract with a third party BRP will be needed.
- § The sharing of electricity should be done fairly locally, according to REScoop. The reason he stated, was that to reap the benefits of utilizing less the distribution grid, the energy community should be local. This will reduce the congestion and losses and should be translated in reduced grid tariffs.

Nuno Brito Jorge, president of Coopernico

Coopernico is a Portuguese renewable energy cooperative with three main areas of expertise: renewable energy production, energy efficiency and commercialization (retail). They have 18 solar rooftop park communities. The main value for energy communities according to Nuno Brito Jorge is the democratic aspect of the decision process and ownership of an energy community. The members should be the most powerful decision makers of the energy community. Following issues are identified as most challenging by Nuno Brito Jorge:

- § Since the smart metering roll-out is still in its early stages in Portugal, Coopernico had to install their own smart meters on the sites of their clients to have access to their consumption data in real-time and their history.
- § Today, collective production and consumption is not allowed in Portugal.
- § The grid tariffs are not fair for energy communities, since low voltage (LV) consumer have to pay for low, medium and high voltage level grid tariffs. If the energy communities are local, they do not use the three voltage levels.
- § Energy communities need to find their ways today in Portugal through the so-called grey areas in the existing regulations. According to Nuno Brito Jorge, there is a need of exemptions.

Tatu Pakkala, Senior Adviser from the Ministry of Economic Affairs and Deployment, Energy Department of Finland

The Ministry of Economic Affairs and Deployment is responsible for the energy preparation in Finland, dealing with the implementation of energy communities. Finland already has extensive expertise on energy communities. They have smart grid and consumer engagement working groups, that are producing policy advice to feed the national initiatives, including all actors in the electricity value chain. Early energy communities concepts have been defined and as a consequence, an open national consultation has been organised in the last trimester of 2018. Industry but also consumer groups representatives have provided feedback that gave a better view on what barriers energy communities are likely to face in the future. Promotion of citizen engagement lies at the heart of this initiative, but more actions need to be taken to sustain development of energy communities in Finland.

In Finland, operation of energy communities within housing companies will be eased so that electricity generated and consumed within a housing company property can be used without distribution fees and taxes. Building a power line which crosses property boundaries directly from production unit to consumption unit will be allowed without a permission from distribution system operator and without a network license. In

addition, using self-generated electricity in another location, for example using electricity generated in summer house in own apartment, will be eased.

Finland is indeed considering to implement a model where multi-apartment houses could share the electricity produced on the rooftop with its dwellers. The netting of the production would be carried out only within the settlement period (currently 1 hour). The basis for the netting would be the readings of the customers and the production from the in-installed smart meters. The dwellers would be subject to all taxes, energy and network charges for the part of the they are procuring from the net-work. Netting within the settlement period would be carried out in the centralised data management system, datahub.

Two additional models are considered for implementation, as illustrated below.

Enabling different kinds of energy communities

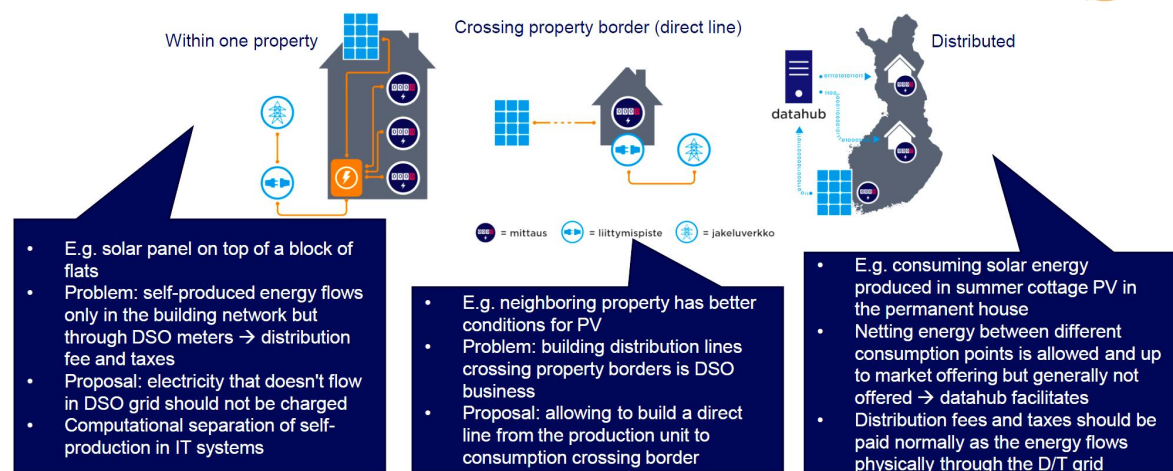


Figure 10: The identified Finnish energy communities, from the Ministry of Economic Affairs and Deployment, November 2018.

Tatu Pakhala has identified the top issues to tackle to turn these concepts into reality:

§ At European level:

- Compatibility of measurement instrument directive (MID) with clean energy package's electricity market design. They are unsure whether the model described above is compatible with MID. Finnish authorities are very concerned that the 1st generation smart meters would be deemed incompatible with MID requirements. This would mean that it would not be possible to offer dynamic contracts. Also easy and cost-efficient realisation of energy communities could turn out to be impossible.
- Consumer protection is essential in providing new possibilities for the consumers. However, far more advanced and user-friendlier means than the small display on the meter are now available to provide the customer all the data needed to verify their bills, such as mobile apps.
- Questions according to Tatu Pakhala, that need to be tackled, preferably at European level :
 - 1) How should the requirements in Measurement instrument directive (MID) annex I 10.5 be interpreted regarding hourly

dynamic price contracts in order to facilitate dynamic pricing with the first generation smart meters?

- 2) Is cumulative consumption enough to fulfil these requirements?
- 3) Are current practices in data transfer (e.g. PLC, 3G) in line with the directive requirements?

§ At national level: Proportionate and forward looking European framework

- While some clarity around the concept of energy communities is welcome and best suited to be taken at European level but should allow for some flexibility in the national transposition. Sharing lessons learned between Member State is the preferred way to go, no precise legislation is needed, that could jeopardise existing national schemes. Some countries have already taken initiatives to refine the legal status and ownership rules of energy communities and cooperatives.

Member States

We also gathered feedback from National Authorities, with a dedicated questionnaire designed to reveal if, and how, energy communities were already active. The idea was to have a better view on the representativeness of energy communities studied in this project. This method complemented the previous “individual” approach that was more focused on capturing the diversity of our research subject. The online survey targeted all National Regulatory Agencies, some Ministries and Umbrella organisations of various Member States. 18 Member States responded to this survey.

