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REPORT

Regulatory and Consumer Considerations for Decentralised Energy Opportunities

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Consumers and Retail Markets Working Group
& Distribution Systems Working Group

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Abstract

This paper C25-[CRM/DS]-01-02 presents CEER's considerations on the implications of new actors and activities on consumers, markets, network and regulatory frameworks – be they self-consumption, energy sharing (also called collective self-consumption, which may be physical, within a building, or virtual), energy communities (which are energy cooperatives that might engage in several activities like generation, supply, energy sharing, aggregation, etc.) or related concepts of consumer-side flexibility. These approaches have in common that they depend on consumer choice and appeal to private acceptance and willingness. They also invite flexible consumption patterns. However, their different implementations can give fundamentally different results from the perspective of the power system and the market (certain designs might hinder price signals, isolate participants ('s liquidity) from the market or lock away flexibility).

In examining the various positive and negative effects of these modalities, CEER draws from a variety of sources, including the experience of NRAs. The aim is twofold: i) to help the consumer (or their associations) to choose the best modality for their own interest with the physical assets at their disposal; and ii) to share the learnings to date of these rapidly evolving activities, and to provide insights on the issues that should be considered when designing the implementation of energy sharing and the other concepts in a way that fits the Member State's progress in the energy transition and reflects national targets and challenges.

Target audience

National regulatory authorities, electricity customers, consumer representative groups, network operators, energy sharing groups, energy sharing organisers, energy communities, aggregators, energy traders and suppliers, Member States, academics and other interested parties.

Keywords

Energy sharing, self-consumption, EMD, energy communities, barriers, grid challenges, flexibility, consumer protection, retail markets, consumer empowerment, distributed PV generation.

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Related documents

CEER Documents

- ACER-CEER Retail Market Monitoring Report 2024, 30 September 2024.
- CEER Report "Regulatory Aspects of Self-Consumption and Energy Communities",29 June 2029, Ref. C18-CRM9_DS7-05-03
- CEER Response to the European Commission's consultation on the Action Plan for digitalising the energy sector, January 2022, Ref. C21-DS-CRM-04-03

External Documents

- ACER's report on Barriers to Demand Response, 19 December 2023.
- Barriers and Action Drivers for the Development of Energy Communities and their Activities.
- Bartek-Lesi, M., Varga, K., REKK. (2024). *Analysis of the changing regulatory landscape of household self-consumption*. https://rekk.hu/analysis-details/364/analysis-of-the-changing-regulatory-landscape-of-household-self-consumption
- European Commission: Directorate-General for Energy, Ilo, A., Rossi, J., Gallego Amores, S., Iliceto, A. et al., *Energy communities' impact on grids – Energy community embedment increasing grid flexibility and flourishing electricity markets*, Ilo, A.(editor), Publications Office of the European Union, 2024, **https://data.europa.eu/doi/10.2833/299800**
- European Commission: Directorate-General for Energy, Veen, A., Winters, E., Fumagalli, E., Klobasa, M. et al., *Multi-supplier models and decentralized energy systems – Energy sharing approaches*, Publications Office of the European Union, 2023, **https://data.europa.eu/doi/10.2833/730792**
- EU DSO Entity: DSOs Fit for 55
- EU Grid Action Plan
- Felice, A., Rakocevic, L., Peeters, L., Messagie, M., Coosemans, T. & Camargo, L. R. (2022). *Renewable energy communities: Do they have a business case in Flanders?*. Applied Energy, 322, 119419. https://doi.org/10.1016/j.apenergy.2022.119419
- Mann, J., Perkins, J., Schittekatte, T. & FTI Consulting. (2024, Dezember). *How the current GB Wholesale Market Design Fails to Make Best Use of Flexible Assets: the Curious Case of Batteries Flip-Flopping in the BM*| FTI. https://www.fticonsulting.com/uk/insights/reports/how-current-gb-wholesale-market-design-fails-make-best-use-flexible-assets-curious-case
- Mergner, R., Rutz, D. & WIP Renewable Energies. (2014). Community Power: enabling legislation to increase community ownership for RES projects across Europe. https://www.rescoop.eu/uploads/rescoop/downloads/Community-energy-in-Germany-report-2014.pdf
- Mulu Bayray Kahsay, Steve Völler, Thermal energy storage for increasing self-consumption of grid connected photovoltaic systems: A case for Skjetlein High School, Norway, Energy and Buildings, Volume 335,2025, 115563, ISSN 0378-7788, https://doi.org/10.1016/j.enbuild.2025.115563.

- Multi-supplier models and decentralized energy systems: Energy sharing approaches, ENTEC, May 2023, https://energy.ec.europa.eu/publications/multi-supplier-models-and-decentralized-energy-systems_en
- Pató, Z. & Regulatory Assistance Project (RAP). (2024, February). *Gridlock in the Netherlands - Regulatory Assistance Project*. https://www.raponline.org/knowledge-center/gridlock-in-netherlands/
- Pató, Z. & Regulatory Assistance Project (RAP). (2024, May 13). *RIP first come, first served - Regulatory Assistance Project*. https://www.raponline.org/toolkit/rip-first-come-first-served/
- Policy Database
- Reference Guide on Energy Sharing for Energy Communities,
- Ritter, D., Mühlenhoff, J., Öko-Institut, Heinrich-Böll-Stiftung European Union, ICLEI - Local Governments for Sustainability, Regulatory Assistance Project, Heinrich-Böll-Stiftung Greece, Solar Power Europe & Florence School of Regulation. (2024). *Facilitating energy sharing: Boosting participation in the energy transition: Five action areas for the new EU policy cycle (4/5)*. https://eu.boell.org/sites/default/files/2024-11/a4-facilitating-energy-sharing-2111-c.pdf
- Roadmap to Developing Policy and Legal Frameworks for Energy Communities
- SolarPower Europe. (2023). *Regulatory Framework for Energy Sharing*. https://api.solarpowereurope.org/uploads/Final_collective_self_consumption_report_133b88bb28.pdf?updated_at=2023-03-03T13:42:12.001Z
- Sunderland, L., Yule-Bennett, S., & Regulatory Assistance Project (RAP). (2024, January). *Flex-ability for all: Pursuing socially inclusive demand-side flexibility in Europe.* https://www.raponline.org/knowledge-center/flex-ability-for-all-pursuing-socially-inclusive-demand-side-flexibility-europe/
- We Share Energy

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1 EXECUTIVE SUMMARY

The acceleration of the deployment of renewables and of the electrification of consumption has meant new challenges and opportunities for the electricity system. New actors and activities such as self-consumers (individual or collective) and energy communities appear as enablers to the rapid development of distributed energy resources, which require a careful consideration of the impact on the market, networks and the energy system overall.

This paper considers the implications on consumers, markets, network and regulatory frameworks of the various modalities – be they self-consumption, energy sharing (also called collective self-consumption, which may be physical, within a building, or virtual), energy communities (which are energy cooperatives that might engage in several activities like generation, supply, energy sharing, aggregation, etc.) or related concepts of consumer-side flexibility. These approaches have in common that they depend on consumer choice and appeal to private acceptance and willingness. They also invite flexible consumption patterns. However, their different implementations can give fundamentally different results from the perspective of the power system and the market (certain designs might hinder price signals, isolate participants (‘s liquidity) from the market or lock away flexibility).

In examining the various positive and negative effects of these modalities, CEER draws from a variety of sources, including the experience of NRAs. The aim is twofold: i) to help the consumer (or their associations) to choose the best modality for their own interest with the physical assets at their disposal; and ii) to share the learnings to date of these rapidly evolving activities, and to provide insights on the issues that should be considered when designing the implementation of energy sharing and the other concepts in a way that fits the Member State’s progress in the energy transition and reflects national targets and challenges.

After providing a status update by NRAs on the national implementation of the different concepts, Section I explores these new possibilities and imperatives from the perspective of the consumer, focusing primarily on the factors that may influence consumer choices. It also explores the potential for these activities to improve affordability for active consumers, underlining the importance of a framework that encourage shifts in consumer behaviour and leads to positive results for the network. In particular, the paper describes the challenges and opportunities of individual and collective self-consumption and consumer-side flexibility, and how they can deliver benefits for the individual, the community and the power system, depending on a careful design. With that in mind, the paper also describes certain design features for these concepts that might increase, decrease or even cancel their benefits or bring new challenges (careful attention should be taken in the design if, through the implementation, benefits are reallocated from one consumer type to another or from one market agent to another, because this might result in overall negative system effects). The paper then presents some of the likely candidates for collective self-consumption or energy communities: multi-apartment buildings and substation level cooperation, local municipalities (also supporting vulnerable consumers), rural areas and, potentially, industrial customers.

The affordability chapter concludes that several factors affect the financial attractiveness (and viability) of energy sharing models, such as existing or new policy incentives that may be counterproductive. In particular, net metering gives network-detrimental behavioural incentives in the case of individual self-consumption, similarly to all other incentives/rules that eliminate price signals that could induce better network behaviour. On the other hand, when designed accordingly (meaning that there is some type of locational limitation ensuring proximity and if the receiver party can in fact shift some of their consumption to match generation schedules), energy sharing can contribute to lower customer costs, lower network costs and lower network development needs, and may serve as a starting point to educate and lead more and more customers to shift their consumption, that is, to behave more flexibly. However, if energy sharing is implemented only as a virtual settlement concept and does not induce behavioural changes, from a network perspective it is not necessarily different from traditional supply. Collective self-consumption or energy sharing may also add challenges to the current supplier business models, highlighting the need for a robust regulatory framework. Suppliers need access to relevant information and a clear regulatory vision to be able to adapt to new business models. The allocation of possible increased supplier costs needs attention, and is a policy and/or a political question. Lastly, for individual or collective self-consumers, the primary way of monetising their flexibility (beyond self-balancing) is through implicit flexibility (reaction to price signals to decrease the energy bill), since explicit flexibility participation of household customers through aggregators is still rare in most jurisdictions, such as energy communities directly bidding in flexibility markets.

Considering the factors above and the fact that, in most jurisdictions, energy sharing is less burdensome to engage in than setting up a formal energy community, Section I closes by identifying typical consumer considerations when choosing one of the following modalities: energy communities, energy sharing or individual self-consumption with flexible assets.

Section II approaches energy sharing, energy communities and distributed assets from a regulatory perspective. Firstly, this Section gives an overview of NRAs' perceived barriers (based on an internal CEER survey), the top three of which are very similar for energy sharing and energy communities:

- Lack of awareness (energy literacy), trust and/or access to technical expertise;
- Missing, lack of or not sufficiently clear legal/regulatory or administrative framework;
- Legal challenges (required contractual agreements, licensing obligations, etc.).

The report then illustrates potential solutions offered by NRAs (adaptation of legal framework and the roll-out of smart meters) and dives into which tools NRAs have to address these barriers. As regards NRAs' key responsibilities, it is important to note that they do not include actively supporting or promoting new actors in the energy market. NRAs are, primarily charged with monitoring and advocating for 'the removal of unjustified obstacles', allowing new actors to be able to compete on equal footing with other market players. NRAs must provide a regulatory framework that considers affordable energy consumption and a sustainable and efficient network operation, at the lowest system cost. After briefly showcasing the European Commission's Roadmap for Energy Communities, the paper discusses the different aspects in a centralised, supplier-centric energy system that need to be rethought to accommodate for new types of consumer participation. Possible areas for NRA involvement are shared through the example of the ILR, the Institute Luxembourgeois de Régulation.

Thereafter, the report discusses in detail approaches to network tariffs and energy sharing arrangements. As a conclusion, generally, it can be said that tariff discounts are mainly applied when the use of the public grid is limited either to the same voltage level or to a specific geographic radius (also implying lower voltage levels). As regards sharing arrangements, fixed, consumption proportional, variable and priority distribution keys have been identified.

In the second part of Section II, the report discusses challenges caused, and potentially remedied, by new forms of consumer participation, both from the perspective of the grid and the current market design. As a start, regarding potentially problematic incentive schemes, different entities (government, regulators, municipalities) should show an alignment in implementing measures. This alignment should prevent countermeasures but also cumulative (dis)incentives.

The paper also notes that in many instances, NRAs do not have sufficient data on these new market participants to properly assess their influence on the system. Therefore, it is crucial for NRAs to gain awareness and have access to relevant data on self-consumption and energy communities. Data is important for other actors as well: a solid infrastructure of intelligent electricity meters and a corresponding reliable communication network and data acquisition are essential for the consumer, the supplier (BRP), the ESO and, if present in the market, the aggregator and the energy community as well. At the same time, appropriate DSO processes for data access of metering data (smart meters or dedicated measurement devices) should be in place.

Finally, the report formulates the following recommendations toward NRAs:

- implement (or complete) and advocate for the national implementation of relevant provisions of (the amended) EMD and RED III, particularly as regards legal provisions on free choice of suppliers and non-discriminatory market access, right to energy sharing, jointly acting self-consumers and, where smart meters are not available, appropriate measurement devices;
- exercise supervision obligations and closely follow the growth of new market agents and adapt the regulatory framework as needed; this requires that NRAs have information regarding self-consumption, energy sharing and communities, and evaluate their impacts.
- remove regulatory barriers within their remit for the regulated activities for every market player for energy sharing, that is: partial supply/multi-supplier configurations for consumers and the sale of renewable energy/wholesale market access: the energy transition requires adaptation of rules for small participants, such as pre-qualification, legal requirements, observability and communication requirements;
- for energy sharing, a balance of the roles in energy sharing has to be properly allocated between the regulated agents and the sharing party; arrangements, communication rules that are of private concern should not be regulated;
- establish a connection with the stakeholders to better perceive their needs and then to choose the most suitable options within the NRA’s remit, making use of tariffs, code level regulation or experimental regulation;
- as an activity that might be pursued by energy communities and a tool to support demand response, the activity of aggregation should be facilitated, with code level non-

discriminatory rules for imbalance settlement and market access for flexibility and wholesale energy markets;
- focus on the basic education of consumers, consumer flexibility and system needs and, once new regulatory milestones have been reached, regularly educate stakeholders on new possibilities;
- ensure energy component and network tariff price signals reach consumers (in the form of dynamic tariffs and/or time-of-use (ToU) system charges) for implicit flexibility, this might also be fostered by increased competition on the retail market. However, by their nature, self-consumption and energy sharing hinder price signals from reaching the consumer;
- Make use of the tools they have available in the regulatory framework, embrace dynamic regulation as deemed efficient and gain observability of the development of the market in order to adapt adequately.

Energy sharing and forms of community energy can help the spread of a new "energy culture" and make people more aware of their role in the energy transition. It is a bottom-up approach – more inclusive than others – that is able to stimulate new investments or bring together small investors and citizens. This approach may also represent a new way to help relieve energy poverty. Therefore, the key idea behind the concept of energy sharing and energy communities should be that they are not islands or isolated from the system, but, on the contrary, they should be at the base of a well-functioning energy sector by providing new services and benefits, especially by offering a variety of flexibility services. The regulatory framework has an important part to play in providing the building blocks for these outcomes, since some of these concepts also carry a risk to create islands isolated from the system. It is therefore important to bear in mind the effects of these concepts on the system as a whole.

2 Introduction

Background

In recent years, the potential of community-led energy projects and the participation of consumers in the energy transition have attracted greater visibility, relevance and feasibility. Technology advances and recent energy crises have underscored the importance (and possibility) of engaging energy citizens in delivering a resilient, independent and sustainable energy system. In 2019, the European Union's Clean Energy Package (CEP) created an enabling framework for active customers, self-consumption, prosumers and renewable and citizen energy communities. Drawing from lessons learned in the intervening years, in 2023, EU co-legislators adopted revisions to two core pieces of legislation: the Electricity Market Directive and Regulation in the so-called Electricity Market Design ('EMD') package [1]. The legislative package contained provisions to ensure the right to energy sharing and new regulatory tools and tasks to ensure system flexibility when and where it will be needed.

At the same time, the role of power grids in the energy transition has shifted more into focus: a review of the Renewables Directive set new renewable targets (42.5%) to reach 55% emission reduction by 2030. The EU Grid Action Plan was also published, outlining a set of actions needed to "make Europe's electricity grids stronger, more interconnected, more digitalised and cyber-resilient". The key role that distribution system operators (DSOs) will have to play in achieving Europe's climate policy targets has also becoming increasingly clear, since approximately 70% of the renewable energy will have to be connected to the distribution network. At the same time, system operators face increasing congestion of their grids, decreasing their hosting capacity and increasing connection times.

Against this backdrop, energy regulators believe it is important to continue to examine the practicalities of putting in place an energy system that is fit for the energy transition and beyond. Invariably, this analysis includes considering the evolving role of consumers in the market and their enhanced interaction with the distribution grid through participation in energy communities and energy sharing [2]. The present report builds on previous CEER work regarding the incorporation of renewables and citizen energy communities into the EU energy acquis[3]. Indeed, CEER's 2019 report emphasised that Member State transposition into national law of the provisions is critical to the viability and valuable role of such communities.

[1] Directive (EU) 2019/944; Regulation (EU) 2019/943

[2] Regulatory Aspects of Self-Consumption and Energy Communities

[3] CEER Report on Regulatory Aspects of Self-Consumption and Energy Communities, June 2019

Community-driven energy initiatives have been present in various forms in many Member States for many years. That being said, implementation of the concepts in the CEP and the EMD face a number of challenges, as outlined in the European Commission's 2024 "*Report on Barriers and action drivers for the development of different activities by renewable and citizen energy communities* [4]*.* The issues may be cross-cutting or specific to a given activity, such as renewable energy generation, energy sharing, retail supply and provision of flexibility services.
Key barriers include (i) lack of clear and uniform legal definition for energy communities; (ii) lack of certainty, predictability and accessibility of financing; (iii) lack of awareness, trust and access to technical expertise; and (iv) lack of access for energy poor and vulnerable households. Each of these aspects require dedicated solutions. However, the complex and overarching nature of these barriers does not allow us to have one silver bullet solution. That is why we have to dive deeper into the context of distributed assets and their potential forms of involvement, and their interplay with business-as-usual market design and market participants, such as suppliers.

Objectives and contents of the document

As a cooperative work between CEER's Consumer Protection and Retail Markets and Distribution Systems Working Groups and the Regulatory, Benchmarking and Legal Committee, this report adopts a multi-disciplinary approach to addressing challenges and opportunities for decentralised energy and active consumers. The report is organised in two sections, exploring the consumer and regulatory perspectives, respectively. In the process, key legislative terminology and novelties are addressed, such as the introduction of energy sharing in the EMD.

From the consumer side, consumers need to be provided with useful key concepts and clear information to be able to take informed decisions on their participation and active involvement in the energy transition, and more precisely, on the forms of community energy.

Also, their choices may be influenced by a description of the workings of the electricity market design (different aspects of affordability, network reliability and flexibility). For regulators, we provide a comparative evaluation of the barriers and solutions to the implementation of energy communities and energy sharing, including challenges created or solved by decentralised actors. With this, we also aim to contribute to the conceptual and practical work of the regulator needed to properly implement the new amendments of the EMD package on the right to energy sharing.

Definitions

To facilitate a common understanding of the concepts discussed throughout the paper, Annex 3 provides a full list of terms and definitions as stipulated in the respective directives and regulations used in this report. Below, we provide a short summary of the most prominently

[4] Barriers and action drivers for the development of different activities by renewable and citizen energy communities: https://circabc.europa.eu/ui/group/8f5f9424-a7ef-4dbf-b914-1af1d12ff5d2/library/22055ff9-1f49-41f8-a321-cbf20ca3d316/details

used terms and definitions. However, due consideration should be given to the fact that both key pieces of legislation dealing with community energy are directives. This means, on the one hand that Member State transposition into national law is necessary and, on the other hand that the exact national content and interpretation of the terms might differ. In addition, the European Commission is set to issue implementation guidance during 2025 which may facilitate national interpretations and provisions.