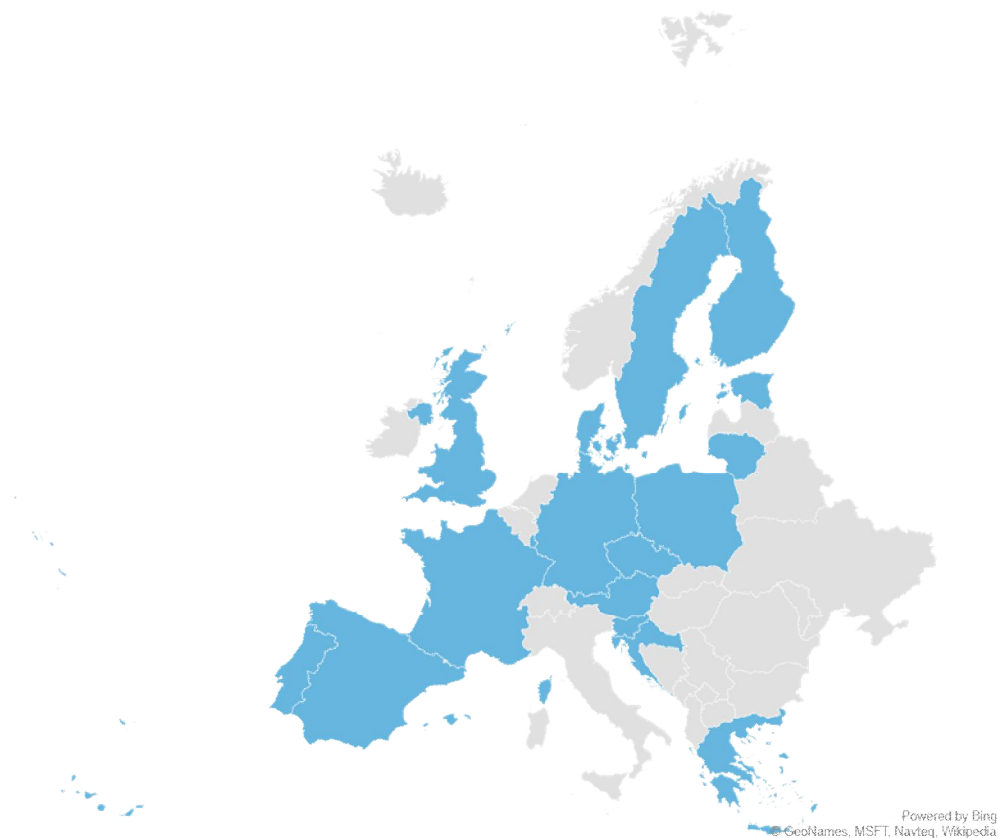


Figure 11: The Member States of the EU that replied to the survey are coloured in blue.

Statistics

Main values of energy communities identified by Member States

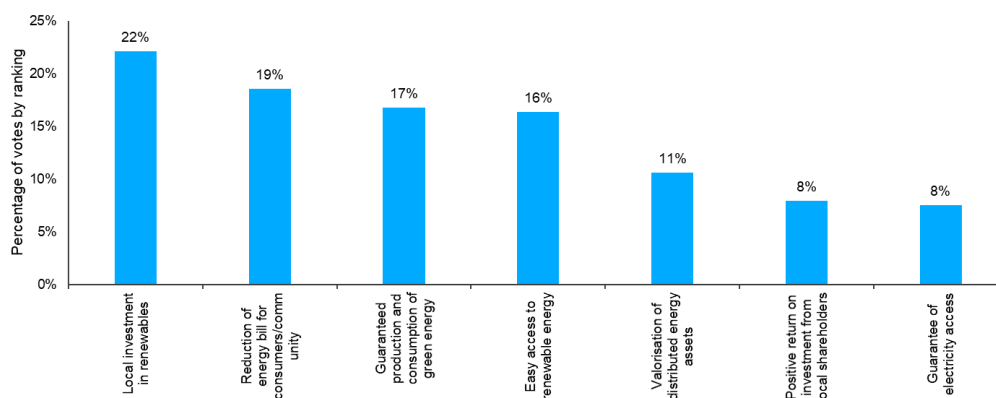


Figure 12: The ranking of the votes by the Member States on the main values of energy communities. (total replies: 18)

The main values identified by the Member States are related to the renewable aspect of the energy community project, with 55 % of the votes (Local investment in

renewables, easy access to renewable energy and guaranteed production and consumption of green energy).

The Member States could identify other values of energy communities in the survey, and the following were given:

- § Public acceptance of renewable energy sources, in particular onshore wind
- § Lowering of emissions
- § Using local resources for energy production
- § Access to new sources of capital through direct involvement of individuals
- § Guarantee of production and consumption of local green energy
- § Local energy management and optimisation
- § Peer-to-peer trading
- § Self-generation and self-consumption
- § Demand response
- § New services, such as electric vehicles charging
- § Ownership and democratization
- § Access to new sources of capital through direct involvement of individuals
- § Different approach over distribution network development

Primary market segment to be served by energy communities

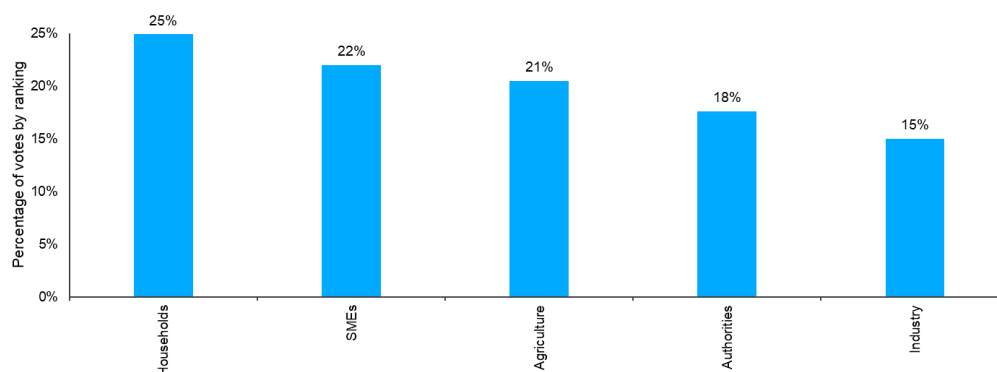


Figure 13: The ranking of the votes by the Member States on the primary market segment to be served by energy communities. (total replies: 18)

As is depicted in *Figure 13*, households are identified as the most important market segment for energy communities, followed by SMEs and agriculture.

Important drivers behind development of energy communities

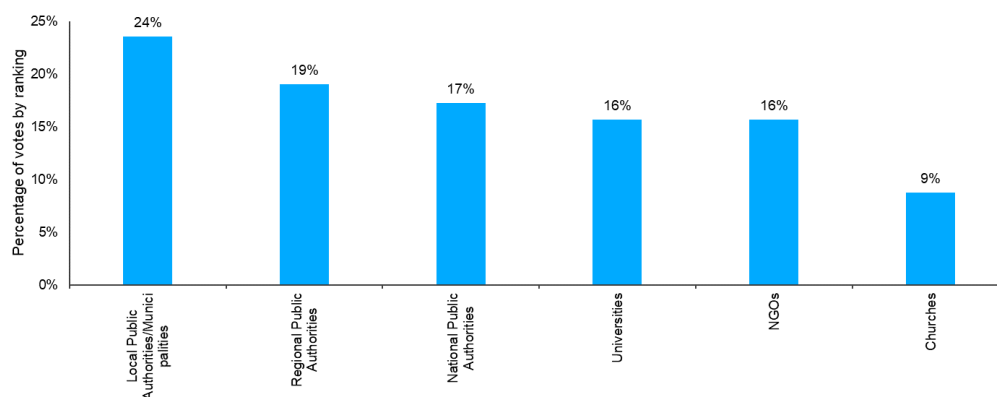


Figure 14: The ranking of the votes by the Member States on the important drivers behind the development of energy communities. (total replies: 18)

The local authorities and municipalities are identified by the Member States as being the most important driver for the development of energy communities. The top three of this ranking consists of the local, regional and national authorities, with 59 % of the votes. UK identified national authorities as the most important since they will need to create the market for energy communities develop.