The concepts of **active customer** (or consumer) also called prosumer and the (jointly acting) **renewable self-consumers** overlap as regards self-consumption and energy sharing. Both of these actors perform their activities within their premises, with defined boundaries and these activities cannot constitute their primary commercial or professional activity. They can also act jointly within the same multi-apartment building which then results in a possible form of collective self-consumption. In certain jurisdictions, 'remote prosumers' are broadening this concept since they commonly relate to active consumers who have (ownership of or otherwise access to) generation assets outside these confined boundaries but are still allowed to consider the production from generation units as their own.

The concept of energy sharing (and peer-to-peer trading) was already introduced in the 2019 Electricity Directive and 2018 Renewables Directive (RED II). A detailed definition for sharing has since been included in the 2024 revision of the Electricity Directive (EMD), as part of the Electricity Market Design review. Energy sharing[5] refers to the self-consumption of renewable energy, be it self-generated or stored or bought/received free of charge from another.

Based on discussions, it seems to be the case that from a legal point of view, physically sharing energy in a building and within closed distribution systems should not be considered energy sharing within the meaning of the EMD, but should be considered as jointly acing active consumers, while what the EMD seeks to grant is a right to sharing energy through the public network (what CEER has called in previous publications 'virtual energy sharing[6]).

In this document, however, unless otherwise specified, energy sharing is used in a broader sense, which incorporates both virtual and physical energy sharing. In the EMD, the right to energy sharing entails that 'all households, small enterprises and medium-sized enterprises, public bodies and (where a Member State has so decided) other categories of final customer *have the right to participate in energy sharing as active customers* in a non-discriminatory manner, within the same bidding zone or a more limited geographical area and 'active customers are entitled to share renewable energy between themselves based on private agreements or through a legal entity'. Furthermore, participation in energy sharing shall not be the active consumers' primary commercial or professional activity. In practice, this means that energy sharing may happen within an energy community or based on bi- or multilateral contracts between consumers, potentially on peer-to-peer trading platforms. Beyond the definition and the right to energy sharing, the EMD introduces a new, potential actor to facilitate energy sharing: the energy sharing organiser (ESO). The EMD also prescribes certain duties for Member States, most notably to ensure access to voluntary template contracts with fair and transparent terms and conditions for energy sharing, access to out-of-court dispute settlement

[5] In literature, energy sharing is often referred to as collective self-consumption

[6] It is considered virtual because the infeed and withdrawal within the same ISP/settlement unit are paired with each other virtually or administratively, irrespective of the actual flow of electricity.

and fair and non-discriminatory treatment by market participants and balance responsible parties (BRPs).

Energy communities, the renewable and citizen/civil/local energy communities (RECs and CECs, respectively), are separate legal entities based on open and voluntary participation of natural persons, local authorities, municipalities and SMEs with the primary aim of providing environmental, economic or social community benefits (as opposed to financial profits). Although a REC is limited to renewable energy technologies and its members must be in the proximity of the mutually owned/developed energy project, it can be active in several activities across the energy value chain: generation, consumption and sale of renewable energy. On the other hand, a CEC has no geographic limit (even cross-border CECs are possible[7]), is technology-neutral and can undertake a wide variety of activities[8], although, only in the electricity sector. Based on the Electricity and Renewables Directives (IMED and RED, respectively), both types of energy communities are entitled to organise energy sharing between their participants, although the term itself is not defined in either Directive[9]. RECs and CECs are also required to collect network tariffs from their members, if they use the public grid. By default, the operation of communities should not entail additional privileges as regards charges or tariffs.

However, in the present report, the term “energy community” is used in a broader sense: it refers to any association of several grid users who collectively operate one or more production or storage systems through a separate legal entity (and in many cases, would like to consume the electricity generated from or stored by these systems themselves to the largest possible extent). In addition, energy communities can negotiate collective electricity supply contracts for their members and some of these organisations have the technical means to determine and, if necessary, control both individual and collective consumption and production of electricity.

3 Section I: Consumer Perspectives

Since 70% of renewable generation is expected to be connected to distribution networks, and electrification will also have a considerable effect on the distribution grid and many of these assets will be and are already either residential or otherwise small assets, it is of the utmost importance that policy makers and regulators have a clear view on how they wish to achieve the proper system and market integration of these assets, that is, the consumers themselves.

In this regard, it is necessary to recall insights of the latest ACER-CEER Electricity Retail Market Monitoring Report[10]. Firstly, that active consumer participation is key to driving the

[7] Pursuant to article 16 (2) of **Directive (EU) 2019/944**

[8] generation, distribution and supply, consumption, aggregation, storage or energy efficiency services, generation of renewable electricity, charging services or other energy services to members

[9] Peer-to-peer trading is a definition in RED II, but with the introduction of the term ‘energy sharing’ which can be for a price or free of charge, it’s questionable whether it will keep its relevance.

[10] ACER-CEER Retail Market Monitoring Report 2024 https://www.ceer.eu/publication/acer-ceer-2024-market-monitoring-report-energy-retail-and-consumer-protection/

energy transition. Secondly, that retail markets can play a pivotal role as providers of flexibility and that providing flexibility also creates opportunities for consumers through lower energy prices. Thirdly, that smart meter rollout and appropriate price signals reaching the consumers are key to making flexible consumer behaviour possible. For this purpose, the identification of challenges and the development of essential prerequisites might also be necessary.

Since empowering consumers for the energy transition has been a cornerstone of CEER's 2022-2025 strategy, this paper will explore how possible configurations of participation (individual or collective self-consumption, participation in energy communities, providing flexibility) influences both the consumer and the system and how this participation could be beneficial to both. However, the report will not cover benefits related to potentially increasing renewable deployment or social inclusion and increased participation in the energy transition, since these goals in themselves belong rather in the remit of climate and social policy and, as such, are the responsibility of Member States. Drawing on consumer-side motivations, Section I will cover affordability from the energy trilemma, and how consumers can make their energy consumption cheaper or explicitly earn revenues for flexibility through forms of self-consumption or energy communities.

Implementation of relevant concepts based on the survey among CEER members

For this deliverable, CEER circulated a survey among the NRAs[11] ('Survey') to gain insight into member countries' implementation of community energy initiatives, having received input from 23 authorities[12]. The Survey questions include information about the national implementation of the terms (i) renewable active self-consumers; (ii) jointly acting renewable self-consumers; (iii) energy communities (CECs and RECs); and (iv) energy sharing.

On a range of full, partial and mostly missing, most respondents indicated that the concept of active consumers has been fully implemented; 15 indicated full implementation of energy communities; and only 8 considered that the concept of energy sharing has been fully implemented[13], with a further 3 noting a growing number of participants even with partial implementation. Furthermore, three NRAs reported having more than 100 RECs, another three have up to 10 and one NRA reported 46. As for CECs, 3 NRAs indicated they have 3 to 46 existing communities, and one NRA reported having 3 CECs. Regarding other comparable entities, four NRAs reported having more than 100 and three others reported more than 10 such entities (from the answers received, these other comparable entities are more than the REC and CEC)[14]. On the one hand, this suggests that although all member states have made implementation efforts, the topic of community energy is much more complex[15] (with implications on consumer protection, network access, network regulation, supplier relations, licensing etc.) than could be addressed by simply mirroring the provisions of a European legislative act. Fine tuning is still needed. The European Commission has put a lot of effort into

[11] Data collection finished in mid-September 2024.

[12] AT, BE, CZ, DE, EE, ES, FI, FR, HU, IE, IT, LT, LU, LV, MT, NL, NO, PL, PT, RO, SI, SK and XK

[13] The question was whether they consider the concept that's currently in the EMD implemented.

[14] REC: [> 100 (AT, FI, IT), [10>, <100] (BE); <10] (HU, LT, SK); CEC: [10>, <100] (BE, LT, LU), <10] (HU); Other comparable entities: [> 100 (AT, IT, NL, SI), [10>, <100] (BE, LU, PL).

[15] Report on the implementation of Directive (EU) 2019/944 on common rules for the internal market for electricity https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0650#document

facilitating[16] energy communities. This is an area where there is still plenty of room to improve, to be able to make better use of these options during the energy transition.

When asked about the **concept of energy sharing**, some answers regarding geographical limitations were received. The geographical area for energy sharing is considered the bidding zone (Italy) or a narrower area (500 m to 2 km, Spain, and mostly up to 2 km in France) or even distance related depending on the voltage levels (Portugal)[17]. Energy sharing across several or all voltage levels is also possible but not available in all Member States. In five Member States[18], energy sharing is only allowed at low voltage (LV) and medium voltage (MV) and eight others have energy sharing also at high voltage (HV) or very high voltage (VHV)[19]. In some countries' views, geographical limits cannot be regarded as barriers, but as a safeguard for the efficient operation of the system. Nor can it be forgotten that collective self-consumption schemes can allow energy sharing.

Case studies for national implementation can be found in Annex 1, whereas a detailed description of the implementation process in Luxembourg opens Section II on the regulatory perspective.

Table 3-1 – Legal adoption of concepts

Definition	AT	BE	CZ	DE	EE	ES	FI	FR	HU	IE	IT	LT	LU	LV	MT	NL	NO	PL	PT	RO	SI	SK	XK
Renewable active self-consumer	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	PA	FU	FU	FU	PA	FU	PA	FU	FU	FU	FU	FU
Jointly acting renewables self-consumers	MM	FU	FU	FU	FU	FU	FU	FU	PA	MM	FU	PA	FU	PA	FU	PA	FU	PA	FU	MM	FU	PA	PA
REC, CEC	FU	FU	FU	FU	FU	PA	FU	FU	PA	PA	FU	FU	PA	FU	FU	FU	MM	PA	FU	MM	FU	FU	FU
Energy sharing	MM	FU	FU	PA	PA	PA	PA	FU	PA	MM	FU	PA	FU	FU	PA	PA	FU	PA	FU	MM	PA	PA	PA

Legend: FU – Full, PA – Partial, MM – Mostly missing

[16] "Commission services have been in close contact with Member States to support them in the implementation of the Directive to identify best practice and any areas where particular challenges have arisen. The Commission has also established the Energy Communities Repository and the Rural Energy Community Advisory Hub which are providing technical assistance, sharing best practices and producing guidance documents for energy communities and relevant stakeholders implementing these provisions of the Directive on the ground. The Energy Communities Repository is compiling information on existing energy communities, their impacts, common barriers and action drivers and policy developments across the EU. The Energy Communities Facility will merge both initiatives 2024 onwards and continue some of the activities of the Repository in addition to providing cascade funding to energy communities."

[17] In a radius of 2 km in low voltage, 4 km in medium voltage, 10 km in high voltage and 20 km in extra high voltage.

[18] BE, CZ, RO, SI and SK

[19] or extra high voltage (EHV)

3.1 Improving Affordability Through Self-consumption

The following chapter delineates the most important factors for consumers to consider when deciding which type of consumption behaviour to choose and what level of involvement or commitment they can and want to have in the energy transition. Beyond motivations linked to sustainability, there is another core aspect of consumer side motivation for self-consumption, either individual or in some collective form: to increase affordability (or economic benefit). The following sections will address how these aspects unfold in certain market design settings and what a consumer should bear in mind to be able to make a beneficial decision, for themselves, as well as for the grid[20].

In this chapter, we consider "affordability" outcomes stemming from the use of tools and means to decrease electricity bills and/or increase income from selling electricity or providing flexibility services. The following section of the report will explain how different forms of self-consumption could be key to providing affordability for consumers, but also shows the other side of the coin, how certain aspects of self-consumption can put a strain on the network (e.g. net metering schemes, badly designed incentives), cause additional challenges for the supplier or on network users overall, who bear the system costs for the collective of network users through network tariffs (e.g. certain tariff exemptions and derogations from the payment of the imbalance price). In Chapter 4.2, we take a closer look at how the potential affordability benefits of self-consumption, energy sharing and communities can be accessed by different types of consumers.

3.1.1 Individual self-consumption

During the crisis and the corresponding surge in energy prices, a vast number of consumers, equipped with the necessary financial resources and time capacity, opted for PV installations on their roofs. Major drivers in the significant increase in rooftop solar included independence from the price fluctuations of the energy market through self-production and consumption as a way to increase affordability. With significantly high energy prices, the relative cost and the time for the return of investment for PV installations was decreasing substantially[21]. This allowed the number of rooftop solar installations to increase, giving consumers the opportunity for a higher rate of self-sufficiency and reducing their exposure to price fluctuations.

As is typical in most surveyed countries, active consumers usually engage in individual self-consumption. However, this can take at least two forms:

1) Self-consumption without injection to the public grid (be that voluntary or based on an injection limitation);
2) Self-consumption with injection to the public grid.

[20] While we address Section I primarily to costumers, their associations and policy makers, Section II covers more technical details concerning the regulators.

[21] In cases where these installations were realized with the aid of pre-crisis support schemes, over subsidisation might also have taken place.

Where self-consumption occurs with injection to the grid, there are several billing methods to account for the injected electricity (net metering, sell all-buy all, separate metering and billing[22]).

The main benefits for consumers and for the grid come from taking the most advantage of the self-generated energy, as it represents an economic value[23] and less use of the network (also resulting in lower volumetric network charges) when used locally (within the consumer installation). This may require adaptation of the consumption patterns to times of the day when the solar energy is available, self-balancing consumption and generation on the micro level. This self-balancing might be a first step for the customer to feel incentivised and learn to shift their consumption and potentially an incentive to install flexible assets (such as heat pumps, EVs, batteries).

As for the generated energy that is not consumed, residual feed-in or surplus, when injected into the network it may be sold to a commercial agent, such as a supplier, aggregator or a supplier of last resort, depending on the market arrangements available in each Member State. Where the prices for the surplus are not subsidised or are market-based, that is, reflecting actual supply and demand, the surplus economic value is low, incentivising the correct dimensioning (and in-feed) of the generation units considering the consumption profile. However, if market signals are not reaching the customers, this might result in outcomes that are detrimental to the network. This is also the case, when certain incentives are insensitive to when the electricity is fed into the grid; these may cause distortion of the expected benefits of self-consumption, net metering being one of such incentives.

Net metering is an incentive scheme, where the withdrawal from and the injection into the grid are 'netted' against each other for the reference period (which may or may not be different from the billing period). This netting may be performed directly in the meter or calculated in DSO systems. The reference period might be the imbalance settlement period (ISP, in most cases, 15 minutes). However, in the early stages of this incentive scheme, it could span a whole year. This latter approach allows the self-consumer to use the public network as a seasonal 'virtual storage' to which it feeds in credits in the sunny hours and draws back credits during dark hours of consumption throughout the year. It is particularly important to explain to consumers why these schemes (especially where the netting period is longer than the ISP) are detrimental to the functioning of the grid and the electricity market. Consumers should be duly informed that net metering schemes give false behavioural incentives and are a burden on the grid for the following reasons:

- net metering does not allow network (tariff) or energy (price) signals to be passed to the self-consumer at different points of the day, preventing consumers from adapting their consumption behaviour in periods of congestion or oversupply, potentially exacerbating those periods by continued injection into the system;
- as network tariffs are usually only paid for the netted amount of electricity, the network tariff payments do not reflect full use of the network (injection and withdrawal at separate moments in time);

[22] Bartek-Lesi, M., Varga, K., REKK. (2024). Analysis of the changing regulatory landscape of household self-consumption https://rekk.hu/downloads/projects/ECF%20Self-consumption%20study%20REKK_final%201.pdf

[23] The overall cost of residential electricity generation/kWh might not always be cheaper than the market price, but generally it can provide protection against price volatility.

- As a result of these incorrect signals and allocation of costs for network use, other system users pay higher network tariffs (on the one hand due to congestion, on the other hand to recover network operator's actual costs in running the system at all times), leading to a situation of cross-subsidisation and an energy injustice between consumers with access to self-consumption and consumers (often less affluent) with no such access.

The importance in sharing these issues with self-consumers lies in the fact that although EU legislation requires net metering schemes to be phased out from 1st of January 2024, this rule does not concern consumers who acquired their right to net metering prior to this date. If there are alternatives to net metering in a Member State, they are encouraged to promote these different billing and settlement configurations through consumer education and potentially through tariff incentives rewarding network-friendly consumer behaviour.

3.1.2 Energy sharing or collective self-consumption

For consumers lacking the possibility to install rooftop solar e.g., tenants of apartment buildings, **energy sharing** provides a similar opportunity that individual self-consumption presents, to reduce the dependence on traditional energy markets. In energy sharing or collective self-consumption, two or more active consumers or parties (administratively or actually) transfer the electricity fed into the grid to each other. This electricity is then deducted from the electricity bill (issued by the main supplier). Energy sharing may be a way to increase the ratio of consumption of the locally generated energy by active costumers, in the time periods where residual feed-in/surplus exists.

Margins and the Allocation of Ancillary Supplier Costs

Three main theoretical benefits of energy sharing for network users participating in sharing are that on the one hand (i) for the shared energy no profit margin is paid to the supplier that provides the "residual" electricity, on the other hand (ii) when using a private network where no network tariffs are applicable or using the public network when a tariff discount applies and/or no system charges have to be paid, and lastly (iii) increased price predictability. The decrease in retail supplier costs can be a direct saving that can be reflected among the parties participating in energy sharing. However, it should be kept in mind that the sharing does not necessarily occur free of charge: the sharing party might be entitled to charge a price for the shared electricity as well. This price is usually established between the participants[24].

The electricity value also represents an economic benefit when the electricity market price is higher than the value of the self-generated electricity, compared with the expected price of the supplier. In hours that market prices are low or even 0 €/MWh due to the abundancy of (solar) renewable energy, this may not be a benefit, especially when using dynamic and/or time-of-

[24] All solar installations generate electricity when it the resource is available, making it is abundant in times where there is less demand; the number of hours when spot prices are negative increased across the whole of Europe. Under such circumstances, it could be expected that the PV generated shared electricity price be lower than the supplier energy simple prices.

use pricing. These energy cost options should be evaluated, weighting the predictability of energy costs coming from the investment in self-consumption, which may be a benefit to consider, against the possibility of lower market prices.

Working towards Affordability

The main factor in achieving lower and more stable prices and the extent of the final price advantage will primarily depend on how much the electricity consumption of the households can be shifted to times when there is generation within the energy sharing organisation or the energy community or when active consumers make it available[25].

Evidence from studies, such as one conducted by the Flemish regulator VREG, reveals that the peaks in local renewable generation do not typically coincide with peak energy demand among individual self-consumers. These estimated self-consumption levels of at around 15-20% alignment, suggest that energy sharing models – without flexible assets – do not significantly change the behaviour of consumers. It should thus be assessed whether, or to what extent, collective self-consumption increases the self-consumption ratio of the participants[26] and whether that is the primary goal at all[27].

Effects on Energy Suppliers and Cost Allocation

To understand the effect of this activity on consumer bills[28], it is essential to firstly understand the underlying effects energy sharing bring to other actors in the electricity market, and the design choices that determine how the corresponding costs are allocated.

Energy sharing disrupts traditional energy supply patterns, where a single supplier sells electricity to the consumer and the consumer does not sell any themselves, since this part of the consumed electricity (the shared energy) is not accounted for in/withdrawn from the supplier bill. This induces a more variable demand and feed-in patterns, which may pose a challenge for suppliers and corresponding balance responsible parties (BRPs)[29]. Suppliers

[25] This is not always the case. A research (referred to under footnote 21) observed that sometimes, cost reduction and self-consumption maximization might be conflicting priorities.