The Member States could identify other important drivers for the development of energy communities in the survey, and the following were given:

- § The public institutions, such as schools
- § Political parties and associations
- § Energy clusters
- § Business associations
- § Renewable energy cooperatives
- § TSOs and DSOs
- § Local Unions, such as farmers

Energy community services existing in Member States

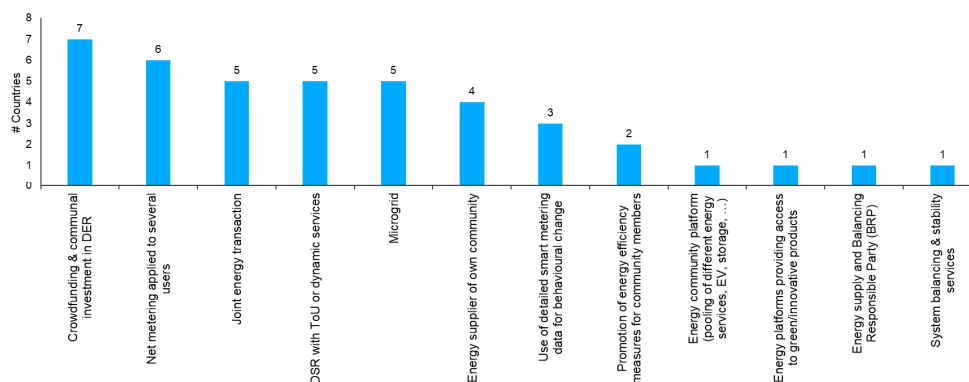


Figure 15: The votes of energy community services existing in Member States. (total replies: 15)

Already a few energy community services exist today in several Member States, see Figure 15. The services joint energy transaction, DSR with ToU tariffs or dynamic services and microgrid are all today already existing in five Member States.

The Member States identified for which of these services there exist barriers today, see the following figures.

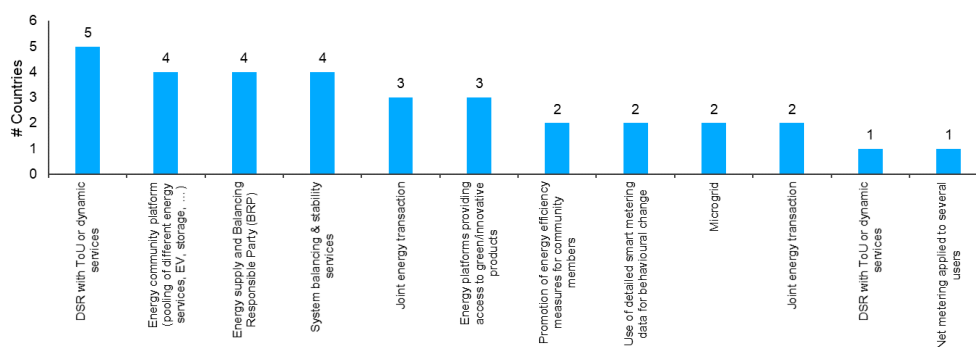


Figure 16: The votes of barriers existing for energy community services in Member States. (total replies: 11)

Some additional clarifications were given:

- § Time of Use applications and wide roll-out of smart meters is necessary
- § Smart metering systems will remove barriers for dynamic tariffs to be offered
- § A balancing market needs to be operational
- § A central data platform is being considered by some Member States to introduce energy platforms
- § The monopoly of DSOs on network operations does not allow communities to operate their own grid. Some Member States believe this is justified, since DSOs can operate distribution networks cost effectively.

Concept of energy communities already existing in the regulatory and/or legal framework

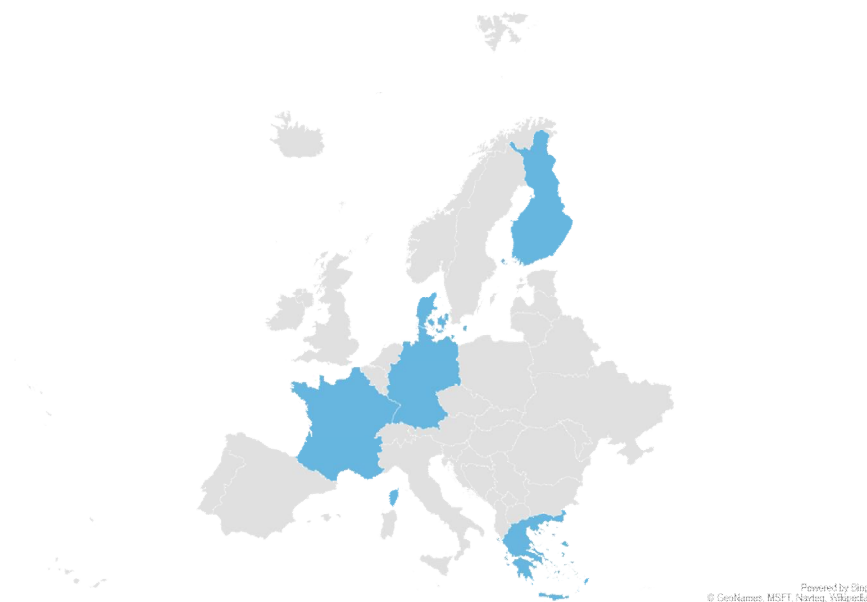


Figure 17: The Member States that responded that the concept of energy communities exists in their regulatory and/or legal framework (France, Germany, Denmark and Finland). (total replies: 16)

The countries that have energy communities existing in their regulatory and/or legal framework, are depicted in *Figure 17*. It needs to be noted that only the results from the online survey are illustrated, thus from the Member States that replied. Following details were given in the survey:

- § Denmark: The Danish Renewables Act requires a certain percentage of new onshore wind installations to be offered to local citizens, which can organise as a cooperative and become shareholders.
- § Germany: §3 No.15 EEG (Renewable Energy Act): "citizens' energy Company" shall mean every Company a) which consists of at least ten natural persons who are members eligible to vote or shareholders eligible to vote, b) in which at least 51 percent of the voting rights are held by natural persons whose main residence has been registered pursuant to Section 21 or Section 22 of the Federal Registration Act for at least one year prior to submission of the bid in the urban or rural district in which the onshore wind energy installation is to be erected, c) in which no member or shareholder of the undertaking holds more than 10 percent of the voting rights of the undertaking, whereby in the case of an association of several legal persons or unincorporated firms to form an undertaking it is sufficient if each of the members of the undertaking fulfils the preconditions pursuant to letters a to c.
- § France: France created the possibility of "collective self consumption", through the "ordonnance du 27 juillet 2016 relative à l'autoconsommation d'électricité ». This law allows collective self-generation, which means the possibility for customers situated under the same MV/LV transformer to exchange energy through a simplified framework, based mainly on declaring the amount of energy exchanged to the DSO, without having to meet the same requirements as a standard supplier.

The community is in charge of attributing the energy produced locally to each participant, and declaring it to the DSO. Consumption is then billed on an individual basis. The part that is not self-produced is billed the standard way by the supplier, taxes included ; the part that is self-produced is paid for according to the contract that links the self-consumers together, taxes included. The supplier also recovers the whole network bill, including the part for the use of the local network by locally produced energy. The law states that all participants must be part of a same legal person, that represents the community. The law does not specify what this legal entity should be. In practice, it is often an ad hoc association. Legally speaking, all types of generations are possible, but in practice, every project is based on PV generation. The possibility to increase this perimeter is currently under debate in Parliament.