[26] Some research suggests that the collective self-consumption ratio might be increased to up to around 50%: https://www.sciencedirect.com/science/article/abs/pii/S2210670722000221

[27] If self-generated electricity is more expensive than what's available on the market (e.g. in the case of dynamic price contracts), than the reasonable goal would be to optimise consumption to the lowest price time periods, from whichever source.

[28] The electricity bill broadly comprises of 4 components: (i) the energy component that goes to the supplier and includes the supplier's profit as well, (ii) the tariffs that are paid to the distribution system operator for network usage, (iii) taxes and levies that in most cases are paid into the central budget, (iv) any other potential surcharges.

[29] Since the electricity system can only function properly if the electricity fed into the grid equals exactly the amount of withdrawn electricity, the transmission system operator need to 'balance' the grid (when it's short, start up generators, when it's long, turn down generation or turn on demand). However, balancing is very costly, and that is why every participant in the power system needs to balance themselves: for consumers to consume what they bought, for generators to keep their schedule, for suppliers to have matching amount of sell and buy contract volumes at any given moment. Usually, smaller entities belong under the umbrella of a balance group organised by a supplier who is then a balance responsible party. Imbalance costs are then allocated to the balance group,

have to continue to deliver the contracted electricity consumed via the public grid and have to hedge their portfolios to manage the market risk. As BRPs, they are required to guarantee that they buy all the energy they sell at any given moment, to keep the electricity system in permanent “balance”. Variations in the amount of electricity produced and consumed in community energy projects add a layer of uncertainty and complexity when suppliers plan for and procure electricity on the wholesale market.

This variability in energy consumption patterns makes it challenging for suppliers to forecast energy needs accurately. When energy sharing pairs or communities are split between different suppliers, the issue becomes even more pronounced, as suppliers lack access to the necessary data for precise predictions. The availability of renewable energy resources can be forecasted with some clarity; however, it may not always be possible for the supplier to know whether their customers are prosumers or which generation technology they have behind the meter. This unpredictability requires suppliers to account for increased forecasting effort and risk. As result, they may apply higher energy prices for parties participating in energy sharing or spread those across all their consumers. In addition, because of the consumption profile of these activities, suppliers encounter an upward shift in the annual average procurement price (since the consumers are supplying themselves in the cheapest hours) compared to households without energy sharing arrangements.

All that said, it should be noted that it is not only energy sharing that disrupts the traditional consumer-supplier relationship, but rather several processes that we commonly call the energy transition: the decentralisation of the energy system and electrification. The disruption of the status-quo is unavoidable; DSOs face at least as many challenges as a traditional supplier – the question is, how regulators can ensure that the transition is as efficient and as inclusive as possible.

Network tariffs

Where a community power initiative uses any part of the public grid, the network charges should apply, as is the case for all network users. It is worth noting that network tariffs seek to recover a variety of system costs, including the availability of the network, frequency stability and other technical aspects which guarantee the functioning of the network for all users, including energy sharing/communities.

Network tariffs should therefore reflect this usage and services although, in certain cases (such as close proximity), network discounts might be justifiable.

Energy sharing within energy communities

Most of the above would also apply for energy communities, since one of their possible activities is energy sharing. However, per their legal definition, the primary purpose of energy communities is ‘to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where they operate rather than to generate

where the supplier is responsible for the imbalance costs, but can cascade them towards the parties that caused the imbalance.

financial profits'. They certainly can provide their members with professional advice and expertise to make an informed decision. Depending on their design, member structure and the incentives in place, RECs and CECs can also provide energy-poor households or working-poor consumers with reliable and affordable energy while also being inclusive in a just energy transition (e.g., with counselling, including them in (free) energy sharing or providing discounts on energy charges).

However, as will be shown in Section II: The Regulatory Perspective, in the jurisdictions where energy communities do not have a historical background, these forms of community energy struggle to flourish: they face similar difficulties as energy sharing, but they also need to comply with higher administrative requirements (legal personality, governance, not-for-profit character). The fact that the cost advantage is not obvious also hampers the spread of RECs: based on a recent study[30] 'REC cost reduction compared to individual smart-homes amounts to only 4%–6% in the best cases' and 'uncertainties stemming from the costs of setting up a REC may reduce 'even these benefits[31].

Complexity, Fairness and Well-informed decisions

The benefits and costs mentioned above should be interpreted in the context of energy justice. Community power initiatives might move energy suppliers to increase prices for energy sharers or impose an energy sharing fee in a justified manner, since their costs, risks and burdens increase. Governments could prohibit such fees, but doing so would socialize these costs for all consumers, causing non-sharers to contribute to the energy expenses of sharers.

However, if the "user-pays" principle is applied and all costs are allocated to those who generate them, this might create a burden on consumers to make well-informed decisions, due to all the factors they should to take into consideration. For consumers to make informed decisions about energy sharing, they must assess their own consumption, any costs applied by the energy supplier, the generation capacity of the sharing party, and the usage of the sharing party (to determine what is the energy that can be shared). Energy sharing distribution methods also play an important role since they may present different costs, when using the public network for example, with a static distribution key in place, they must also consider a potential feed-in cost. All these factors must be calculated within the maximum of each imbalance settlement period —typically 15 minutes— for the entire timeframe they intend to share energy. In this complex exercise, energy sharing organisers (ESOs) or energy related entities could assist consumers with these calculations, in all likelihood for a fee. This reduces the complexity but decreases possible savings.

As the document titled "Facilitating energy sharing"[32] correctly points out, several factors affect the financial attractivity (and viability) of energy sharing configurations such as the for-profit/not-for-profit nature of the sharing organiser or the sharer, whether the supplier applies

[30] Felice, A., Rakocevic, L., Peeters, L., Messagie, M., Coosemans, T. & Camargo, L. R. (2022). Renewable energy communities: Do they have a business case in Flanders? Applied Energy, 322, 119419. https://doi.org/10.1016/j.apenergy.2022.119419.
[31] However, the study notes that 'electrification of heat and transport will add more possibilities to reduce costs (up to 17% compared to the same cases where no flexible assets are available) in a smart energy system'.
[32] https://eu.boell.org/sites/default/files/2024-11/a4-facilitating-energy-sharing-2111-c.pdf

an energy sharing ‘surcharge’, whether in a given jurisdiction the multi-supplier model is appropriately implemented or partial/residual electricity supply contracts are penalized, whether there is a non-market based price for residential customers, how wide-spread dynamic price contracts are, whether there is another more attractive incentive for renewable generation, whether any discounts for network charges apply, what is the composition of the energy bill and whether there is a dedicated national incentive mechanism/support scheme for energy sharing[33]. Some countries have public policies and entities giving support in these matters.

3.1.3 Consumer side flexibility

The flexible use of energy, i.e., adjusting consumer behaviour implicitly or explicitly to a range of signals, can also contribute towards affordability, for example when costs decrease (or potentially income arises).

Increasing flexibility in the energy system is vital to the management of the intermittent renewables and decentralised energy supply alongside the increasing deployment of distributed energy resources (DERs) such as electric vehicles (EVs), heat pumps and PV systems. While the deployment of these assets is key to decarbonising the energy system, they can put a strain on distribution networks due to increased load and changes its nature.
As a tool, flexibility of generation and consumption can effectively address these challenges, enabling the integration of intermittent renewables and increasing DERs on the system, while balancing supply and demand and alleviate pressures on the grid[34], potentially leading to network development deferral or increased hosting capacity.

3.1.3.1 What is flexibility and how to provide it?

There are two primary types of flexibility: market flexibility and system flexibility. System flexibility is the ability of the power system to adapt to variability, while market flexibility is the ability of market participants to react to prices.

[33] Ritter, D., Mühlenhoff, J., Öko-Institut, Heinrich-Böll-Stiftung European Union, ICLEI - Local Governments for Sustainability, Regulatory Assistance Project, Heinrich-Böll-Stiftung Greece, Solar Power Europe & Florence School of Regulation. (2024). Facilitating energy sharing: Boosting participation in the energy transition: Five action areas for the new EU policy cycle (4/5). https://eu.boell.org/sites/default/files/2024-11/a4-facilitating-energy-sharing-2111-c.pdf
[34] The IMED and RED grant active consumers and energy communities the right to access flexibility mechanisms through aggregators, as outlined in Article 22 of REDII and Articles 15 and 16 of the EMD.

System flexibility can be achieved by TSOs and DSOs through regulated services and prices, or it relies on markets, be they day-ahead, intraday, balancing[35]. For anyone wanting to monetize their flexibility, there are two possibilities:

- implicitly, reacting to price signals (like time-of-use or dynamic tariffs or energy prices on the spot markets); or
- explicitly, offering flexibility services on the flexibility markets (balancing markets, congestion management (where the design is market-based) or other local flexibility platforms (where applicable).

It is important to differentiate between price signals provided by energy markets through the energy price and by system operators through network tariffs: energy market price signals reflect the relation between supply and demand (and have no local aspect), whereas time-of-use network tariffs reflect what the system operator needs us to do when in order to manage the operation of the network. Sometimes, a market-optimised behaviour can result in a grid-detrimental outcome[36]. Accordingly, implicit flexibility on the day-ahead/intraday markets is passed on to customers via dynamic or otherwise differentiated prices. This is particularly important for integrating variable renewable energy sources (such as wind and solar) that are harder to predict.

Consumers can provide flexibility and alleviate the pressure their or other assets are putting on the system by (i) self-balancing, (ii) responding to price signals (either energy price or network tariff) or (iii) offering explicit flexibility directly or through an aggregator[37]. A consumer can do this individually or collectively, bidding into markets via an aggregator or through the energy community itself. Individual consumers providing implicit flexibility is well-established in European markets, with dynamic price contracts taking up and time-of-use tariff arrangements being commonplace in many countries and their adoption growing (in line with ACER's tariff recommendations[38]). Lastly, as for flexibility signals in general, flexible self-consumption tariff design is key to ensure their uptake by consumers while protecting them from undesired bill outcomes. For instance, fixed-price time-of-use contracts might not entirely pass spot prices to consumers but help them to predict their bill. In turn, this can improve their trust in flexible tariffs, and foster behaviour changes.

Explicit flexibility bidding into balancing markets or local flexibility markets (where they exist) come from resources that can rapidly increase or decrease their generation or consumption to help correct imbalances. Such assets are flexible generation, like gas turbines or hydropower, or demand response (which entails a change of electricity load by final customers from their

[35] Generally, we refer to balancing markets and local flexibility markets together as flexibility markets. Balancing markets are the frequency-related ancillary services markets, where balancing energy and capacity is bought by the TSO as a single buyer, whereas local flexibility markets are more precisely markets for local flexibility services which might include congestion management and voltage control and where the buyer of the services is the DSO.

[36] https://www.fticonsulting.com/uk/insights/reports/how-current-gb-wholesale-market-design-fails-make-best-use-flexible-assets-curious-case

[37] In self-consumption, individual or collective, the flexible capabilities may mostly be used for self-consumption optimization and not for other purposes, unless other incentives such as price signals reaching the self-consumer do not override this. However, these price signals might even be in conflict with one another.

[38] ACER's review on national network tariffs and recommendations: https://www.acer.europa.eu/sites/default/files/events/documents/2024-10/ACER_Hybrid_Workshop_Tariffs_30092024.pdf

normal or current consumption patterns in response to market signals), or energy storage systems such as batteries that can discharge or charge up, all of which can be quickly ramped up or down). However, there are several significant hurdles that small, distributed assets have to face when trying to offer explicit flexibility: (i) local flexibility markets are nascent or non-existent in many Member States; (ii) balancing markets have limiting prequalification and/or product requirements; and (iii) and aggregation frameworks are not implemented properly, limiting the presence and potential activity of aggregators (through which small assets could participate).

3.1.3.2 Individual or collective self-balancing

Self-consumption of PV systems can result in benefits both for consumers and the whole energy system if it is controlled on short time periods (such as a 15-minutes basis) and reacts to price signals. It can enable consumers to actively participate in the electricity system and benefit from consuming the energy they produce, leading to (i) on the one hand reduced energy bills and potentially, for the grid, reduced power losses and reduced congestion, or (ii) benefiting from additional income from selling surplus injected into the grid[39]. Under an appropriate tariff framework, self-balancing encourages smarter consumption patterns which put less strain on the energy system.

An individual consumer with a PV system is likely to obtain self-consumption rates in the range of 30%. With demand-side response and decentralised energy storage, the self-consumption rate of an average Central European household running a PV system has been found to go up to 50-75%[40]. Therefore, a consumer is more able to make use of their own electricity if they have energy storage in the form of battery or thermal storage or via an electric vehicle (EV).

In terms of energy communities, while their main objective is to provide environmental, economic or social community benefits, they could provide flexibility within them and potentially be another vehicle for aggregated flexibility to be bid into the system. However, energy communities seem to primarily utilise their assets to balance supply and demand within the community, by matching collective demand with local supply through optimisation of their DER[41] assets. This seems often to be part of an energy community's business model and may be driven by the fact that active consumers or energy communities are responsible for their imbalances, as stated in the CEP[42]. According to some regulators, this internal optimisation could be one of the drawbacks of energy communities, if they avoid reacting to market signals, thus reducing the market's readiness for RES-integration. It is to be explored though, whether this would remain the case if energy communities' access to wholesale and flexibility market

[39] However, if feed-in is not sensitive to price signals, their injection might result in negative market prices or congesting the local grid.

[40] EUR-Lex - 52015SC0141 - EN - EUR-Lex

[41] DER: distributed energy resources, including distributed generation, storage and demand response.

[42] Pursuant to Art. 15(2)f) and 16(3) c) of the IEMD. (Directive (EU) 2019/944)

access would be facilitated. Economic reason[43] would dictate for them to allocate flexibility where it is worth more (internally or on the market). However, this is conditional on the fact that their non-discriminated market access is granted.

The potential benefits of such self-balancing for the energy community include financial benefits in the form of reduced energy costs due to higher self-consumption and reduced purchase of energy from the wholesale market. This self-balancing might also provide system benefits, potentially alleviating local congestion by higher consumption of locally generated electricity when it's produced.

The coordination of the consumption of electricity between individual households or network users requires the willingness of each network user to adapt their own consumption, both in terms of the timing of electricity consumption and its intensity. This is exactly where an energy community (similarly to an aggregator) can make a positive contribution, especially when equipped with software solutions, for example by informing its members about the current availability of locally generated electricity and by creating incentives to use it at the right moment. This is an example of the positive role and effect energy communities may have on the load on the power grids and consequently on their stability.

However, evidence suggests there are limits to the extent to which an energy community can self-balance without flexible assets. Solar energy communities indicate that their current self-consumption rates are approximately between 30-40%. This means that about 60% of the generated energy is fed into the grid, and if 100% of sharing within the EC uses the local grid, these 60% are surplus or have to be used by nearby consumers or upstream – possibly making congestion worse. There is still uncertainty whether energy communities will always lead to reduced grid congestion – the benefits for the system can be limited to energy communities which are located within the same constraint area given the highly local nature of distribution level grid congestions.

Batteries or thermal storage have the potential to significantly increase the flexibility potential of individual consumers and energy communities, however, the roll out of these assets is – although increasing – still relatively low in most European countries. In the future, if electricity generation can be linked to thermal storage at the district level, self-consumption rates could significantly increase[44].

3.1.3.3 Providing explicit flexibility services to the system

Consumers or groups of consumers can also provide explicit flexibility to the system either individually or, more likely, through aggregators. For example, individuals and energy

[43] European Commission: Directorate-General for Energy, Ilo, A., Rossi, J., Gallego Amores, S., Iliceto, A. et al., *Energy communities' impact on grids – Energy community embedment increasing grid flexibility and flourishing electricity markets*, Ilo, A.(editor), Publications Office of the European Union, 2024, https://op.europa.eu/en/publication-detail/-/publication/0cd22fb0-1989-11ef-a251-01aa75ed71a1/language-en

[44] See documents under the following links: https://www.sciencedirect.com/science/article/pii/S0378778825002932 and https://www.researchgate.net/publication/358224616_Investigation_on_Individual_and_Collective_PV_Self-Consumption_for_a_Fifth_Generation_District_Heating_Network .

communities can aggregate their flexibility and bid it into local flexibility markets and/or balancing services where such markets exist and are open to small scale flexibility. In order to do so they need to collaborate with a balancing responsible party such as aggregators and suppliers.

Aggregating and selling the flexibility of an energy community also requires high levels of automation and often the energy community is required to contract with a third-party aggregator who can aggregate their flexibility capacity and bid it into local flexibility markets and balancing services on their behalf.

Both energy communities and the system can benefit from active consumers and energy communities providing aggregated flexibility to the system. Typically, energy communities could generate revenue by providing such flexibility services, thereby reducing costs of energy and/or providing revenue for re-investment or some financial profit for the members of the community. Additionally, in order to provide aggregated flexibility, an energy community will typically be required to have smart assets and more advanced metering, data collection and digital platforms within an energy community, which can provide benefits such as enhanced efficiency, data-driven decision-making and higher levels of automation for those within the energy sharing arrangement.

3.1.3.4 How much flexibility do consumers and energy communities provide now?

Given the nascent state of distributed flexibility markets in Europe and the early stage of implementation of energy communities in others, it is difficult to quantify the potential flexibility which consumers and energy communities could provide to the system and/or the benefits of providing such flexibility to members of an energy community. In numerous European countries, time of use tariffs are well-established as a form of providing implicit flexibility. There are also some examples of consumers providing explicit flexibility in Europe, for example in Great Britain. In the UK, consumers with certain assets such as EVs and energy storage can enter into contracts with aggregators to bid their flexibility into the National Energy System Operator's Balancing Mechanism[45].

When providing flexibility as a means to decrease electricity costs/increase income, consumers should be aware of the following:

- as regards explicit flexibility:
  - the only flexibility market which is operational in all EU member states is the national balancing market, but these are in the process of being integrated on

[45] Examples include partnership between Kaluza and Flexitricity to allow aggregation of domestic smart chargers, V2G chargers and batteries, to bid into BM: Flexitricity | Flexitricity. Another example is Octopus Energy's Intelligent Octopus Go tariff, which aggregates consumers EV charging to participate in the BM: Octopus leads the charge: National Grid welcomes more electric cars to Balancing Mechanism | Octopus Energy

a European level[46], where only standard products can be offered, and participation of small-scale assets faces several difficulties[47];
    - markets for local flexibility services are only present in some countries, and even in some of these, are in their early stages of development; product design, revenues and activation are difficult to predict; however, where they are established and are operational, they might provide an important revenue stream for eligible service providers or their aggregated assets;
    - generally speaking, prosumers, consumers will face hardships to enter any flexibility market by themselves (that is, to become a balancing or flexibility service provider) in most jurisdictions, where this is a possibility, it is advisable to consider joining an aggregator/energy community engaging in aggregation (in case they are allowed in participate).
- as regards implicit flexibility (reacting to price signals):
    - reacting to dynamic energy prices: most often, this type of flexibility brings avoided costs, and only much less frequently grants income: the direct participation of small-scale prosumers in wholesale markets faces difficulties[48], and the sale of small-scale renewable energy (especially if it is non-dispatchable) is also difficult since it's abundant in off-peak hours and has very often 0 or negative market value at the moment of its generation;
    - as time-of-use tariffs find their way in more and more tariff regimes, consumers have the possibility to alter their consumption behaviour to decrease their system use charges.
    - It should also be noted that energy shared within private networks (e.g., residential or services buildings) is not subject to volumetric network tariffs, so this is the ultimate way to decrease network user's system charges costs.

Assuming that the appropriate legal, regulatory and technical prerequisites are met, there is considerable flexibility potential in distributed energy resources. Where these prerequisites are missing, the average consumer should seek their benefit first and foremost through implicit flexibility, and if they have the assets, offer their explicit flexibility through aggregation – either through their energy community, aggregator or supplier.

3.2 Who are the likely candidates for self-consumption, energy sharing and participating in ECs?

The following chapter aims to draw detailed profiles of certain consumer types and suggests appropriate forms of involvement.

[46] If you wish to expore this topic further, you might want to look for balancing energy platforms PICASSO (for aFRR) and MARI (mFRR balancing product).

[47] See ACER's report on barriers to demand response.

[48] It most often happens indirectly through the suppliers, since direct participation most often requires a suppliers licence (where electricity supply is a licensed activity).

Multi-apartment building and substation level co-operations

(Physical) energy sharing within building (collectively acting renewable self-consumers), closed distribution grids or within a narrow geographical scope have one common core feature: it makes the use of renewable electricity possible even for those who do not have renewable generation assets while contributing to a better self-consumption ratio of the generated electricity. In fact, energy sharing is not exactly “self-consumption”, as sharing is another word for supply or delivery. These in-house solutions may be exempt from any grid fees if they do not use the public network. When they use a small segment of it, reduced tariffs may apply and might also be exempt of taxes. One challenge with this model might be partial supply: all of the electricity demand cannot be satisfied by the renewable generation asset and thus, the participants of energy sharing need to have contracts for the remainder of their demand. For countries that have not implemented an energy sharing framework yet, this form might be the easiest to start with[49].

Local municipalities

Local municipalities represent a viable option as a founder of energy communities and can also help increase public acceptance of the expansion of renewable energy, especially if the expansion interferes with the existing landscape e.g., construction of new wind power plants and solar parks. In Austria, two local municipalities founded an energy community. The local incumbent built a solar park in the respective municipalities, which the energy community leases. Only residents of the municipality can join the energy community and cover part of their electricity consumption with the energy from the solar park at a fixed price. Another example of local authorities taking the lead in energy communities is in Germany[50], where local authorities are engaged in the supply, production, and distribution of energy, too, via municipal utilities (Stadtwerke). Municipal utilities are owned either by the municipality, or by a private company. For example, the Stadtwerke München GmbH (Munich City Utilities, SWM) is a communal company which offers public services for the city and the region of Munich. It is 100% owned by the city of Munich. From 2008 until 2025, SWM plans to invest up to 9 billion Euros in renewable energy. Possible advantages of such a setup might be an already existing community (of interest), already existing administrative and operative functions, better planning (utilities, transport, charging points, flexibility assets) and joint public-private financing, potentially providing local SMEs with cheaper energy, increasing local solidarity and awareness of the energy transition.

[49] Although unless the public network is used, this is not considered energy sharing in the EMD.

[50] Source: Mergner, R., Rutz, D. & WIP Renewable Energies. (2014). Community Power: enabling legislation to increase community ownership for RES projects across Europe. https://www.rescoop.eu/uploads/rescoop/downloads/Community-energy-in-Germany-report-2014.pdf And another forms of community energy: In Germany, the main groups of actors in community energy are **citizens’ energy companies** (Bürgerenenergiegesellschaften), individual owners and energy suppliers. The particular legal form of company should be well considered before launching a project as it defines different basis for cooperation of partners, participation and control. Citizens’ energy companies mainly include **energy cooperatives**, **profit participation of employees or customers**, **community projects by a small group of local investors** (Gemeinschaftsanlagen), **joint local investments by citizens and municipal authorities**. In general, citizens’ energy companies have local investors in the region where the facility is located and the participation of community or citizens is quite high (up to 50% of the equity of the company). Individual owner groups contain private individuals as well as agricultural sole proprietorships (Einzelunternehmen), partnerships (Personengesellschaft) and small corporations (Kapitalgesellschaft) (e.g. agricultural cooperatives).

Vulnerable consumers

According to Article 15a(7) of the EMD, Member States shall take appropriate and non-discriminatory measures to include vulnerable customer groups and customers affected by energy poverty to access energy sharing schemes. Member States can ensure this by including financial support mechanisms or production allocation quotas. Article 15a(8) requires energy sharing projects owned by public authorities to make at least 10% of the shared electricity accessible to vulnerable customer groups.

Based on the survey results, most countries have not yet implemented the concept of energy sharing into national law, in particular the requirement to ensure access of vulnerable customer groups to energy sharing schemes. The responding Member States are struggling with implementation due to a lack of strategy and missing final conclusions on how to implement it. Portugal and Lithuania have indicated that additional support schemes and incentives for energy communities are necessary to include also vulnerable customer groups in energy sharing schemes.

Usually, the establishment of and participation in energy communities, is based on ecological and energy-related benefits. The energy transition is generally supported by customer groups that have sufficient financial and time resources to deal with energy-related topics with the necessary level of detail and to carry out the subsequent implementation. It is often difficult for vulnerable consumer groups such as energy-poor or working-poor consumers to participate in the energy market and in the energy transition. To alleviate this issue and enable vulnerable population groups to participate in the energy transition, solidarity-based energy communities can be one solution. In solidarity-based energy communities, surplus electricity produced within the energy community is donated to low-income households. In Austria, solidarity-based energy communities have emerged over the past two years with special focus on consumers affected by poverty, consumers within the system of a supplier of last resort and working-poor customers. One solidarity-based energy community for instance allows participating households, companies and public institutions to donate a chosen percentage of their surplus electricity to the energy community. In this way, energy-poor consumers that also participate in the energy community receive the donated electricity surplus for free. A second solidarity-based energy community enables nationwide surplus electricity donations to either consumers affected by energy poverty or directly to social facilities. A variety of solutions and initiatives are beginning to appear, exploring a range of models to facilitate access of vulnerable and energy poor consumer groups to participate in and benefit from community energy initiatives[51].

Rural areas

Another variation to the community energy format are rural energy communities, where local municipalities also play an enabling role, but the connection with agriculture is more pronounced: In the example of *Erzeugergemeinschaft für Energie in Bayern eG* (established in 2015), the cooperative is owned by local, small and rural renewable energy producers that operate photovoltaic, wind, and biogas plants. The energy community is strongly rooted in the rural region, closely cooperating with local authorities as well as small and medium-sized enterprises (SME) and strives towards an energy transition in balance with nature. Among others, it developed a project to create photovoltaic plants that promote biodiversity. It is

[51] https://www.raponline.org/knowledge-center/flex-ability-for-all-pursuing-socially-inclusive-demand-side-flexibility-europe/

organized as a cooperative consisting of the electricity producers as members. These are operating with different renewable technologies – solar, wind, and biogas. Currently, the community has 44 photovoltaic, 10 biogas, and 3 wind power plants (potential to include hydro in the future). It currently encompasses a peak potential of 145 MWp which continuously increases through the incorporation of new members and is developing a virtual power plant to show the production capabilities of the members at a given time and place. The main stakeholders the community depends on are the service providers and a network of local SMEs. Local municipalities are especially important stakeholders for both, as the community is dependent on their acceptance and approval for building permits[52]. Other examples are available in the Rural energy community Advisory Hub - Best Practices[53].

Industrial customers

"Energy communities" or "sharing electricity" are not limited to private households and small producers; such concepts are also possible for professional actors who have a much higher energy appetite and therefore have a significantly greater impact on the network load and the associated financial contribution to the costs of the use of a power grid[54]. In 2022, the yearly electricity consumption of the EU's industry was around 700 TWh, which roughly corresponds to the total energy consumption of Germany and Poland. his amount is constantly increasing due to electrification and decarbonisation trends. Several arguments could justify allowing or even incentivising industrial customers to participate in energy sharing, such as network reinforcement deferral, attracting private investment in generation or tackling generation adequacy issues.

The problems self-consumption and energy sharing are most suited to resolve has not yet been explored, but by direct market participation at least some of the volatile load on the networks during peak times could be reduced, which means that a massive expansion of capacity could at least be partially unnecessary or could be postponed.

Industry companies have always been interested in purchasing the electricity they need as cheaply as possible, and not only since the rapid fall in the price of solar technology. Since the recent energy price crisis, many companies wanted to generate electricity themselves. This investment appetite could be harnessed in a way that also benefits the community, fosters renewable integration and local consumption of locally generated electricity (also explicitly incentivised by ESG objectives). It should be noted however, that electricity shared outside the electricity markets decreases market liquidity and the efficiency of market-based dispatch, unless market logic can be made to prevail.

[52] Rural energy community Advisory Hub - Best practices, Erzeugergemeinschaft für Energie

[53] European Commission. (2022, October). Best practices. Rural Energy Community Advisory Hub. https://wayback.archive-it.org/12090/20240322151553/https://rural-energy-community-hub.ec.europa.eu/best-practices_en

[54] However, member states are only obliged to ensure the right to energy sharing for households, small enterprises and medium-sized enterprises and public bodies. It belongs in the discretion of the member state to grant this right to any other categories of final consumers.

3.3 Key Considerations for Consumer Choices

For consumers who consider engaging in the aforementioned forms of self-consumption, choosing the most adequate form of participation requires informed decisions, as detailed below. In addition, a visual representation of certain specificities of each of the new forms of active participation suggests which form is most suitable under which circumstances.

The affordability chapter outlined how different forms of self-consumption (individual or collective, within or outside an energy community) influence key financial aspects (energy price, network charges, cost decrease/income from engaging in flexibility) of the active consumers energy consumption/network behaviour. Self-balancing and changing consumption patterns increases levels of efficiency in self-consumption. Locally shared energy may be a form of optimization of self-consumption and increase profitability of the installed systems, at the same time as potentially decreasing congestion, network losses and voltage problems. However, flexibility used for self-balancing is not used for other potential purposes. The affordability chapter concluded that several factors affect the financial attractivity (and viability) of energy sharing configurations, among others:

- Existing or new incentives may be counterproductive, in particular net metering billing gives network-detrimental behavioural incentives in case of individual self-consumption, similarly to all other incentives/rules that eliminate price signals that could induce better network behaviour;
- Collective self-consumption or energy sharing may add challenges to the current supplier's business models, highlighting the need for a robust regulatory concept;
- Suppliers need access to relevant information and a clear regulatory vision to be able to start their adaptation to new market models;
- Energy sharing consumers may increase supplier costs – there is a policy and/or a political question on how to allocate these costs;
- From a network cost perspective, energy sharing that uses the public network should not receive any exemptions from network tariffs, except for certain duly justified cases;
- If properly designed, energy sharing can contribute to lower customer costs, lower network costs and lower network development needs and can serve as a starting point to teach more and more customers to shift their consumption, that is, to behave more flexibly;
- However, unless properly incentivised, energy sharing or collective self-consumption most likely uses behavioural flexibility for self-balancing, locking away consumers' flexibility from markets;
- For individual or collective self-consumers, the primary way of monetising their flexibility (beyond self-balancing) is through implicit flexibility (reaction to price signals for a decrease in the energy bill), since explicit flexibility participation of residential customers through aggregators is still rare in most jurisdictions;
- As for energy communities, based on CEER's information, it is not typical for them to explicitly offer flexibility to the market, they seem to use flexibility potential to self-balance and increase self-consumption which can be considered suboptimal. This might, however, be due to their limited market access (barriers for market access and missing local flexibility markets) options and not an in-built inefficiency.

As a recent study correctly mentions, there 'has not been a broader analysis of energy sharing's strength and weaknesses compared to other instruments that could perhaps achieve the three main objectives of participation, renewables expansion and easing pressure on grids more effectively[55]. However, both the decision of the Member State and the customer should be based on the best possible information. The customers decision should be facilitated by Member States providing public calculation tools for common use cases (such as weshareenergy.lu) and publicly available voluntary template agreements. To support calculations and planning, at least appropriate metering data (smart meters or appropriate measurement devices) and DSO data processes should be in place, so that customers can become more in charge of their energy bill and their contribution to the energy transition.

Which solution to choose: energy communities or energy sharing schemes?

When opting for energy sharing or energy communities, the following considerations are necessary for residential users

- What (generation, flexible) assets are available?
- What is the national regulatory environment like?
- What is the motivation for and objective of participating in community energy?
- What are the expectations and commitments of each user regarding participation and decision making?
- What is the level of investment available (as regards time, efforts and money) and what are the expectations regarding benefits (monetary vs. societal/environmental, short-term vs. long-term etc.)?

The answers to these questions will influence the choice of what is the more or most suitable form of participation.

Energy communities can develop several activities such as generation, supply, renewable energy activities, energy efficiency, consumption management and energy sharing. Energy security and reliability, as well as protection against high prices and market volatility may be provided by energy communities when engaging in several activities of the energy system. The participants, investing and being a part of the community, have a word to say about the objectives of the community and the use of resources. However, the development of a new activity takes time, for the creation of rules, to develop technical capacity and business models and to inform consumers on the possible benefits and challenges of the initiative. The figure below identifies typical objectives when engaging in energy communities.

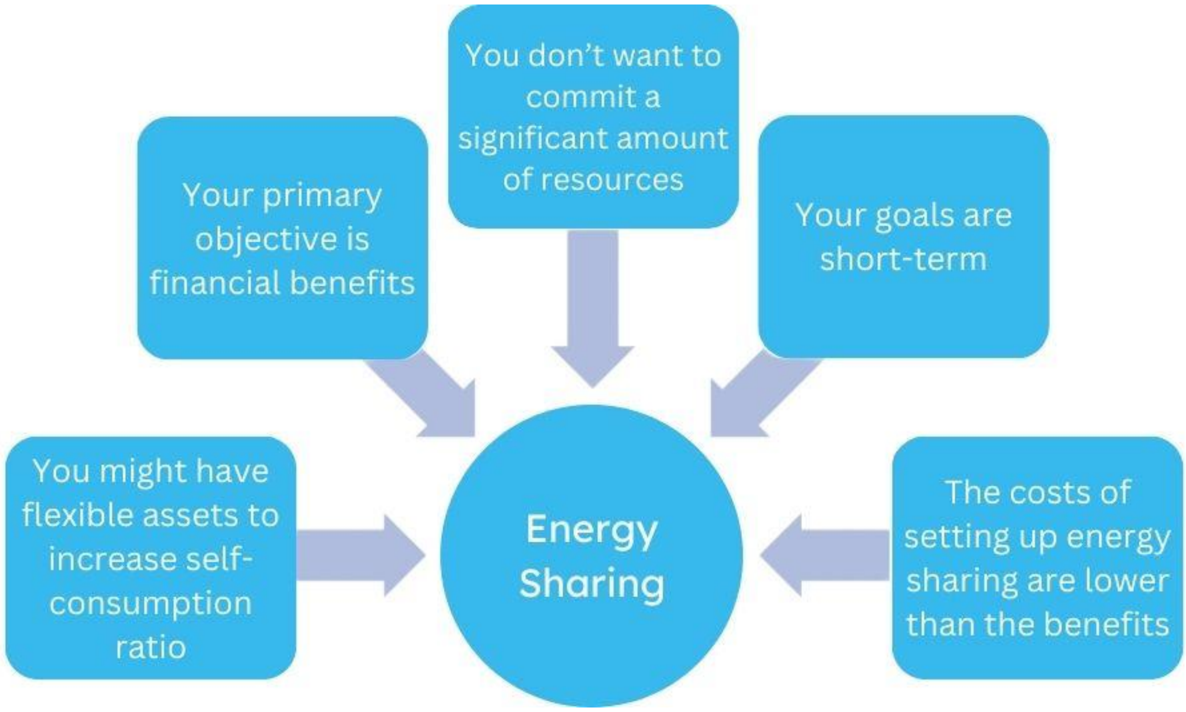
By comparison, collective self-consumption or jointly acting self-consumers have a single base concept: energy sharing. Combining different consumption profiles allows to improve the efficiency of the self-consumption. Energy sharing is something that an individual self-consumer may develop with other consumers or self-consumers if the conditions are right: the expected benefits exceed the costs and the benefits of alternative behaviour (such as offering

[55] Ritter, D., Mühlenhoff, J., Öko-Institut, Heinrich-Böll-Stiftung European Union, ICLEI - Local Governments for Sustainability, Regulatory Assistance Project, Heinrich-Böll-Stiftung Greece, Solar Power Europe & Florence School of Regulation. (2024). Facilitating energy sharing: Boosting participation in the energy transition: Five action areas for the new EU policy cycle (4/5) https://eu.boell.org/sites/default/files/2024-11/a4-facilitating-energy-sharing-2111-c.pdf

flexibility as an individual self-consumer) and the resource type prerequisites are fulfilled. Although social connection and the definition of functioning rules are required for energy sharing, it enables self-consumers to share their excess energy, decreasing their electricity bill or providing additional income. The Figure 3-1 below shows the typical objectives when engaging in energy sharing.

Figure 3-1 – Energy community objectives/characteristics

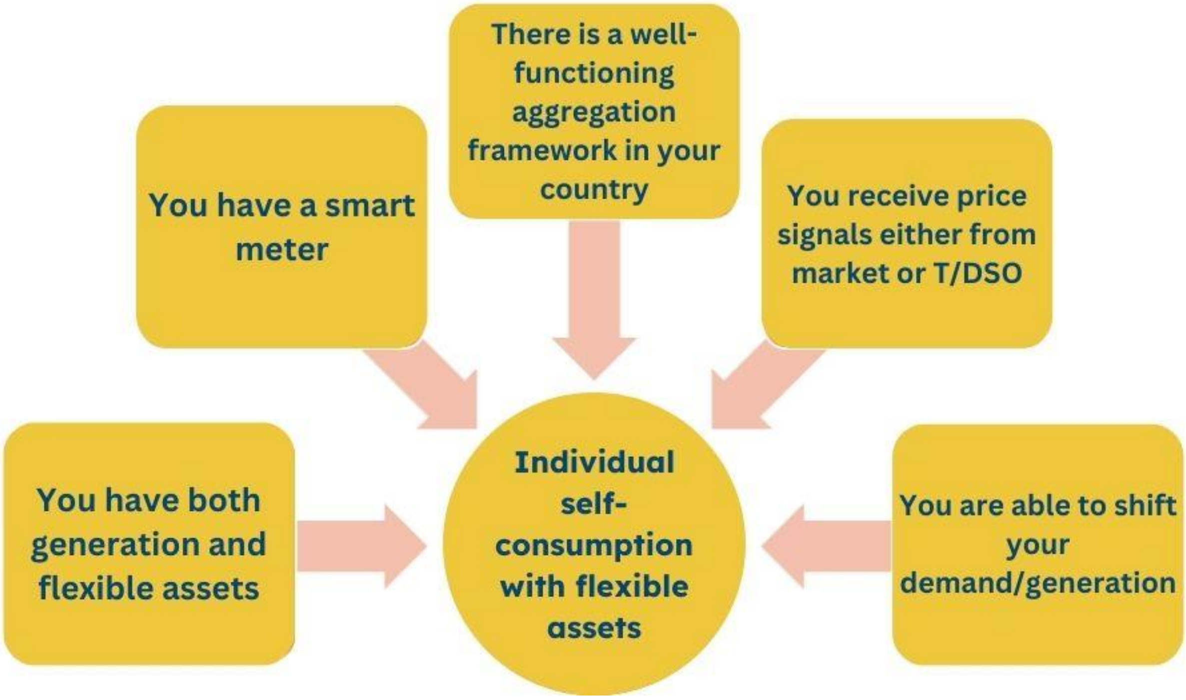
Figure 3-2 – Energy sharing objectives/characteristics



The choice between an energy community or an energy sharing scheme depends on the degree of commitment, investment and benefits that the participants expect. An energy community may provide benefits such as cost reduction, energy efficiency and increased resilience of the local community, even without energy sharing or supply activities. In the end, an energy community is more than just energy sharing. When it comes to developing a new activity, energy sharing is simpler and easier to develop. Especially if there are already active consumers with their own generation and storage units who are able to share energy.