Sharing of electricity among their members

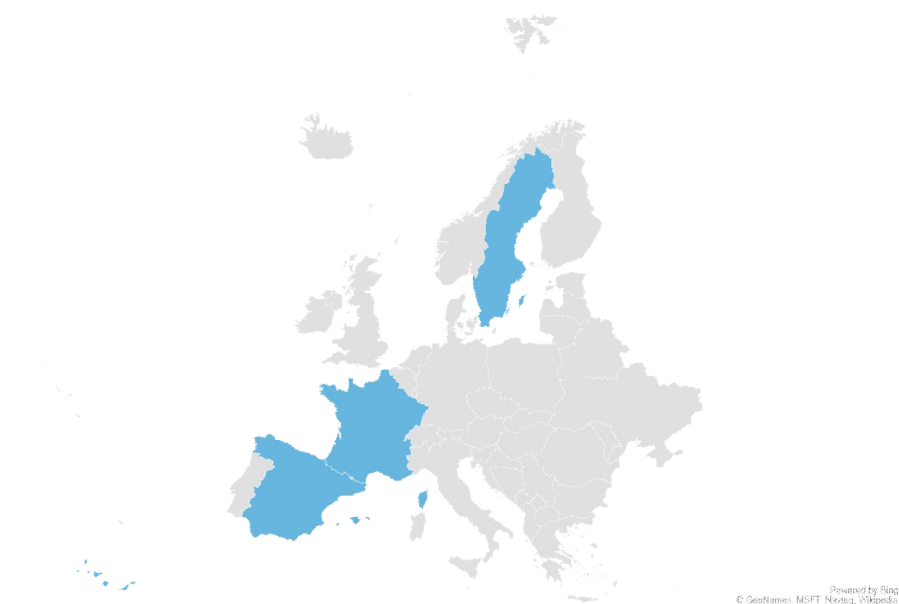


Figure 18: The Member States that responded that the concept of electricity sharing exists in their regulatory and/or legal framework. (total replies: 14)

The countries that have energy communities existing in their regulatory and/or legal framework, are depicted in *Figure 17*. *Figure 18*. It needs to be noted that only the results from the online survey are illustrated, thus from the Member States that replied.

Regulatory and administrative barriers existing today for energy communities

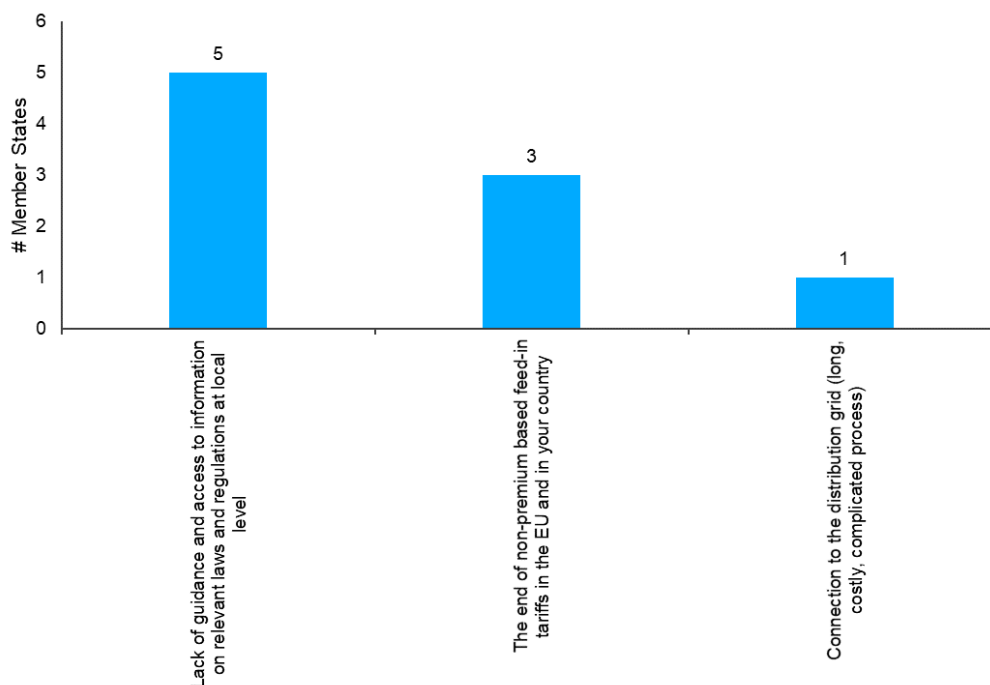


Figure 19: The votes for regulatory and administrative barriers existing for energy communities (total replies: 11)

The main barrier identified by the Member States, is the lack of guidance and access to information on possibly existing relevant laws and regulations at local levels, followed by the end of non-premium based feed-in tariffs in the EU.

Some specific answers given were:

- § According to Greece, there are no specific barriers, on the contrary. Energy communities enjoy preferential treatment, such as exemptions from RES auctions, priorities in some licensing procedures.
- § According to Luxembourg procedures for connection to the grid are public, transparent, and are the same for connection points that are part of an energy community as for other comparable connection points.

Positive discrimination of energy communities

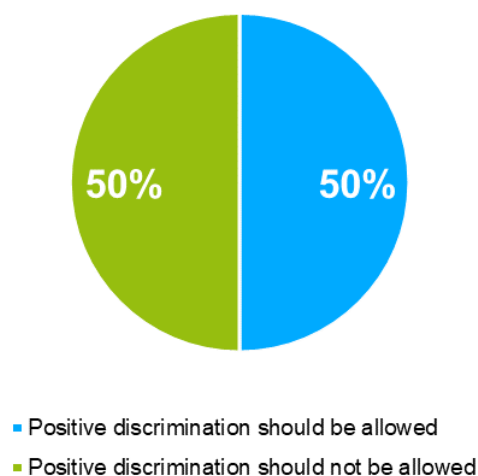


Figure 20: The percentage of Member States from the survey that believe that energy communities should be positively discriminated (total replies: 12).

The Member States that replied positively for positive discrimination, see Figure 20, could recommend concrete actions or regulatory measures to be implemented:

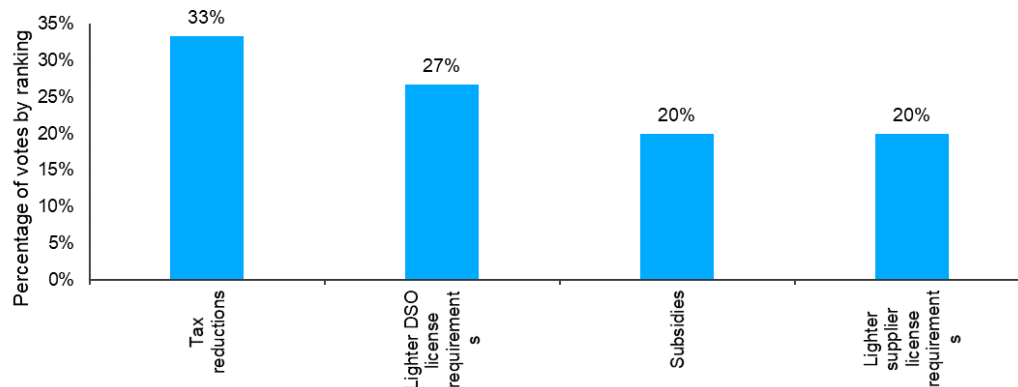


Figure 21: The ranking of the votes by the Member States that replied yes on positive discrimination of energy communities on which regulatory or concrete actions they would implement.