Where the costs of setting up either activity are relatively high or are simply administratively difficult, but consumers have flexible assets, consumers will most likely be inclined to offer their flexibility reacting through price signals or through aggregation. Such activity would constitute a form of individual self-consumption, as seen in Figure 3-3 below.

Figure 3-3 – Individual self-consumption characteristics



4 Section II: The Regulatory Perspective

The practical application of energy sharing, communities and market participation of consumers' distributed energy resources raise a variety of questions, some of which lie within the remit of NRA responsibilities. Generally speaking, these responsibilities include aspects such as infrastructure planning, tariff setting, consumer protection, quality of supply and market monitoring and surveillance. In addition, IMED Article 59(1)(z) adds a duty for NRAs regarding 'monitoring the **removal of unjustified obstacles to and restrictions on the development of consumption of self-generated electricity and citizen energy communities'**. As regulatory bodies, NRAs do not have legislative powers; although they can issue network and market rules and codes. As such, there are tools available to NRAs to help address some of the barriers faced by new actors and energy sharing models. These tools include: **network access rules and network tariff design, data exchange requirements and energy sharing methodologies. Furthermore, regulators can establish consumer protection obligations on market actors and facilitate market access through the wholesale market rules.** Also, NRAs may engage in advocacy of certain concepts and design configurations towards the legislator and may also acquire a legal mandate to develop detailed rules on a certain topic.

The first part of Section II focuses on barriers and potential solutions for energy sharing and energy communities and highlights regulatory involvement in the definition of energy sharing distribution keys and network tariffs. The second part focuses on the key challenges that the arrival of new market players and their assets bring to market design and the power system, highlighting existing and potential challenges and solutions to consider.

4.1 Barriers for energy sharing and energy communities

Financial considerations regarding the return on investment of renewable generation or self-consumption are naturally a key consideration for consumers.

Self-consumed energy can help to reduce local load and network bottlenecks or to otherwise lower system costs in the presence of proper incentives. In the absence of such incentives, however, self-consumption might lead to suboptimal network or market outcomes. This is why both the legislator, and the NRA, should give due consideration when designing the framework for renewable generation and community energy opportunities. On the one hand, the initial framework to incentivize investments and enhance the financial attractiveness of these solutions (e.g., user-friendly and simplified administrative requirements, investment support schemes, whether to allowing the supplier to apply higher charges or not, tax or tariff reductions or other potential benefits or charges) and market access conditions. On the other hand, incentives to optimise the consumers' use of the self-consumed energy, to reduce their energy bills at the same time as they support the network (e.g., price signals, design of time-of-use network tariffs, network use alerts in case of congestion risks, etc.).

In addition, assessing the benefits of an energy community opportunity will most likely also mean considering non-financial considerations, such as socio-economic benefits, which are the primary aim of an energy community. Energy communities may perform several activities (including energy sharing), but many of these activities (e.g., market participation, network operation, supply, etc.) need specific licensing and pre-requisites that require energy system expertise. Therefore, the appearance of energy communities may not be as easy as simple as owning a self-generation asset, due to the need for stronger participant involvement, energy expertise and more demanding administrative requirements. Energy sharing may be simpler to develop since it is less demanding on participants with little expertise and may be managed by a third party. However, as the following chapters show, even energy sharing outside a formal energy community structure faces several barriers.

In chapters 4.1.1 and 4.1.2, we present the most frequent barriers and potential solutions to alleviate these, based on the latest CEER member Survey.

4.1.1 Energy communities

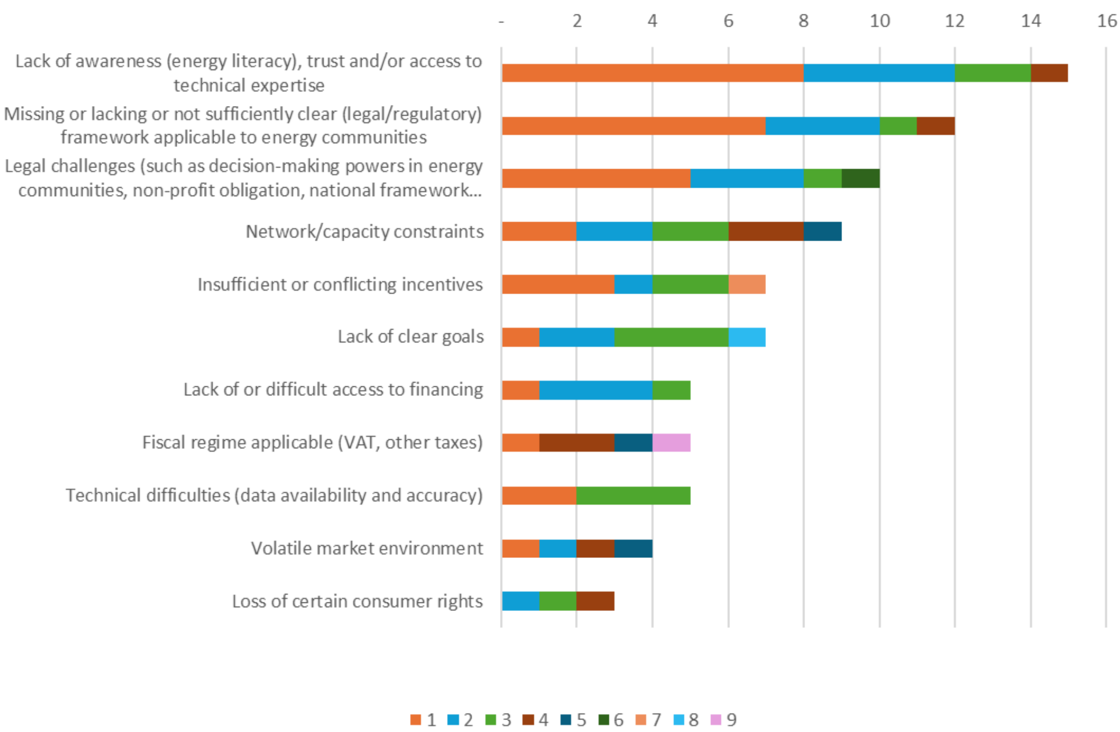
Input received from NRAs via the Survey, provided some insights into the difficulties of Member States to develop energy communities and energy sharing. The Survey outlined a variety of possible issues, including the legal/regulatory framework, consumer information, technical expertise necessary for the activities, network constraints and design of incentives (financial, benefits, rights).

The top three **barriers identified for energy communities** were:

- Lack of awareness (energy literacy), trust and/or access to technical expertise;
- Missing, lack of or not sufficiently clear (legal/regulatory) framework applicable to energy communities;
- Legal challenges (such as decision-making powers in energy communities, non-profit obligation, national framework for closed distributions systems or local system operation).

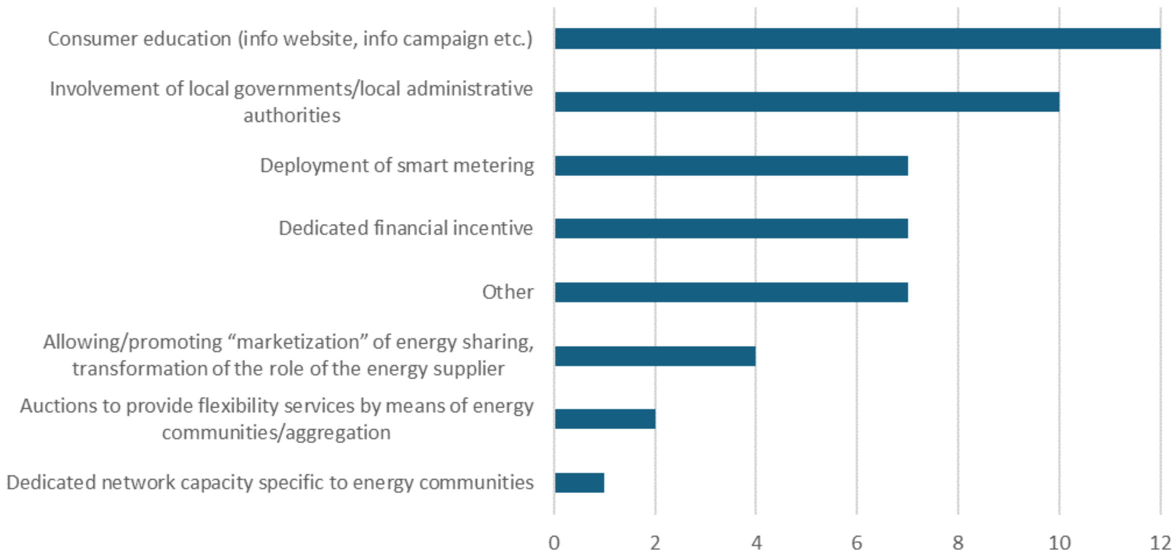
As observed in Figure 4-1 below, when weighing the ranking by fifteen NRAs of the importance of barriers, we see that these three barriers were the most highly ranked. To note also the subsequent three barriers, which received a high ranking (between 1 and 3) from several NRAs: network capacity constraints, insufficient or conflicting incentives and lack of clear goals. In an earlier CEER survey, certain NRAs marked the not-for-profit character (or insufficient clarity on what this exactly means) of energy communities as a barrier.

Figure 4-1 – Energy community barriers



As for implemented solutions, as Figure 4-2 shows, consumer education appears to be the most widely-used measure, followed by the involvement of local governments/administrative authorities. The deployment of smart meters and dedicated financial incentives were also popular measures. Some of additional measures indicated by NRAs included the possibility to apply network tariff rebates depending on the extent of the use of the network when sharing energy, the development of non-firm/flexible connection agreements and the development of regulatory and legal frameworks. Examples of national information awareness developments may be found in these footnotes[56]. Facilitating the activities that energy communities tend to engage in (firstly energy sharing, then aggregation and supply) for new actors will also strengthen the value proposition of energy communities.

Figure 4-2 – Energy communities – solutions



Finally, it seems that energy communities face another inherent barrier: in the absence of an existing community, the administrative burdens weigh even heavier on newly established energy communities. For this reason, it seems advisable and more efficient to prioritise enabling already existing communities to develop an energy aspect.

[56] FR: https://www.ecologie.gouv.fr/energies-citoyennes; LU: https://www.wesharenergy.lu; SI: https://uro.si; SK: https://www.siea.sk/projekt-rec4eu-predstavil-moznosti-rozvoja-energetickych-spolocenstiev-na-slovensku/; PT: https://poupaenergia.pt/energia-verde/ and https://www.erse.pt/en/activities/regulations-electricity/self-consumption/#know-more; ES: https://www.cnmc.es/sites/default/files/5418567.pdf.

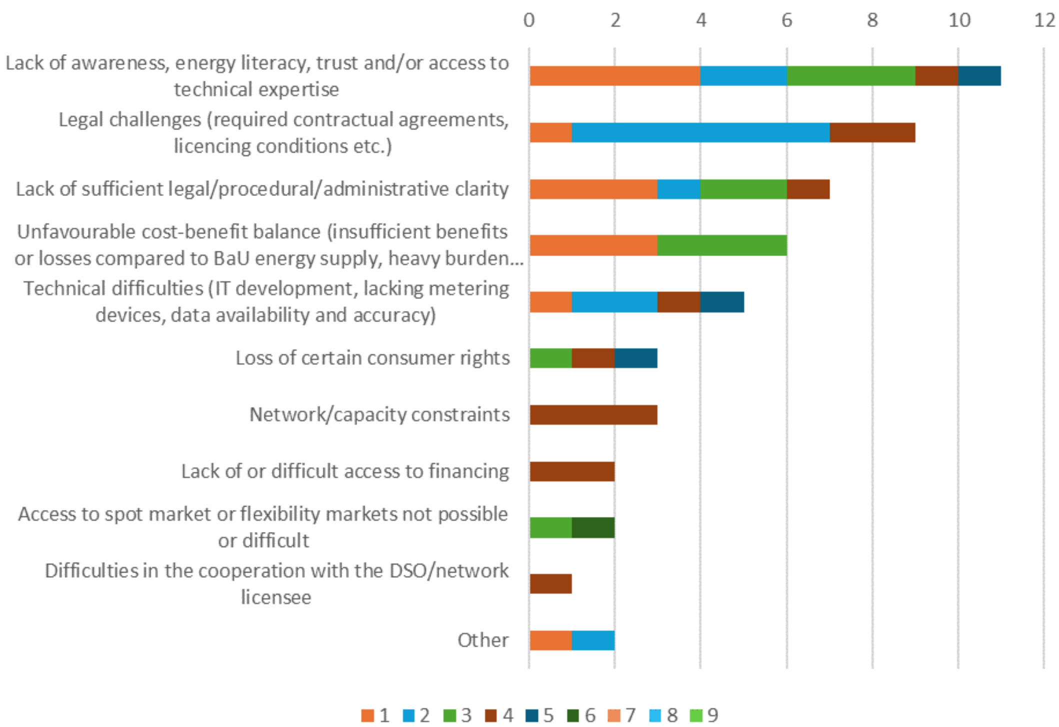
4.1.2 Energy sharing

First, we recall the input received from the Survey in Table 3-1, which shows that 8 countries considered energy sharing as defined in the EMD to be fully implemented, and 12 to be partially implemented. Concerning **barriers for energy sharing**, although not exactly the same, a similar question and list of barriers was included in the Survey. All options were identified by NRAs as possible barriers, however, the top three were, in fact:

- Lack of awareness, energy literacy, trust and/or access to technical expertise.
- Legal challenges (required contractual agreements, licensing conditions, etc.);
- Lack of sufficient legal/procedural/administrative clarity.

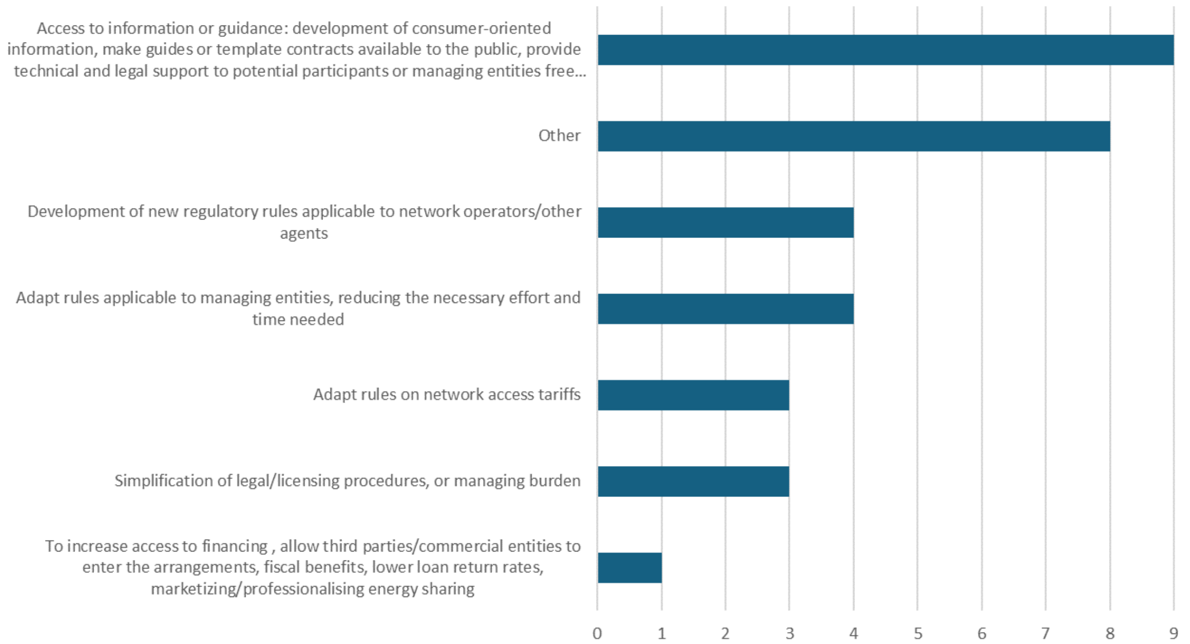
When weighing the ranking by NRAs of these barriers, Figure 4-3 below shows that the next barrier, on "unfavourable cost-benefit balance (insufficient benefits or losses compared to BAU energy supply, heavy burden of managing, insufficient incentives)," also received a high rank (1st and 3rd) from several NRAs. Meanwhile, network constraints, were identified as a fourth priority barrier. Other barriers mentioned include the "concept of energy sharing is under discussion and not yet implemented" and "lacking metering devices".

Figure 4-3 – Energy sharing barriers



From the potential solutions identified by NRAs to tackle such barriers, Figure 4-4 shows the most common measures were the development of consumer-oriented information, guides, templates for contracts, providing technical and legal support to potential participants or managing entities free of charge. Other measures highlighted where the '**ongoing development of rules for energy sharing**', either legal or regulatory framework (main issue), '**the development of a communication forum**' with potential participants, that helped to identify other barriers and propose solutions, and the '**simplification of rules for market integration of surplus and aggregators'** (integrating in the market residual feed-in to the grid) such as registration in the wholesale market or billing.

Figure 4-4 – Energy sharing – solutions



Developing a specific framework/set of derogations to kickstart energy sharing has also proven to be helpful. In **France**, the participants in a self-consumption scheme – which must be spread over a defined and limited geographical area - gather together within the same legal entity to share local electricity production. In this case, collective self-consumption operations derogate from the rules of ordinary law applicable to the supply of electricity. For example, the legal entity organising a collective self-consumption scheme is not requested to comply with specific pre-contractual obligations or the obligation on invoicing for the electricity consumed. Allowing the market to develop the services to be offered can also bring positive outcomes: When asked about existing commercial offers that are being developed, 11 NRAs[57] are aware that commercial offers exist from private entities, such as suppliers or banks, and that - depending on the country - some of the services available involve financing, managing or offering discounts on the energy supplied from the grid. A relevant commercial practice identified is that of a 'simplified compensation mechanism' available to consumers in Spain. This consists in the energy injected to the grid not being considered as energy incorporated into the electricity system and being exempt from paying network access tariffs, although the supplier is responsible for balancing this energy. This energy is returned by the supplier to the consumer and cannot exceed the amount billed for energy consumed from the grid in each billing period. Some suppliers are offering so-called 'virtual wallets' to apply the money that has exceeded the above limit in subsequent billing periods.

4.2 NRAs Tools to Address Barriers

4.2.1 The task ahead: need for adaptation to a decentralised system

With the consumer at the centre of all decisions and actions, NRAs have the task of guaranteeing that private and professional network users have a reliable energy supply at the most advantageous conditions possible, with fair and transparent access to the liberalised market. When implementing the EU Directives mentioned in this report at national level, the NRA should therefore ensure that application of the provisions results in rules that can be understood by consumers and **can be implemented in practice with a reasonable amount of effort**.

In that respect, the NRA can indeed play a central role as an intermediary between the legislator, other authorities, grid operators and energy suppliers - all professional actors - and the (often) private end-consumers, who may not always be sufficiently familiar with the complexity of the energy market and the corresponding laws and regulations.

Generally speaking, current **regulatory frameworks are supply-oriented** and delegate various system responsibilities from consumers to suppliers (e.g., network access, legal responsibilities for market access, financial robustness, balancing, etc.). When consumers are asked to take action and be active in the electricity system, it is not possible to expect them to

[57] BE, CZ, ES, FR, HU, IT, LT, LV, PT, SI and XK

assume directly the same level of rules and administrative procedures for an activity that, until today, was designed for centralized generation facilities and professional agents. The translation of these rules for (self-)consumers, even when participating by means of an aggregator that represents them, does not simply mean adapting the requirements to aggregators.

When a generator wishes to **access the wholesale or balancing market,** it has to comply with rules from the TSO, legal responsibilities, authorizations and observability and communication requirements. This variety of requirements now has to be adapted to a dynamic where all consumers are now possibly small generators. Although it is most probably not defined by NRAs, even the tax framework may require adaptation, since the generation of renewable energy may not differentiate between a residential consumer, who benefits less than one hundred euros a year for their surplus, and a powerplant generating more than 1 TWh a year, whose sole purpose is energy generation and market participation. Settlement rules, responsibility for imbalance and the possibility and economic rationale and administrative simplicity to sell self-generated electricity (directly or through aggregation) all come to mind as areas where small and big players may need different treatment.

The **switching process** for aggregators will one day be similar to switching between suppliers; the same could be true for participation in energy sharing/communities. The rules for market participation have to be detailed when addressing small consumers/self-consumers, or even medium-sized consumers under 1 MW of contracted capacity. The simplification of these rules may be the responsibility of regulators. Even the registry/licensing of energy sharing requires dynamic communication with the relevant/responsible entity. If it is a static or heavily administrative process, it is a barrier to implementation and changes. When participating in energy sharing, either within or outside an energy community, **supplier coordination** and consumer experience matters. Consumers with different suppliers and different prices may struggle to compare the information received from the DSO regarding energy sharing with the invoice received from suppliers. Different billing periods, overestimations for consumers and non-matching information from the ESO may lead to less positive experiences for the different participants, including concerns about paying the bills or compensating estimations. The mere possibility to have multiple suppliers (or actors that are performing supply activities) and their coordination depends on the regulatory framework in each Member State.

Network access contracts and tariffs also have to be addressed. Who should have priority access? Renewables or only dispatchable renewables? Should energy communities receive privileges in terms of network connection queues? Should consumers engaging in energy sharing receive a network tariff discount? What happens in case of non-performance? These are situations that NRAs may address to facilitate implementation of energy sharing**.**

Data exchange processes play a significant role in energy sharing. Depending on the responsibilities of each agent, the DSO, or a dedicated metering operator, has to read and validate metering data in order to make it available for stakeholders (consumers, ESO, aggregators, suppliers, BRP). The Commission Implementing Regulation (EU) 2023/1162 of 6 June 2023, on interoperability requirements and non-discriminatory and transparent procedures for access to metering and consumption data, also defines data reference models, roles and data exchange processes[58]. This impacts suppliers as regards billing periods, network access tariffs and taxes. It affects BRP energy volumes and also the consumer that will have to understand their energy bill. The ESO may also have a responsibility in giving the participants information, therefore, it needs to have access to relevant metering data. The mechanism chosen for performing the energy sharing affects each participant differently and data sharing with suppliers and energy sharing participants could be aligned with the billing period for a better experience[59].

The different **methodologies for energy sharing** implementation create different impacts on the different agents. A purely administrative process may not affect the metered electricity nor the supplier's regular activities and responsibilities; it is easy to implement, but its behavioural effects might not be as significant. In other cases, the energy supplier still supplies the shared energy, and the benefits are only the reduced network tariffs, taxes or dedicated refunds. Another scenario is, when a dedicated settlement process calculates the metered energy volume, and the impact of the shared energy is reflected in the supplier energy bill (that is, not only in the tariff component), but otherwise has no impact on the billing process itself and the data exchange between DSO and supplier (and any other parties). If the energy sharing is facilitated by the ESO, they also need information on the energy flows among the sharing participants and need to be made part of the data flow. Other processes may exist where the supplier is a part of the energy sharing process, where compensation and/or settlement procedures may need to be adjusted for the supplier or BRP in this case[60].

Residual feed-in, self-generated or shared energy that is not consumed, may be injected into the grid. This surplus can be accounted and, eventually, be sold at a fixed price or in market conditions. If it is not accounted it may affect the network and cause hidden effects, such as, reducing losses or aggravate existing problems in the network. When accounted for, its effect can be duly identified, managed and dealt with. One option is to account this surplus by the DSO (when smart meters allow settings adaptation) and assign it to reduce the effect of network losses[61] (taking in consideration the possible effects on existing regulatory procedures, such as losses related incentives); another option would be to sell the residual energy to a trader, in which case this should be covered by another contract.

By way of example, Table 4-1 below illustrates potential configurations of implementing energy sharing schemes in Czechia, prepared by the Czech NRA (ERU).

[58] Member States shall provide the reporting of national practices referred to in paragraph 1 to the Commission no later than on 5 July 2025 (article 10 (4))

[59] Electricity market design reform - Implementation guidance from the solar sector, Solar Power Europe, July 2024, https://api.solarpowereurope.org/uploads/EMD_implementation_guidance_final_e5a3aee317.pdf?updated_at=2024-07-16T13:32:58.173Z

[60] Multi-supplier models and decentralized energy systems: Energy sharing approaches, ENTEC, May 2023, https://energy.ec.europa.eu/publications/multi-supplier-models-and-decentralized-energy-systems_en

[61] The Portuguese regulatory framework applies this measure.

Table 4-1 – Electricity sharing implementation parameters. Source: ERU

	Implementation options	Implemented in Czechia
Institutional and generation limitations	• Only for members of organized and registered energy communities • Only for independent active customers • For both, independent active customers and energy communities • For all generation types • Only for selected generation types, e.g. RES, decentralized,…	**For both, active customers and energy communities** **For all generation types**
Size limitations	• Limited number of customers in one energy sharing group • Unlimited number of customers in one energy sharing group • Each customer can participate only in one energy sharing group • Each customer can participate in more energy sharing groups	**Limited number of customers in one energy sharing group** *For Energy communities up to 1000 customers, for independent customers up to 11 customers but up to 1000 in apartment one building* **Each customer can participate only in one energy sharing group**
Regional limitations	• Regional limitations on energy sharing communities • No Regional limitations on energy sharing communities • Regional limitations on energy sharing groups • No Regional limitations on energy sharing group	**Partly regionally limited renewable energy sharing communities** **All other types of electricity sharing regionally unlimited**
Allocation model	• Static allocation key defined by fixed % only. • Static allocation key defined by % that can change during the year • Dynamic allocation key defined by consumption • Combined allocation key: 1st static round, 2nd dynamic round	**Combined allocation key** *For small groups up to 50 customers static allocation can be computed in 5 iterations which approximates static allocation key combined with dynamic key. For larger groups only static allocation key*
Administration and settlement	• Decentralized, evaluated by active customers and energy communities • Partly decentralized, evaluated by individual DSOs • Centralized, evaluated by one entity – MO, DataHub, etc.	**Centralized** *evaluated by newly established entity called Electricity data center (EDC) closely cooperating with the Market operator (MO) and with DSOs*
Tariff savings	• The amount of electricity shared does not impact tariff payments • Simple impact on tariff payments depending on 0/1 usage of the grid • Complex impact on tariff payment depending on distance	**Simple 0/1 impact depending on the usage of the grid:** *Only when sharing within apartment buildings, customers save also the regulated part of the bill. Otherwise, only the payment for electricity supply is decreased by electricity sharing*

4.2.2 Need for a concerted approach (Roadmap)

As is demonstrated by chapter 4.2.1, increased consumer participation requires that many, if not all, aspects of traditional power system processes be reconsidered. To facilitate this review, the European Commission's Energy Communities Repository has issued two reports, one assessing Barriers and Action Drivers for the Development of Different Activities by Renewable and Citizen Energy Communities, and another providing a Roadmap to Developing a Policy and Legal Framework that Enables the Development of Energy Communities[62]. The Roadmap provides an overview of the key steps to follow for the implementation of energy communities, which can be easily applied for energy sharing as well. It sets out four key steps:

- a clear definition
- access to financial support
- minimal regulatory conditions
- access to information, awareness-raising and expertise

While the first 2 steps (and especially step 2) fall under the legislator's responsibility, steps 3 and 4 can also be performed by the NRA. For step 3, the use of **regulatory sandboxes** and **pilot projects** may also be considered by NRAs where deemed appropriate since they could be an effective tool at their disposal. Experimental regulatory frameworks allow countries to test and adjust the rules that best fit their market participants, either by assigning specific projects to regulated agents or by opening to the general public the participation and

[62] A roadmap to developing a policy and legal framework that enables the development of energy communities: https://build-up.ec.europa.eu/system/files/2024-03/c6990021-e30c-4b29-9dd9-147989a1869b_en.pdf

development of specific rules. CEER developed a paper on Regulatory Sandboxes[59] where the different experimental approaches for supporting innovation may be found. As was previously mentioned, NRAs regularly use **awareness-raising, education and information campaigns** to help with the introduction and implementation of new rules or regulatory approaches. However, in this particular case, there is another entity whose role is key in the success of the implementation: the agent responsible for the metered data.

4.2.3 What can NRAs do?

One example of the application of the possible regulatory approaches mentioned in chapter 4.2.1 can be found in the Grand-Duchy of Luxembourg, where the regulatory authority (ILR) was mandated by law to develop the practical modalities by which grid operators should enable the sharing of electricity between grid users.

The model distinguishes **sharing groups** between spatially limited small groups of grid users who share locally generated electricity within the same building ("**collectively acting renewable energy self-consumers**") and larger distribution groups ("**energy communities**"), which may share electricity across the country. Grid fees are addressed and regulated having in mind the geographical distribution of participants within a specified radius (300 meters). Regarding the final energy bill, taxes and levies need to be considered as well.
Predefined **sharing keys** are based on **static**, **variable** or **dynamic** calculation methods that can be predefined or agreed upon by the active customers. The definition of these calculation methods includes the definition of essential rules and procedures for metering, validation, billing, role definition (who implements it) and the settlement period. The price for shared electricity is not regulated by law, and it is at the discretion of the sharing group to determine the price for shared electricity.

Every household is connected to the **public electricity grid** and an **electricity supply contract must exist for every consumer** point of delivery (POD), regardless of the household receiving part of its energy via a sharing group. For each generation unit, there must also be a contract with an electricity supplier that buys the excess energy that was not consumed by the sharing group members and that was consequently injected into the grid. This supplier may also serve the purpose of ensuring the internal consumption of the generation or storage facilities (if they receive energy that is not shared with them, it comes from the grid).

Regardless of whether it is a geographically limited or a nation-wide sharing group, it must **always sign an agreement with the respective grid operator** through which every member (i.e., every consumer POD and every production POD) in the sharing group can be clearly identified.

Having a quarter hour **(15 minutes) settlement period** is only possible for households whose PODs are connected to the grid operator via a **smart electricity meter**. This brings with it numerous opportunities and challenges that grid operators in particular have to face, such as the **development of a solid infrastructure of intelligent electricity meters and a corresponding reliable communication network**; in addition, the **data** collected must be able to be verified, corrected and stored securely and, last but not least, be accessed by individual market participants and the grid users. A modern network operator must therefore not only have qualified electricians and engineers, but also specialists in data communication and experts in secure data processing. At the same time, the regulatory **authority must also develop a solid understanding of the technical aspects and challenges** in order to be able to appreciate and approve the physical and human investments of the grid operators.

Providing the relevant information on energy sharing can also pose a challenge, for example as regards what voltage levels are used and how much of the public network is energy sharing using. Provisions in Article 15a(6) of the new EMD considers rules for monitoring, collection, validation and communication of metering data related to energy sharing.

Rules on commercial and data relations between DSOs and suppliers must also be taken into account: do all suppliers of energy sharing participants process billing information at the same time? What is the impact of having different settlement periods for energy consumption? Does the DSO have a contact point to deal directly with energy sharing organisers? Who defines the time limits to process the information regarding consumption data? Does the NRA have to mandate the DSO on these rules or is it a part of the legal framework? Are there any preferential rules in place for the connection of energy sharing participants? What are the consumer protection rules that energy sharers or energy sharing organisers also have to comply with?

The functions that deal with the necessary aspects to implement energy sharing have associated costs and need to be assigned. The **roles definition** for the necessary functions to ensure energy sharing may fall, essentially, on the involved agents: ESO, DSO and supplier[63]. Assigning a facilitation function to one of these agents will relieve the involvement of the others. Considering the main facilitator as the:

- DSO – as a regulated entity, tasks such as implementing the calculation tool, receiving sharing keys, providing metering information and data exchange (where this data model is in place) are assigned to the DSO, representing a good option to develop energy sharing;
- Supplier – not enforced by law, to engage in activities may be a drawback of this choice, tasks may be implemented by means of contract with the participants, represents less regulation and public investment, but depends on the private will to develop such relations and offers;
- ESO – assigning the tasks to the interested parties may also lead to lack of incentives in engaging in sharing, requiring more effort from consumers for investment and necessary technical capacity.

The above example provides a general description and approach of the regulatory issues that need to be addressed regarding energy sharing and other community energy arrangements. The following two chapters will describe potential approaches to network tariffs and energy sharing keys in more detail.

[63] https://energy.ec.europa.eu/publications/multi-supplier-models-and-decentralized-energy-systems_en

4.2.3.1 Network tariff approaches in energy sharing

The IMED establishes that active consumers are subject to cost-reflective, transparent and non-discriminatory network charges that account separately for the electricity fed into the grid and the electricity consumed from the grid, ensuring that they contribute in an adequate and balanced way to the overall costs of the system. Where electricity is shared, this shall be without prejudice to applicable network charges, tariffs and levies, in accordance with a transparent cost-benefit analysis of distributed energy resources developed by the competent national authority. Also, the new rules on energy sharing in the EMD state that participants in energy sharing are entitled to have the shared electricity injected into the grid deducted from their total metered consumption within a time interval no longer than the imbalance settlement period (usually 15 minutes) and without prejudice to applicable non-discriminatory taxes, levies and cost-reflective network charges.

The results of the Survey show that of the nine countries that reported having grid users involved in energy sharing, six confirmed the use of differentiated network tariffs[64]. **Belgium** reported an 80% reduction in proportional network tariffs on shared electricity when energy is shared between jointly active customers acting collectively within the same building. For energy shared within an energy community, regular network tariffs are applicable. In **Spain**, for private connections or in the case of consumers connected to the public grid under 1 kV, the energy shared is free of any network tariffs or charges. On the other hand, consumers connected to high voltage (HV) must pay network tariffs for the shared electricity (lower than network tariffs applied to energy consumed from the grid). In all cases, charges are not applied to the energy shared. In the modality of self-consumption not covered by the above discount, the owners of the production facilities must pay the network tariffs for the energy injected to the grid (not shared). In **France**, when all the participants of an energy sharing operation are under the same MV/LV substation, they can opt for a specific tariff option. It reduces the tariff paid by participants who are able to maximize their self-generation at critical times for the grid. The virtual regulatory model in **Italy** is based on the premise that each participant is connected to their own point of delivery and the electricity is shared through the public distribution grid. Each participant can modify their own choices, both in relation to the participation in the collective self-consumption configuration (opt-in and opt-out) and in relation to the choice of the supplier for the electricity withdrawn from the public distribution grid (be it shared or not). The customer within the self-consumption configurations buys their own consumption, by paying the traditional electricity bill for energy withdrawn from the public grid. Then, the contact person (who is either the legal representative of the building, a producer managing generation units or the energy community itself) receives a “cash-back” corresponding to the avoided network costs (losses and congestion) for the self-consumed electricity and, if due, an incentive. The Italian model is described in detail in Annex 2. **Luxembourg** has a different approach since sharing renewable electricity within a 300-meter radius is exempt from network fees. Irrespective of the distance between the individual members of a sharing group, the shared electricity is always exempt from taxes and levies.

In **Portugal,** the cost-reflectivity of network tariffs takes into account the expected utilization of the public grid. Self-consumption does not use higher voltage levels of the public grid (e.g. transmission) and, because of this, it is exempted from the respective network tariffs for the

[64] BE, ES, FR, LV, PT and SI

use of those parts of the system. That is to say: if shared energy uses only the internal grid within a building, no network tariffs apply. For shared energy that uses the public grid, network tariffs are applied based on the voltage levels involved in transporting energy from generation to consumption (e.g., if both are located in the LV grid, only the LV distribution tariff applies; if generation is located in MV and consumption in LV, the sum of MV and LV distribution tariffs apply). This partial exemption is subject to a proximity criterion: 2 km for LV, 4 km for MV, 10 km for HV, and 20 km for EHV. Also, if inverted power flows become more dominant (i.e., energy flows from lower to higher voltage levels) this partial exemption will be reduced by decision of the regulator. The **Slovenian** NRA provided an incentive for energy communities, i.e., a special rebate tariff for shared energy dependent on the extent of network used while sharing energy - the less extent of network that is used, the higher the rebate.

Summing up, there are different approaches related to energy-based[65] network access tariffs in the context of energy sharing. However, generally, it can be said that tariff discounts are mainly applied when the use of the public grid is limited either to the same voltage level or to a specific geographic radius (also implying lower voltage levels). Since energy sharing under the same substation feeder allows a better use of local generation, thus avoiding use of higher voltage levels, when local load and generation are balanced simultaneously, that can be reflected in tariff differentiation. The same principle can be applied to a distance variable. Also, the use of private networks for energy sharing, such as within a building, does not use the public grid and the application of tariffs should take this in consideration. When energy sharing is performed through the public grid, through all voltage levels with no geographical limitations, full tariff discounts may not be justifiable, as tariffs should reflect the use of the network.

So, careful design of a system that allocates the appropriate cost drivers (e.g., availability versus volume) to the use of the network is necessary.

As regards the collection of tariffs, in order to have the least impact on market agents, self-consumption should not create different procedures between parties (DSO/suppliers). Optimally, what is possible should be incorporated in existing procedures, just as for the collection of network tariffs.

[65] We have not encountered differentiation in the power based or other tariff components.

4.2.3.2 Energy sharing arrangements

The shared energy may come from one or several assets: generation, behind-the-meter self-consumption units or storage. Self-consumption (behind-the-meter) participants may be given the right or the obligation to share their surplus or residual generation/electricity with the other participants in a sharing arrangement. At the same time, participants may have electricity shared with their POD, including storage or generation, if not injecting it in the network. If they are injecting in the network and electricity is shared through it, then a surplus/excess is created – who will take it for what price and based on what type of what contract? A number of questions come to mind regarding the design of the sharing arrangements: When do the participants or ESOs define the sharing schemes or sharing indexes? Is the shared energy the total sum of all electricity injected into the network or the amount of each source/generation provided to each consumer/participant? These options will impact the development of the necessary systems to perform the sharing operations and may increase development costs.

Different aspects in the sharing arrangements and in the profiles of the participants may serve different purposes and might lead to different outcomes: for example, higher benefits for participants who invest the most, lower network usage, reduction of the surplus, benefits for energy vulnerable consumers or other specific participants. Prioritisation of these different outcomes may mean different sharing arrangements; one size does not fit all. However, the greater the number of sharing schemes, the more complex and costly the development of the DSO systems can become. That is why (at least initially) the sharing arrangements should be as simple and transparent as possible. This includes giving the possibility of easy-to-implement simplified methods for less organised entities/participants and allow other more complex organisations. Predefined methods may have an important role in the development/growth of energy sharing groups. The responsibilities of the managing entities or of the DSOs may need to be adapted to the different sharing schemes.