Some concrete replies are:

- § France: CRE considers that energy communities should be able to compete on a level-playing field with other energy stakeholders, which implies suppressing undue regulatory barriers, but that they should not benefit from specific help/subsidies only on the ground that they are energy communities (they should be eligible for subsidies associated with renewable energy production).

- § Spain: Not allowed, because they might prove useful for some groups of consumers and distributed producers under certain circumstances, but they should not be privileged above those who don't share such circumstances.
- § Slovenia: Positive discrimination should be allowed to incentivise local RES generation and consumption.
- § Luxembourg: Energy communities as such do not need to be positively discriminated. Energy communities, depending on their structure, can provide system services that should be incentivised in the energy system overall to facilitate a transition towards a sustainable, resilient and cost-efficient energy system. They should be incentivised to provide such services, but being an energy community in itself should not be incentivised in the context of energy systems.
- § Greece: In Greece, up to specific predefined thresholds (W/F up to 6MW and PVs up to 3MWp) are exempted from RES auctions. Above these limits, the same rules as by other Project promoters are applied.

Specific loans from development banks



Figure 22: The percentage of Member States from the survey that have or don't have specific loans from development banks available (total replies: 11).

Role of the DSO regarding energy communities

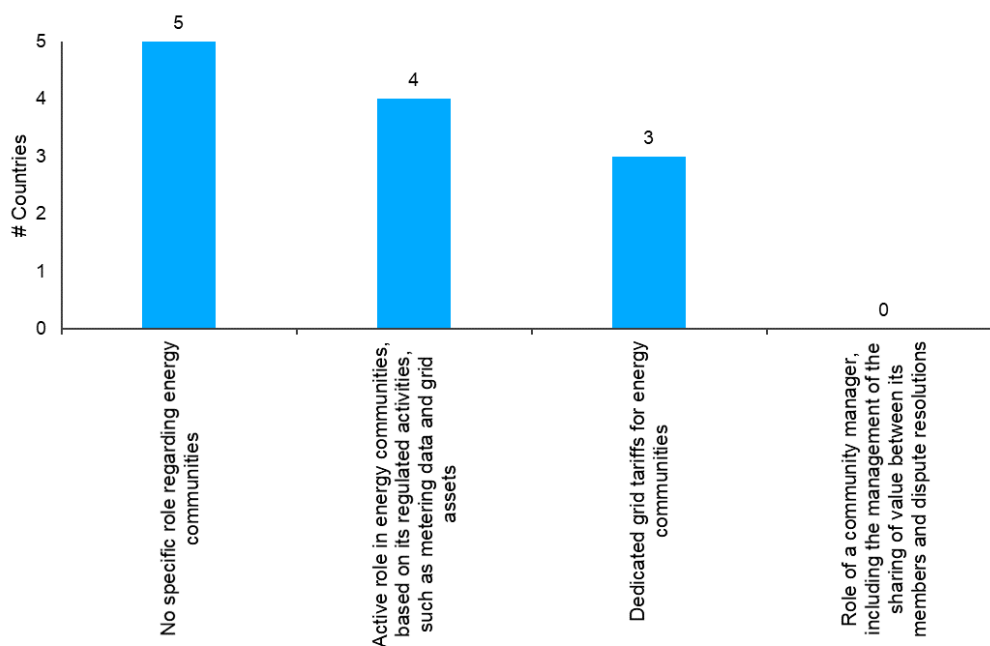


Figure 23: The votes of energy community services existing in Member States (total replies: 12).

From the Member States that replied to this question in the survey, not one sees the distribution operator in the future in the role of a community manager. 42 % of the Member States that replied see no specific role for the DSO. 58 % of the Member States that replied do see a role for the DSO related to energy communities, in the form of adapted grid tariffs or with regulated activities related to metering data and grid assets.

Some additional replies from Member States were:

- § France: CRE introduced a dedicated tariff for energy communities, which differentiate between a reduced rate, applied to local transit, and a higher rate, applied to non-local transit. The DSO is in charge of metering the community consumption, and implementing the net-metering between production and consumption. A dedicated tariff component was added to cover the costs associated to these activities.
- § Sweden: The role of the DSO is to neutrally facilitate the needs of network users and use available flexibility to efficiently manage the network, regardless of what type of flexibility assets are available.
- § Luxembourg: DSOs should act as market facilitators towards all actors, and should not treat energy communities in a fundamentally different way than other actors. Energy communities may, depending on their activities, require some level of metering data post processing, which DSOs could provide. They should, on a non-discriminatory basis, provide the same level of service to other actors with equivalent activities.

Technical challenges that will arise when a Member State will transpose the Clean Energy Package related to energy communities

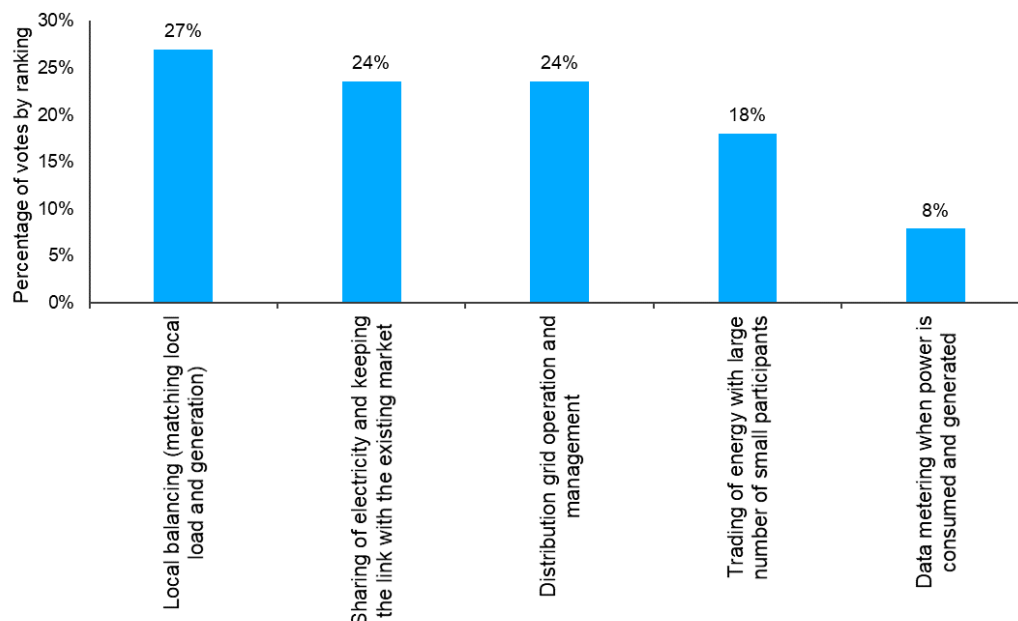


Figure 24: The ranking of the votes by the Member States on the technical challenges that will arise when a Member State will transpose the Clean Energy Package related to energy communities (total replies: 13).