4.2.3.2.1 Sharing keys

As for energy sharing schemes, of the countries that reported having grid users participating in energy sharing or collective self-consumption, they all have more than one predefined sharing arrangement available. Eight countries [66] use fixed coefficients and, except for Spain and Latvia, they also allow other sharing arrangements. Another three countries pointed out that the sharing arrangements are based on private agreements and no predefined sharing arrangement was mentioned [67].

In addition to the "**fixed distribution**" and "**proportional consumption**" arrangements, another two predefined methods were identified: "**priority**" (in Luxemburg, Czechia and Portugal) and "**dynamic**" (in Portugal).

[66] BE, CZ, ES, FR, LU, LV, NO, PT and SI
[67] FI, IT and LT

Static sharing schemes such as *fixed distribution*, or *fixed percentages*, are simpler and may be used, for example, to reflect the individual investment of each participant. Or it can be used to define a constant sharing proportion (equal parts) of the generated energy. Although this arrangement should not be changed during a given period (day, month, year), it is not limited to a constant percentage throughout the year, since different distributions may be defined, taking into account the different time periods, such as months, days, hours or quarter hour periods.

Variations of this method are implemented, such as optimal distribution where more than one iteration of the process may occur, sharing energy with the participants that still have consumption left. These rounds of sharing may occur until all energy is distributed, or all consumption is covered (within a quarter hour period). These options should consider the impact on the system which may be needed to support such operations. By way of example, one year of a fixed percentage scheme for one participant could mean 35 040 separate values, one for each 15-minute block of the system settlement periods.

Variable sharing methods may include *proportional consumption* or *pro-rata* distribution where the available generation takes into account the proportion of the consumption of each participant in each time period. This way, all participants receive a share of the available electricity depending on their own consumption as a proportion of the total consumption of all participants, making the sharing dynamic. The more energy a participant uses, the more weight is given to their sharing proportion when distributing the energy available in each sharing period. With this scheme, it may not be possible to prevent the use of private or public networks and this may result in network access tariffs for the shared energy using the network (depending on the regulatory framework in each Member State).

Another example of variable sharing schemes is using **priorities,** where the generated electricity is distributed according to a predefined order. This may be applicable to all of the generated electricity or assign priority indexes to consumption participants from generation participants. This method can also be applicable to specific groups of generation-consumers in a first iteration and then in the following iterations the remaining energy sharing happens with all participants, i.e. energy sharing in a “hierarchy” or in a 2nd level priority model.

When prioritising certain consumer participants for the energy shared from a generation unit, it is possible to minimise the use of public networks, for example. This leads to less grid costs and more cost-efficient sharing for the whole group.

For example, if a member of a sharing group is designated as "priority" they will have the right for the shared energy ahead of the other members of the group and only when their needs have been fully met (for the respective sharing period) will any remaining energy be shared with the other group members. If several generation systems are assigned to a sharing group, one (or more) can also be treated with priority. In this situation, the energy generated by this priority system is first shared with the members of the group and only when members need additional energy are the other production systems used to cover their needs. Otherwise, the excess energy flows into the grid.

Dynamic sharing solutions, where the sharing indexes vary in each time period, may require the active intervention of the participants or of the ESO, who are required to define the sharing coefficients *ex post*. In this arrangement, the responsible party evaluates the generation and consumption for each sharing period and defines the sharing percentages, after the consumption has occurred, for example, at the end of the billing period or month. For this to happen, they have to access the measured consumption and injection data in a given time window, calculate their electricity sharing indexes according to their preferences (privately settled between participants) and provide the necessary information to the DSO, who will perform the necessary sharing operations. This means that a higher response capacity and organization from the managing entity is required. For these interactions, the DSO should publish the necessary rules and procedures for participant interaction, including data formats. This activity may also include private oversight of the measured data including additional metering devices to communicate in real time. These dynamic calculation methods also require more technical capacity from the ESO.

These energy sharing methods may be **optimized or combined.** Situations exist where several ‘rounds’ of the energy sharing are performed and may even differentiate the sharing arrangements in each iteration; this improves the efficiency of the energy sharing. Also, the use of steady and predefined arrangements may adapt to sharing groups with specific characteristics, allowing them to benefit from advanced energy sharing schemes without the burden of heavy management.

The residual electricity that is left after the energy sharing occurs can be dealt with as surplus, fed to the grid and sold, as referred in section 4.2.
In Belgium, one of the available arrangements relies on two rounds of energy sharing, one with fixed distribution and another with proportional consumption distribution. In Czechia, for small groups up to 50 participants (consumption and sharing/generation) a static allocation can be computed in 5 iterations or rounds, which approximates the developing arrangement of a static key combined with a dynamic key (1^{st} iteration static, 2^{nd} dynamic) to be made available in 2026. In Portugal, the hierarchy sharing arrangement has a two-iteration process, the sharing arrangement in each iteration may be different and one of two: fixed distribution or proportional distribution. In the first round, energy is shared within specific generation-consumer groups (up to three) and the second iteration shares the remaining energy with all consumers at once.

4.2.3.2.2 Who should define the sharing key?

As an input of the calculation method, measurements of renewable energy generation and consumption of every POD are required. Smart meters (or, in their absence, dedicated measurement devices, DMD) are essential for this activity, especially if the settlement is calculated in near real-time (15-minute intervals, as suggested by the EMD). For this to happen, DSOs, or the entities responsible for data metering or otherwise determining the sharing key, need to be able to handle and process these amounts of data and need to have in place an appropriate data infrastructure (and the corresponding regulatory framework).

After discussing the different sharing keys, it also important to discuss who should define and implement them based on what is prescribed in the sharing agreement. Although several options are imaginable, and depend on market organisation and the implemented sharing model, as mentioned in 4.1.2, the two most likely candidates are the DSO and the ESO (who might be a range of market players, for example, a supplier, an energy community, a local authority, an aggregator or any other private party).

Since energy sharing is based on a private contract between consumers/prosumers, the sharing group, represented by the ESO, is the main responsible party for sharing key communication and information with the participants. In this way, less regulation should be required. However, information responsibilities regarding metering data, validation and communication to the ESO or sharing participants (consumers) may be assigned to the DSO, since it is a regulated entity and has no commercial interests in supply or sharing, being an impartial, trusted third party. In markets that have only one DSO/TSO, or a main one like in France and Portugal, the assignment of these responsibilities to these agents facilitates the development of energy sharing, since most of the clients are connected to the same network. When assigning such tasks to the supplier, besides creating mixed interests in their business models, they may need incentives to perform such 'extracurricular' tasks. Another option is to delegate sharing key definition and communication to the ESO. However, the more responsibilities fall on the ESO, the more challenging/costly it will be to engage consumers in energy sharing[68]. In countries, where there is a central energy data hub, it might be possible to split the task of accumulating and processing the data between the data hub and the ESO. In any case, metering and billing information for participants, suppliers and ESOs is essential.

Regulation needs to address the methodologies and responsibilities. The implementation and calculation of the sharing methodologies only need to know the involved participants, the sharing keys and the entry/exit of participants (or foresee situations where a participant breaks a supply contract or is cut off from the grid). A solution for detailing rules is to delegate the responsibility on the regulated entities in order to facilitate their revision according to the difficulties encountered. These details may address, for example: validation procedures and data communication models; deadlines such as for changes in the participants, for applying changes to the sharing key/schemes and for providing information; for communication between ESO/TSO/DSO and other possibly involved entities.

[68] In addition to supplier costs, taxes like VAT and energy levies apply to shared energy transactions, introducing administrative costs. An ESO - either a supplier or an independent organization - could play a central role in managing these obligations, centralising tax compliance to reduce the burden on individual consumers and enhance the efficiency of energy sharing systems. However, ESOs might impose a fee for that service.

The details of the sharing arrangement, information and decisions should be left mostly to be defined within the sharing group, according to their private contract. The same applies to entering or leaving a sharing arrangement; this should occur, whenever possible, within the private arrangement between participants.

4.2.3.2.3 Aspects of consumer protection

Based on the results of CEER's Survey on the need to adapt consumer rights on energy sharing, most respondents consider that consumers are already appropriately protected. However, the EMD establishes a few rules that tend to make energy sharing more similar to energy supply, levelling the information and requirements applicable to ESOs. Member States are required to lay down a regulatory framework for the adaptation of rules applicable to energy sharing:

- Sharing organiser's obligation to provide non-discriminatory services and transparent prices, tariffs and terms of service;
- Consumer/participants' basic contractual rights;
- Consumer/participants' right to switch and rules on switching-related fees;
- Bills and billing information requirements;
- Access to out-of-court dispute settlement with other participants, in the event of a conflict arising from an energy-sharing agreement.

The adaptation of such rules will require adaptation of national legislation to enforce such rules on nonregulated entities such as energy sharing organisers or energy communities. The participation in energy sharing of energy communities is still a private endeavour between private parties that may recur to a third party for management, but this "entity" is subject to rules similar to those applicable to suppliers. For this matter, it is important not to lose the focus of the weight of such organisations versus supplier rights and obligations.

The rules for information exchange between the DSOs, suppliers and ESOs, as mentioned earlier, for example, fall within the remit of NRAs, and are important to improve the experience of consumers when engaging in energy sharing.

In the ACER-CEER 2024 Market Monitoring Report on Energy Retail and Consumer Protection, CEER recommendations for improved energy consumer protection and market measures refer, amongst others, to the importance of ensuring **clear information to consumers** in supplier communication and commercial offers. Regulators have a role when designing incentives, providing directed information to vulnerable consumers, establishing rules for transparency and comprehension in information provided by suppliers. The extent to which ESOs should be subject to similar obligations should be explored.

When designing policies and sharing models, it should be considered that there are different types of consumers with different needs and resources. Standardised and less technological solutions need to exist, alongside solutions for more interactive consumers and sharing schemes.

4.3 Challenges: caused or solved by distributed assets? How to see and solve the challenges

4.3.1 What type of data do NRAs have?

Based on the Survey, 13 NRAs [69] do not have sufficient data on prosumers, energy sharing and energy communities to be able to assess their influence on the power grid, and several NRAs do not have data on the number of energy communities and consumers engaged in energy sharing either. Despite this, 14 NRAs were able to identify grid challenges posed by residential PV. The Survey thus shows that different NRAs have a range of different data sets with some NRAs having no data at all. Given the impact that energy sharing, rooftop PVs and energy communities have on the grid, it is of crucial importance for NRAs to have full insight into the market to be able to tackle grid issues.

With the responsibility for collection, validation and communication of metering data related to the shared electricity and the registration of sharing arrangements, system operators are in a privileged position to be able to provide the NRA with the necessary information to oversee energy sharing and evaluate its impacts (technical issues, quality of service, reverse flow, consumer rights aspects, etc.). The regulatory framework should consider the reporting of such information and, when necessary, assign the task for the system operators to develop network studies, such as reverse flow analysis, energy sharing impact on network costs and congestion.

It should be also taken into consideration that some Member States have various public bodies with different assigned responsibilities. In those Member States where other public institutions are tasked with data obligations concerning energy sharing and energy communities, the insights and data should be shared with the NRAs on a regular basis.

For an in-depth overview of the market and to be able to make informed decisions, NRAs should have the following data, amongst others:

- Number, location and size of energy communities, size including participant number and installed capacity, differentiated between legal concepts e.g., CECs, RECs, other similar concepts
- Number of grid users involved in energy sharing or collective self-consumption schemes per voltage level, and per geographical scope (within building, within closed distribution system, on the public grid)
- Average number of participants per sharing group
- Generation facilities and their capacity used within the self-consumption schemes
- Integration and capacity of storage facilities
- Impact of self-consumption on national consumption, voltage level and local networks

[69] BE, CZ, EE, ES, FI, HU, IE, LU, NL, NO, PL, SI, XK

It should be noted, that Article 15a of the EMD also sets data obligations on system operators: "Member States shall ensure that relevant transmission system operators or distribution system operators or other designated bodies **monitor, collect, validate and communicate metering data related to the shared electricity with relevant final customers and market participants at least every month**, and in accordance with Article 23, and for that purpose, put in place the appropriate IT systems. Within the context of the implementation of the EMD, it is important for NRAs to take the initiative and try to make the best use of the data that is available to system operators, aiding them to properly take into consideration the effect of active consumers on the power grid and through that, any relevant tariff issues (possibly, through network development plans or flexibility needs assessments if the data is collected there).

4.3.2 Grid challenges

4.3.2.1 Problems potentially stemming from active consumers and incentive schemes aimed at them

Regarding the impact of incentives or support schemes for energy communities/prosumers/network users engaged in energy sharing, only 6 of the 23 responding NRAs[70] identified negative effects on grid congestion and grid hosting capacity linked to specific support tools, namely (i) net metering; (ii) subsidies; (iii) exemption from imbalance payments; and (iv) the presence of private (economic) optimisation versus market optimisation. The low number of answers identifying problems might be, in part, a result of the lack of data mentioned above, as well as the fact that only 5 NRAs expect energy communities to have a measurable impact on the power grid in the near future. On the potential impact that energy communities may have on the power grid, 13 respondents expect measurable impacts from these agents[71], less than half expect it in the near future[72,] which still confirms the need to effectively monitor their development and growth.

4.3.2.2 Solar PV systems

Most responding NRAs shared (14 respondents out of 21)[73] a perception of grid challenges posed by residential PV. The problems identified include: local grid issues such as voltage stability, transformer loading, reverse power flows, loss of distribution system capacity. In addition, 11 out of 16 responding NRAs indicated that solar PV was the 'main renewable energy source' and that the main type of activity is individual self-consumption. Taken together with the responses outlined above on the difficulties posed by the use of net metering as an

[70] DE, HU, NL, RO, SI, XK
[71] BE, CZ, FI, HU, IE, IT, LU, LV, PL, PT, RO, SI, XK
[72] CZ, IT, LV, PL, XK
[73] AT, CZ, DE, EE, FI, HU, IT, LT, MT, NL, NO, PL, RO, SI

incentive, it is possible to conclude that the topic of residential PV and net metering (especially when combined) deserve special attention.

A 2024 REKK study on ‘The changing regulatory landscape of household self-consumption’[74], sums up the potential metering and billing arrangements, sell rate design, retails price system and other charges that impact the individual self-consumption framework and, correspondingly, grids with high levels of solar PV penetration. The results of the study show that net metering is easy to apply both for policy makers and consumers. However, the inability for price signals to pass through to consumers when renewable penetration levels are transforming markets is making the net metering scheme unsustainable. It should be noted that although the levelized cost of electricity (LCOE) for solar PV is falling, it seems that, under current market conditions, Member States will not be able to keep up with the EU renewables and GHG emission targets without additional support or other incentives for renewables. With a greater deployment of solar PV, and the need to ensure appropriate price and grid signals to prosumers, net metering should not be among the available incentives. In the study, those countries in the sample that are phasing out net metering opted either for net billing or for separate metering and billing. Net billing is the separate metering of injection and withdrawals, then assigning a monetary value for the two, and then netting these two monetary values against each other. Meanwhile, separate metering and billing covers a similar approach, but here the prosumer has two separate contracts, one for consumption and one for injection (and there is self-consumption as well). Depending on the other components of the compensation matrix (sell rate, retail rate, other levies on self-consumption) this change in settlement methodology can result in lower injection of surplus during the sunny hours, potentially reducing congestion and reverse flows on the distribution grid.

As an optimal outcome, a suitable retail price system that reflects actual market value, time-of-use grid tariffs or grid tariffs for generation can encourage greater prosumer flexibility. Properly designed time-of-use tariffs can also mitigate grid connection issues: they can help to reduce grid capacity utilisation during peak hours and alleviate connection issues to some extent by freeing up grid hosting capacity. Another way to tackle grid challenges might be to temporarily set aside the principle of first come-first served and grant priority (and/or discounts) to projects where the consumer has storage or other controllable assets (EVs, heat pumps). The REKK study also lists a good example from Greece, where a dedicated share of new grid connection capacity is granted to prosumers and energy communities in case of system upgrades.

Generally, it seems that one of the key problems with small, distributed assets is that they are not receiving any signals from the market or from the system operator (or even if they are, they do not react to them). This might be because dedicated incentives are shielding them from receiving these very signals. In this regard, it is of utmost importance to have appropriate data on the functioning of these assets so that NRAs can be in a position to test for small but perceivable changes to a given regulatory setup (e.g., in the context of a dynamic regulation or regulatory sandbox) and to suggest changes accordingly, in order to integrate distributed energy resources (DER) into wholesale and flexibility markets.

[74] Bartek-Lesi, M., Varga, K., REKK. (2024). Analysis of the changing regulatory landscape of household self-consumption. https://rekk.hu/downloads/projects/ECF%20Self-consumption%20study%20REKK_final%201.pdf

Respondents to the CEER Survey also suggested to (i) define grid forming capabilities for power plants connected to distribution grids; (ii) apply active distribution network management (iii) run pilot projects for local flexibility markets; (iv) eliminate net metering; (v) use of redispatching; and (vi) flexible connection agreements.

4.3.2.3 Solutions the energy communities or energy sharing can provide

Based on the Survey, it seems that those countries that have already introduced energy sharing experience less of the grid challenges caused by residential distributed generation, although this needs to be confirmed. Some of the above-mentioned studies refer to local grid use optimisation and thus, increased self-consumption rates from energy sharing or participation in energy communities. If paired with larger batteries, the self-consumption ratio might also increase to a range of 60-80%[75], contributing significantly to the benefits of the participants and decreasing grid use, depending on the configuration of the sharing scheme or community (if the sharing happens within a confined geographical area).

In terms of system benefits, energy communities participating in flexibility could help to avoid and/or defer costly investments in grid infrastructure by reducing peak loads, provide a tool for active network management as an alternative to curtailment, and help DSOs to address power quality issues. Energy community arrangements may also help to improve grid stability by offering flexibility services which can reduce the likelihood of voltage fluctuations, blackouts or technical issues. For example, an energy community could play a coordinating role with the DSO to help manage a voltage problem due to supply or demand by aligning consumption with supply levels. Energy communities, similarly to aggregators, can act as a catalyst to mobilise distributed flexibility from households, facilitating consumers' access to flexibility markets or consumption management services, thereby increasing overall participation in flexibility.

Distributed generation and self-consumption can also foster electrification and thus, new flexibility assets coming online; through this, it also eases generation adequacy issues.

However, energy communities bidding into wholesale energy and national balancing markets may not always benefit the local network, as this could just as well generate local constraints, driving higher costs (although this is not a DER-specific problem, but the consequence of wholesale energy, balancing and local flexibility markets (where existent) having no or insufficient coordination between themselves). To deliver flexibility effectively (where this is organised in a market-based way), energy communities require the knowledge and expertise to participate in flexibility markets, as well as the ability to access any markets, similar to other agents, which often happens via a third-party aggregator. However, the use of flexibility services by DSOs is still in its early stages and in many countries, (independent) aggregators face difficulties both in offering their services to smaller grid users and in participating in balancing markets.