According to the results of the online survey, Member States believe that the most difficult technical challenge will be the local balancing, meaning the matching of local production and consumption. This technical challenge is related to the aggregator and microgrid type of energy community.

Others identified by the Member States were:

- § Operation and management of storage facilities in order to avoid or minimise curtailment of RES production
- § Access tariffs specifically designed for both generation & consumption @ low voltage levels.

Some clarifications by Member States were given regarding the technical challenge for energy communities on distribution grid operation and management.

- § Greece: The DSO with the development of distributed generation and smart grids, DSR and electrical vehicles will stop being a passive network operator and will assume more responsibilities and a more active role.
- § Croatia: Energy communities deploying local grids in areas where a DSO grid already exists may lead to unnecessary duplication of assets and cost. DSOs of a certain size have shown that scale effects can lead to an economically more efficient grid operation. A move to smaller grids could, in turn, lead to higher system costs. Economic regulation of grid operators incentivises a sustainable management and

development of grids. Small entities facing little regulatory pressure may develop grids in a way that cannot be sustained in the long run. DSOs are incentivised to provide customers with a high quality of services and to improve the quality of service constantly. With smaller entities that are not efficiently regulated, it becomes more difficult to ensure an adequate quality of service

Sharing electricity for energy communities

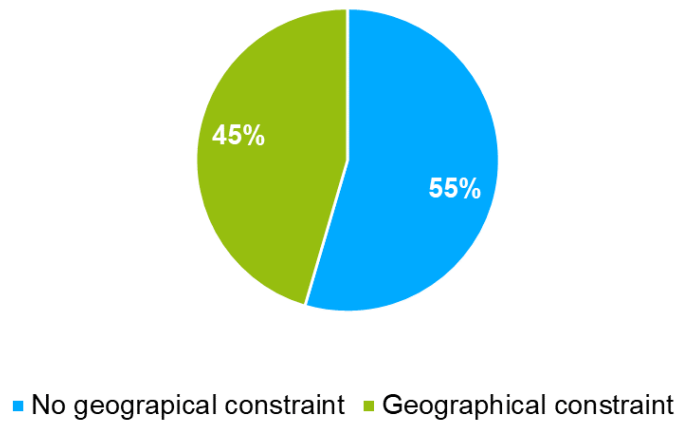


Figure 25: The percentage of Member States agreeing on the geographical constraint of sharing of electricity for energy communities, multiple answers possible (total replies: 11).

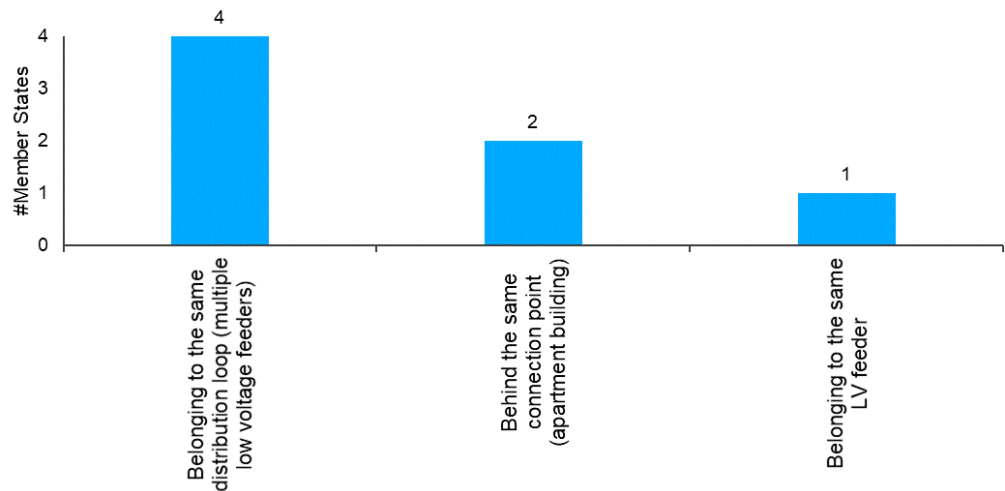


Figure 26: The number of Member States on the geographical constraint for the sharing of electricity, multiple answers possible.

According to the results of the survey, Member States mostly feel that there should not be a geographical constraint for energy communities, see *Figure 25*.

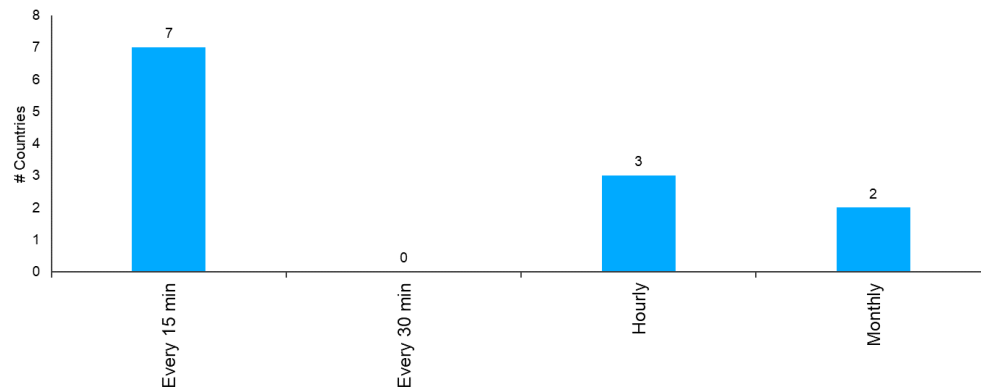


Figure 27: The votes of the period for sharing of electricity in energy communities, multiple answers possible (total replies: 12).

The period for the sharing of electricity between the members of an energy community is closely related to the smart metering roll-out characteristics of each Member State. Most Member States would set the sharing period of electricity in an energy community to 15 minutes.

Community manager and the distribution grid

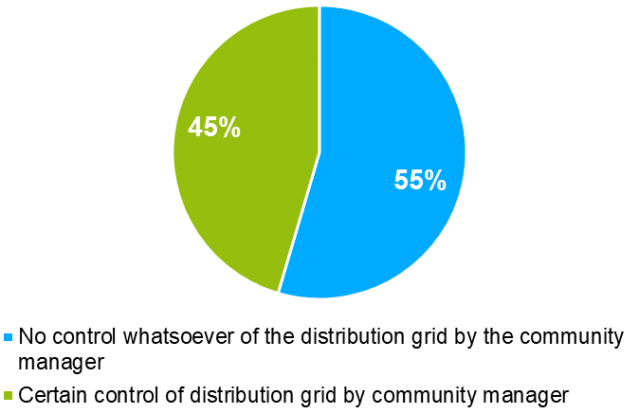


Figure 28: The votes for the role of the community manager related to the distribution grid. (total replies: 11).

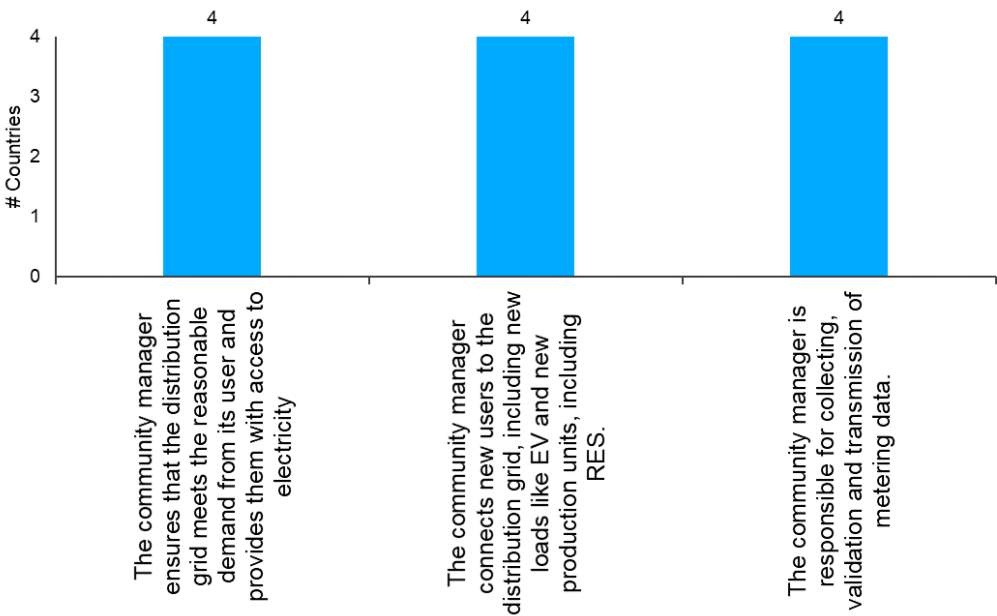


Figure 29: The votes for the role of the community manager related to the distribution grid, multiple answers possible (total replies: 5 (the remaining 6 out of 11 replied that no control should be given to community manager)).

More than half of the Member States that replied to this question in the survey agree that no control of the distribution grid should be given to the community manager. 45 % of the Member States agree that a certain level of control should be given to the community manager, see *Figure 29* for the examples. There is no clear distinction between the Member States which role this exactly should be.

Spectral: Service provider to energy communities

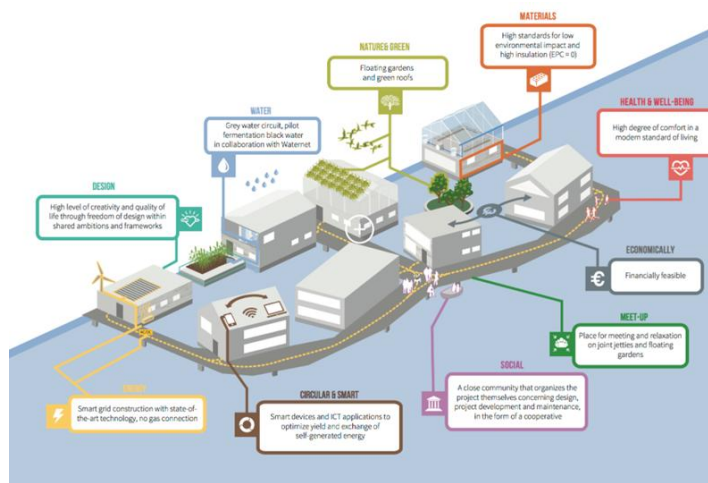


Figure 30: The schematic representation of the Schoonschip community in the Netherlands ⁴⁶

A reply received on the online survey for energy community project, was given by the company Spectral, that provides services to energy communities, today mainly in the Netherlands. One such energy community is Schoonschip in the Netherlands, which identifies itself as a community smart grid. They have a range of activities, ranging from energy production, aggregation, local balancing (without responsibilities to TSO nor SO) to EV charging, local heating, sewage services including future biogas production.

The energy community Schoonschip was able to implement such services thanks to the so-called 'Experimenteerregeling' of the Netherlands. This allowed them to receive certain exemptions from the electricity laws in the Netherlands. Therefore, they have developed their own behind-the-meter microgrid with only one central connection to the main distribution grid. Schoonschip therefore owns its own local distribution grid.

An interesting concept they have introduced is a local currency, the so-called 'Jouliette', using the blockchain technology. With this currency, an energy community participant can be paid for its PV electricity production used for example by his neighbour. With these Jouliette, the participant can buy beers and possibly also do EV charging.

Spectral has expressed certain expectations towards policy makers on both local and national level:

- § Different energy tax regime for energy communities
- § Uphold the possibility for SMEs and large communities to participate (role in local balancing, DR, ancillary services)
- § Changes in other legislation - real estate legislation (jointly own systems (PV+storage+HP) on private real estate objects)

The key factors influencing the value obtained from energy communities were also shared by Spectral:

- § Technical
 - Smart metering roll-out and specifications
 - Storage units

⁴⁶ <http://schoonschipamsterdam.org/en/>, Last Accessed on 11th of March 2019.

- Having a broad range of energy consumption profiles, such as residential, SME, large companies for local balancing
- Direct operational access to all production, consumption and storage units within an energy community

§ Regulatory and legal

- An energy community should have the right to own & operate the distribution grid and the decentralised units on private real estate land
- An energy community should have the right to determine the local costs of grid use
- An energy community should have the rights to supply electricity peer-to-peer

§ Customer and Business aspect

- The business aspect of peer-to-peer electricity supply and trade should be further developed
- An energy community should be able to participate to all energy (including electricity) markets, including ancillary grid services

Stakeholders engagement Workshop

During the workshop on 27 February in Brussels, this study was presented alongside with a bilateral discussion regarding the recommendations of the stakeholders present at the workshop.

The agenda of the workshop was as follows:

- § Welcoming address by Jan Steinkohl and Mikolaj Jasiak from the European Commission
- § Context of the project by Frédéric Tounquet (Tractebel), where the projects objectives and the projects challenges due to the evolving legal framework and the diversity of the stakeholders were given. Also, the Renewable Energy Directive and Internal Market Electricity Directive definitions on energy communities were overviewed.
- § The state of play of energy communities within the EU by Izabela Kielichowska (Navigant). In this section of the workshop the EU regulatory definitions were compared. Several regulatory and legal examples already existing today in some Member States were shared. Finally, four different segments of types of energy communities were identified, followed by some existing examples in Europe. It needs to be stated that the regulatory Member States examples and the energy community examples do not always fit in the directives. The differences will be highlighted in the report.
- § The results of the surveys and interviews performed by Louise De Vos (Tractebel) were given in the form of bar charts and key takeaways.
- § The value drivers for energy communities by Frédéric Tounquet (Tractebel): The value drivers discussed the 4 different identified energy community segments, the primary market roles that are fulfilled by them and the different impacts they have on other market roles. Some technical and societal challenges and opportunities were highlighted. Finally, the example of France and its regulatory challenges were analysed and discussed in the terms of energy sharing.

- § The value sharing of energy communities for its members by Ibrahim Abada (Tractebel) were discussed and two optimal allocation rules were identified for value sharing between the members of a community.
- § The sharing of best practices and recommendations by Frédéric Tounquet (Tractebel) was done by an open discussion with the attendees of the workshop by discussing some important aspects of energy communities, such as localisation, non-profit, role of DSO etc.
- § Concluding remarks by Frédéric Tounquet (Tractebel)

Attendees of the workshop

Company	Country
Enedis	France
3E	EU
Alliander	Netherlands
MISE – Energy Department	Italy
EASME Energy	EU
DCCAE, Department of Energy	Ireland
VVH	Belgium
CEDEC	EU
Eurelectric	EU
Powerpeers International	Netherlands
Bundesnetzagentur	Germany
Fluvius	Belgium
GEODE	EU
International Association TIP	EU
Institut Luxembourgeois de Régulation	Luxemburg
European Commission	EU
Innogy SE	Germany
Tractebel	Belgium
BRUGEL	Belgium
MHPS	
Finnish Ministry of Economic Affairs and Employment	Finland
Th!nk E	Belgium
Oesterreichs Energie	Austria
Powerpeers Netherlands	Netherlands
Encevo	Luxemburg
Rescoop	EU
EnBW	Germany
Union Renovables	Spain
Creos Luxembourg	Luxemburg
Uniper	Germany
Spectral	Netherlands
EDSO for Smart Grids	EU
VREG	Belgium
EON	Belgium

Comments and remarks collected during workshop

EU regulations on energy communities

Clean energy package initiative has materialised into a new regulatory framework whose status is highlighted in the following figure as of 1/1/19.

	European Commission Proposal	EU Inter-institutional Negotiations	European Parliament Adoption	Council Adoption	Official Journal Publication
Energy Performance in Buildings	30/11/2016	Political Agreement <small>***</small>	17/04/2018	14/05/2018	19/06/2018 - Directive (EU) 2018/844
Renewable Energy	30/11/2016	Political Agreement	13/11/2018	04/12/2018	21/12/2018 - Directive (EU) 2018/2001
Energy Efficiency	30/11/2016	Political Agreement	13/11/2018	04/12/2018	21/12/2018 - Directive (EU) 2018/2002
Governance	30/11/2016	Political Agreement	13/11/2018	04/12/2018	21/12/2018 - Regulation (EU) 2018/1999
Electricity Regulation	30/11/2016	Political Agreement	Pending	Pending	-
Electricity Directive	30/11/2016	Political Agreement	Pending	Pending	-
Risk Preparedness	30/11/2016	Political Agreement	Pending	Pending	-
ACER	30/11/2016	Political Agreement	Pending	Pending	-

In the context of energy communities, the Internal Electricity Market Directive and the Renewable Energy Directive provide the most relevant provisions. Those provisions, being published in the Official Journal or subject to a political agreement for IEM and RED respectively, are not expected to change in the future and should be considered as final.

- § The IEMD is specifically for electricity, while the RED includes other energy vectors, such as heating and cooling.
- § In the context of electricity, the IEM provides the level playing field for the communities, while the RES Directive goes further – as it provides incentives for communities that are: (i) 100%, (ii) fulfil the criteria provided in the definition of RECs;
- § IEM provides rules on grid dimension.
- § RED also includes all energy market, but the grid dimension is not specified.

State of play

- § The specific number of energy communities is difficult to estimate, but according to REScoop, there are around 3000 energy communities across Europe.
- § Should Member States report their national regulation and support schemes targeting energy communities to the European Commission and afterwards do additional efforts to turn those national insights into a consistent monitoring scheme.

Sharing best practices

The discussions and recommendations received during this part of the discussion, can be divided into four different categories:

1. DSO: The problematic of the DSO tariff system, the operation of the grid by energy communities and DSO investments was strongly debated during the day. There were two main visions:
 - a. DSO should identify constraints in their distribution grids in their 10 year plans and identify how energy communities and their associated flexibility could alleviate these investments. Possibly future grid investments could be reduced with the introduction of energy communities, since DSO requirements could be lowered.
 - b. Communities could induce certain problems for the DSOs for their tariff system, their daily operation and investments. There are opinions that since DSO is a CAPEX intensive model, the ownership and control of the distribution grid should remain with the DSO to remain cost-effective.
2. Flexibility: Also here different views were giving regarding the flexibility aspect of energy communities
 - a. Flexibility of an energy community can reduce congestions and other issues on the distribution grid at local level, but less so at MV or HV level
 - b. Flexibility from aggregators is not high enough to provide services to TSO levels. The costs of data transmission would also not be in line with the provided benefits.
 - c. Energy efficiency services and Energy Service Companies could also play a role for the flexibility of energy communities
3. Societal
 - a. Energy communities can include solidarity schemes for fuel poverty, such as donations on energy bill. Municipalities can also play a role in this.
 - b. Socio-economic benefits for renovations of local infrastructure, such as schools, social housings, etc can be included in the range of benefits of energy communities
4. Organisation of the energy communities towards the type of participants has certain risks and opportunities. The risk is related to the fairness of value sharing between large consumers and small consumers, the opportunity towards the extension of the scope of activities possible with large consumers.
 - a. Value sharing should be the internal organisation of the energy community. There could possibly be a fairness issue between big and smaller users, such as residential consumers. Are the value sharing possibilities explained during the workshop still valid, since there would be an unbalance between the consumers (in terms of investment capacity, peak load and ability to turn actual loads and generation units into flexibility sources. It is important to align the interest of both households/SME and industries that are part of the energy community. It also needs to be noted that the differences in profiles are important for the local balancing between demand and production.
 - b. The value drivers of the energy communities should be decided by the energy communities themselves. It is possible that by including large consumers in an energy community, a larger investment capital will be available, and more value can be obtained.

Conclusion

In this ASSET study, we investigated European energy communities, taking as a starting point the latest policy initiatives (Clean Energy Package, and concepts of Citizens – and Renewable energy communities) triggered at European level. We faced two main challenges: How to gather lessons learned from Member States on a topic that is rather new from the European regulatory perspective AND whose definition was evolving according the then ongoing trialog.

To solve this, we constantly tried to establish an acceptable balance between an holistic and a normative approach. In the holistic approach, the feedback from what was actually happening now in EU-28 Member States, taking into account the high level of diversity encountered in MS when it comes to the implementation of energy communities. In the normative mindset, we also investigated the way the EU Directives would be likely to be put in motion at national level, deep diving into a limited set of exemplary national frameworks enabling energy communities and assessing their intent and key features in the light of the newly adopted E & RES directives.

The assessment of energy communities took us a step further, in order to better understand the inner dynamics, in terms of value creation and value sharing, focusing respectively on the key relationships energy communities had to master (like retail business for energy sharing or access to support schemes for cooperative investment in renewable energy) and the way the value could be split over time between their actively participating members.

During the course of this project, we engaged with many stakeholders, whose insights significantly contributed to this exploratory study. Interviews were performed, we circulated an online questionnaire throughout the EU-28 National Authorities and we finally organized a dedicated workshop with more than 75 participants.

Finally, we delivered the targeted outcome of this assignment, namely summing up insights recommendations gathered through our analysis to facilitate further implementation of energy communities at national level.

In this final conclusion, we wish to highlight the need for National Stakeholders to embrace the topic of energy community with due care in implementation. We have witnessed various operating models that are already acting as *de facto* energy communities in many Member States. The enabling framework adopted at EU-level will act as a catalyst for those initiatives, but it is left at local players' discretion to decide what kind of impact, other than purely financial, their energy community will pursue.

All stakeholders were unanimous to recognize that EU authorities acted in full respect of National prerogatives. Ambitious climate goals have been defined for a clean energy union and a set of legislative instruments have been put at Member States disposal, respecting their national prerogatives.

However, with subsidiarity also comes accountability: we strongly encourage National Authorities and Stakeholders to test, design and implement suitable provisions that can deliver a real impact in their territories. Local acceptance of RES-based generation units due to co-ownership and job creation through maintenance, energy sharing coupling multiple buildings or even local ownership of the electricity infrastructure, including the distribution grid, have all become legitimate expectations of EU policy makers.

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