[75] Behnam Zakeri, Samuel Cross, Paul.E. Dodds, Giorgio Castagneto Gissey,
Policy options for enhancing economic profitability of residential solar photovoltaic with battery energy storage, Applied Energy, Volume 290, 2021, 116697, https://doi.org/10.1016/j.apenergy.2021.116697

Based on the above, we can conclude that energy communities and energy sharing can alleviate some of the problems that are caused by the same assets they can integrate. Jointly acting self-consumers and energy sharing within a limited geographical area might decrease injections during solar peak and use of higher voltage network elements. This might even lead to increased grid hosting capacity and reduced connection times. However, energy sharing has a limitation as compared to an energy community: its activity only focuses on sharing. There is a question whether an energy sharing group that is also optimising asset flexibility is not doing aggregation. In any case, given their potential to aggregate flexibility, energy communities could have greater potential in helping the power system in the energy transition. However, this is conditional on whether they manage to evolve beyond simple energy sharing collectives[76]:

Figure 4-5 Possible transition from basic towards fully integrated operation of energy communities. Source: European Commission (see footnote 76)

4.3.3 The effect of self-consumption on markets and market design

4.3.3.1 The effects of self-consumption

In addition to the effects mentioned earlier, self-consumption has a comparatively strong positive effect with regard to the acceptance of decarbonisation. Citizens benefitting from the financial advantages (such as reduced energy price and network tariffs) of self-consumption can refinance their investment in just a few years (in some countries, the support for self-consumption is even higher than the explicit support for the construction of solar systems). However, self-consumption might have some notable drawbacks from the perspective of market functioning:

- The de facto high price reduction for electricity in self-consumption reduces the subjective electricity costs of the prosumer, which reduces the incentives to use electricity efficiently and might encourage electricity waste.

[76] European Commission: Directorate-General for Energy, Ilo, A., Rossi, J., Gallego Amores, S., Iliceto, A. et al., *Energy communities' impact on grids – Energy community embedment increasing grid flexibility and flourishing electricity markets*, Ilo, A.(editor), Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2833/299800

- The strongest market effect that self-consumption usually has is the withdrawal of generation and demand from the wholesale electricity market. It cannot be expected that the prosumer will switch off their solar PV system or increase their consumption when prices are low, since they have unbeatably cheap electricity in their own home. As a result, self-consumption is usually disadvantageous for the market integration of renewable electricity. The latter disadvantage of self-consumption can be alleviated if the prosumer household is actively managed by an aggregator. In this case, the solar PV system, the electricity storage system and, if present, the EV and the heat pump respond to market prices. Ideally, consumption quantities and grid injections are postponed. The other disadvantages remain unchanged even in the case of active prosumer management.

4.3.3.2 Effects on suppliers

As previously addressed in Section I, energy sharing has an effect on suppliers: it can decrease revenue, increase costs if the consumption profiles are not corrected (missing revenue for energy sourced but not sold, costs related to more unpredictable imbalance position of the BRP, increased ancillary costs) and can create extra tasks on the supplier side to better predict consumption/load profiles. These costs will certainly be allocated to a market party: if it is allocated to consumers engaged in energy sharing it may constitute a significant counter incentive to those consumers; if it is allocated (even if partly) to the supplier, then other network users will be cross-financing the costs of energy sharing.

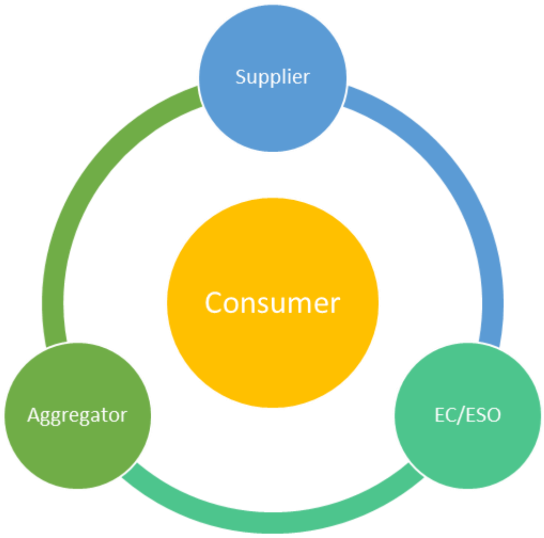
The decision on how ancillary supplier costs, such as risk premiums and customer management costs, should be distributed is illustrative of this dilemma: typically, these costs are shared evenly across all customers within a uniform pricing structure. But as energy sharing consumers reduce their absolute consumption, their share of these costs also declines, leading to a redistribution issue. Should non-participating consumers bear higher costs to offset the lower contributions from energy sharing participants, or should energy sharing households face additional fees? Since these costs arise, a policy/political decision needs to be made on how to mitigate and reallocate these additional costs. Reallocation of network costs to other tariff (such as power-based or lump sum) components may be required, taking into account a greater presence of self-consumption and the growth of energy sharing.

Depending on the target market model of a country, it is imaginable that the supplier’s role will adapt to new arising phenomena by providing new services (similar to that of an energy sharing organiser) for which it can recollect some part of its new costs. These services may arise within the business structure or partners and not specifically from the supplier. It is thus important to monitor the growth of new market agents and adapt regulatory framework accordingly.

4.3.3.3 What are the market implications of energy as a service?

Given the policy objectives of renewable integration and electrification, it is safe to assume that the number of prosumers will steadily increase and with that, the significance of their network behaviour, capabilities and needs and how these differ from those of traditional consumers. We can see that, new activities like selling energy, energy sharing or offering flexibility, all interact with the traditional supplier contract, and potentially (but not necessarily) involve other market players, such as aggregators and energy sharing organisers or energy communities. In this sense, these actors are competitors as regards attracting the consumer. On the one hand, this offers the possibility to professionalise and market these activities and to have new revenue streams. On the other hand, since these activities all depend on the consumer's behaviour, some of these are mutually exclusive: demand response contradicts maximising volume sales; monetising flexibility (initially) contradicts lowering forecasting/consumer management costs; also, if the supplier, aggregator and energy sharing organiser compete for the same resource, their expected profit margins will shrink. But this is a desirable outcome: prosumers should be invited to participate in new activities by competitive offers. The efficient system and market integration of these assets is absolutely essential for the energy transition and net zero emissions to happen, and it is not possible without changing the traditional business model of suppliers.

Figure 4-6 Consumer energy contracts



However, how (or in what order) this will be achieved is a design choice. Are there any activities that regulators should be keen to prioritise? Does the priority depend on specific circumstances? We cannot afford to lose the potential of prosumers(' flexibility). However, their abilities and likelihood of responding to market signals/regulatory changes differ. Also, solutions to specific problems might require different approaches within the same jurisdiction; it seems advisable to create a legal and regulatory environment, where most of the potential solutions are available.

For example, in a country where congestion is not that prevalent, but volatile wholesale prices are causing concern, reducing market effects of price volatility would take priority. If dynamic retail contracts are widely used, energy sharing would not add much value, since self-generated solar energy is abundant when market prices are also low. In such a case, participation in demand response should be encouraged (for consumers, aggregators and suppliers alike). However, if there is a fixed-price or pre-paid contract regime, self-generation may still be able to reduce the energy bill (but at the same time, probably increase costs for the retailer). Energy sharing could also allow participants to assign non-monetary values to their energy: local governments could invite businesses to their regions by granting access to cheap(er) energy or households with low consumption flexibility could look for a ‘pair’ with greater flexibility. If this last configuration happens in a country where congestion is high, this would be a good idea, only if the sharing pair is located close to each other. In this case, energy sharing could even help alleviate congestion. Although energy sharing seems inferior to providing explicit flexibility services for the grid (especially, if no flexible assets are involved), only a few countries have well-functioning local flexibility markets, so energy sharing might be a low-hanging fruit to tackle, at least partly, local congestion or voltage fluctuation. At the same time, it could serve as an incentive to roll out flexible assets like EVs and heat-pumps and steer consumers towards behavioural flexibility. It seems that ensuring that jointly acting self-consumers can engage in energy sharing would be obvious, but even so it does not happen in every Member State.

This might be correlated partly with retail market structure, non-market-based prices (if any), the role of the supplier of last resort and whether Member States ensure that all customers are free to have more than one electricity supply contract (or energy sharing agreement) at the same time. This last point might depend on the presence or absence of smart meters (or as the EMD introduced, dedicated measurement devices) and the necessary data exchange rules and infrastructure. As was emphasized in previous CEER (and ACER) work, granting access to consumption (and generation) data reflecting the imbalance settlement period is indispensable for most aspects of the energy transition. Creating a framework where the market players can settle their transactions based on trusted data is a must for self-consumption, energy sharing and aggregation alike. If they cannot, their market access is jeopardised, and if market access is missing, price signals are not delivered to consumers.

4.3.3.4 Effects of a lack of market access

Wholesale energy market

One concern ‘against’ not-so-small-scale energy sharing is the fact that energy shared is kept out of the market and thus (i) decreases market liquidity and (ii) decreases dispatch efficiency, in the same way as other non-market actions, like power purchase agreements or energy efficiency measures. These concerns may seem justified; however, they do not reflect the fact that in certain cases, renewable energy that is shared would otherwise either be lost (curtailed or falling under injection limits), or fed into the grid at a non-market price (potentially causing congestion), not reflecting the market’s and the grid’s needs. Thus, in all likelihood, it would never actually reach the wholesale market. It is also important to remind ourselves that energy sharing is primarily a tool for increasing the share of useful renewable electricity and one that is somewhat alien to the market design, but very much central to Europe's decarbonisation and net zero goals. However, with an enabling regulatory framework, small-scale users could bring their leftover electricity to the market through aggregation. In this way, a link between energy sharing and wholesale markets is created, rendering market prices relevant for energy sharing and energy community participants as well (although these are highly dependent on the implementation model and the specific applied energy sharing keys).

Flexibility markets

The EU legal framework for consumer and energy community participation in flexibility markets is established. However, the status of implementation varies across Member States, with different perceived barriers to implementation in each country. The next section dives into the answers given to the Survey questions focusing on energy communities and flexibility.

As previously noted, time-of-use tariff mechanisms as a way of encouraging implicit flexibility from individual consumers are well established in many European markets. However, the Survey results demonstrate that consumer participation, especially that of energy communities, in demand-side response in explicit flexibility is at a nascent stage in most European markets. The Survey found that only 2 Member States have energy communities which offer flexibility services. Further, while 9 respondents stated that energy communities can participate in their spot markets, it is unknown how many, if any, actually do participate in them. This indicates that while many energy communities may self-balance, providing system benefits, the participation of energy communities in local flexibility, balancing or spot markets remains very limited.

From the Survey, it was not possible to retrieve information regarding energy communities that actively participate in flexibility. Flexibility and demand response services and engagement from these new actors require maturity of regulatory frameworks, and the engagement of commercial agents (mostly based on revenue expectations). NRAs reported that a large number of barriers to energy communities and sharing arrangements participating in flexibility remain. However, many of these barriers are not unique to energy communities/sharing arrangements but relate to the maturity of distributed flexibility within the energy system. This suggests that energy sharing/community arrangements should not prioritise/rely on participating in flexibility markets until the regulatory and market context for small-scale flexibility is more developed.

These key barriers are (i) the lack of defined regulatory/legal framework, the lack of established local flexibility markets; (iii) the not-for-profit character provision for energy communities/lack of financial incentives; (iv) regulatory burden of participating in markets; and (v) interoperability issues. The effect of difficult or impossible market access for distributed resources is primarily the missing flexibility they could provide and a decreased profitability for these actors, making their setup or involvement more unlikely. To enable the participation of consumer flexibility in the system, ACER is preparing a no-regret list of recommendation for NRAs.

5 Conclusions and Considerations for NRAs

Self-consumption and energy sharing of electricity offer new opportunities for consumers, as they allow a separation between the need for equity and the possibility to consume locally-generated electricity themselves[77]. While this was previously reserved for specific market agents who owned private generation assets, households can now actively participate in the energy transition by consciously deciding to purchase renewable electricity from their neighbour, without foregoing the benefits of a secure supply from a professional energy supplier. However, solidarity should be safeguarded: the costs of the underpinning energy system should be shared by all grid users in a fair manner and not favour users of self-consumption and energy sharing (at the risk of creating undue cross-subsidisation).

Several factors affect the affordability (and viability) of energy sharing initiatives. Existing or new incentives may be counterproductive, in particular net metering billing gives network-detrimental behavioural incentives in case of individual self-consumption, similarly to all other incentives/rules that eliminate price signals that could induce better network behaviour. Although the EMD establishes that settlement of energy sharing should not be more than the imbalance settlement period, there could be legacy cases of grid users who acquired previously this incentive and for whom it continues to apply. On the other hand, when designed accordingly (meaning that there is some type of locational limitation ensuring proximity and if the receiver party can in fact shift some of their consumption to match generation schedules), energy sharing can contribute to lower customer costs, lower network costs and lower network development needs, and may serve as a starting point to educate and lead more and more customers to shift their consumption, that is, to behave more flexibly.

Collective self-consumption or energy sharing may add challenges to the current supplier business models highlighting the need for a robust regulatory framework. Suppliers need access to relevant information and a clear regulatory vision to be able to adapt on new models. The allocation of possible increased supplier costs needs attention, and is a policy and/or a political question. From a fairness point of view, the additional cost of these new business models should be borne by their beneficiaries – but it is questionable, whether this is only the individual or society in the energy transition as a whole.

At the same time, various companies, especially electricity suppliers and energy service providers, have the possibility to stand out with particularly customer-friendly solutions and thus promote competition and challenge less tech-savvy providers to take a serious look at the new possibilities in order to retain their customers.

As regards NRAs' key responsibilities, it is important to note that they do not include actively supporting or promoting new actors in the energy market. NRAs are, primarily, charged with monitoring and advocating for 'the removal of unjustified obstacles', allowing new actors to be able to compete on equal footing with other market players. NRAs must provide a regulatory framework that considers affordable energy consumption and a sustainable and efficient network operation, at the lowest system cost.

[77] However, the "investing neighbour" needs to have that equity.

NRAs need data to properly perform their responsibilities, and this includes the new activities as well. Several NRAs have limited access to relevant data for the assessment of the status of self-consumption, energy sharing and their effects on the energy market and the power grid – this should be appropriately amended. Based on such data, NRAs could be able to help shape the Member State's vision on how to best adapt implementation to their country's needs.

A solid infrastructure of intelligent electricity meters and a corresponding reliable communication network and data acquisition are essential. At the same time, DSO processes for data access of metering data (smart meters or in their absence, other appropriate measurement devices) should be in place.

From the survey shared with CEER members, it was possible to identify barriers for energy sharing and energy communities and certain potential solutions to address these based on the experience of each NRA. In relation to these barriers and solutions, the tasks and responsibilities of NRAs were explained and the potential areas where NRAs can help these actors/activities identified, giving examples of measures already implemented by other Member States. The key enablers identified are i) the adaptation of legal or regulatory frameworks; and ii) the deployment of smart meters. From another 3 key barriers hindering energy sharing and energy communities identified in the survey, only 1 can (partially) be addressed by NRAs (information campaigns, template agreements). However, NRAs should make use of the regulatory tools they have available (tariffs, network development, supply codes, derogations through dynamic regulation or other) to address barriers or discriminatory provisions towards energy communities or consumers engaging in energy sharing. National laws can limit NRA's possibilities if they prescribe solutions in too much detail. Granting NRA powers to explicitly deal with barriers in the secondary legislation, either by issuing them or approving them, could benefit the development of the new players and business models. When applying incentives or measures to alleviate impacts of self-consumption, or energy sharing, different entities (government, regulators, municipalities) should show an alignment in implementing measures. This alignment should prevent countermeasures but also cumulative (dis)incentives.

To enable and implement energy sharing:

- data exchange, roles and responsibilities, sharing models, grid charges, network contracts, injection of surplus to the grid, should be addressed in the regulatory framework;
- roles in energy sharing have to be weighted between the participant agents: suppliers and ESOs/sharing arrangements responsibilities - considering the DSO as a main facilitator might be a good starting point (where the national specificities allow);
- the details of the sharing arrangement, information and decisions should be left mostly to be defined within the sharing group, such as rules for entering or leaving a sharing arrangement. Whenever possible, there should be a private arrangement between participants;
- at a more macro level, different methodologies for energy sharing cause different impacts on market agents and should be assessed considering the market configuration in each Member State;
- the use of the public networks by energy sharing should apply a cost-reflectivity principle for system charges - more weight on power-based tariffs might be considered

in line with ACER's tariff recommendations. Indeed, from a network cost perspective, energy sharing that uses the public network should not receive exemptions from network tariffs, except for certain duly justified cases;

- the handling of energy sharing should be integrated in the regular market processes, facilitating the deployment and reducing burden of market agents.

To enable energy communities, they need:

- clarity of goals and definition of objectives;
- better market access regarding relevant core activities: every improvement on energy sharing will most likely help energy communities (depends on design though);
- better market signals;
- dedicated policies and a roadmap to develop (however, these should take in consideration the needs of the system);
- to address local grid constraints: if the grid is not yet fit to host enough renewables, then the best first way to mitigate grid challenges is to increase self-consumption/self-balancing, physical energy sharing (jointly acting self-consumers);
- to evolve into responsive grid users that are able to offer flexibility for the grid and not only for themselves.

As final remarks, it is recommended that NRAs:

- implement (or complete) and advocate for the national implementation of relevant provisions of (the amended) EMD and RED III, particularly as regards legal provisions on free choice of suppliers and non-discriminatory market access, right to energy sharing, jointly acting self-consumers, and where smart meters are not available, appropriate measurement devices);
- exercise supervision obligations and closely follow the growth of new market agents and adapt the regulatory framework as needed; this requires that NRAs have information regarding self-consumption, energy sharing and communities, and evaluate their impacts;
- remove regulatory barriers within their remit for the regulated activities for every market player for energy sharing, that is: partial supply/multi-supplier configurations for consumers and the sale of renewable energy/wholesale market access: energy transition requires adaptation of rules for small participants, such as pre-qualification, legal requirements, observability and communication requirements;
- for energy sharing, a balance of the roles in energy sharing has to be properly allocated between the regulated agents and the sharing party; arrangements, communication rules that are of private concern should not be regulated;
- establish a connection with the stakeholders to better perceive their needs and then to choose the most suitable options within the NRA's remit, making use of tariffs, code level regulation, dynamic regulation;
- as an activity that might be pursued by energy communities and a tool to support demand response, the activity of aggregation should be facilitated, with code level non-discriminatory rules for imbalance settlement and market access for flexibility and wholesale energy markets;
- focus on the basic education of consumers, consumer flexibility and system needs, and once new regulatory milestones have been reached regularly educate stakeholders on new possibilities;

- ensure energy component and network tariff price signals reach consumers (in the form of dynamic tariffs and/or ToU system charges) for implicit flexibility, this might also be fostered by increased competition on the retail market. However, by their nature, self-consumption and energy sharing hinder price signals from reaching the consumer;
- make use of the tools they have available in the regulatory framework, embrace dynamic regulation and gain observability of the development of the market in order to adapt adequately.

Annex 1 – Comparative case studies: CZ, IT, PT, LU

The responses to the Survey have provided significant information about decentralized energy, energy sharing and energy communities. However, and apart from the variety of experiences and practices, it has been generally pointed out that energy sharing is a new concept to many countries and, moreover, that a general lack of awareness and expertise on these matters, beyond network constraints, are problems to be faced in the direction of fostering energy markets and empowering customers.

This does not impede, however, to direct our attention toward best practices to share and case studies from which to draw a lesson, especially when this may be useful to highlight the role of NRAs in helping end users to become fully fledged customers, to play an active role as producers and to be aware of technological changes and new ways of consuming.

In details, the collected data may be used to deepen the knowledge of how each national system works and to better understand what has been done or may be additionally done by an NRA:

- in adopting measures to make legal provisions work properly and effectively;
- in informing customers and promoting their needs and interests, ensuring their rights and raising their awareness;
- In removing barriers from market access;
- in launching new solutions/regulatory measures;
- in dealing with grid management challenges.

According to the above-mentioned criteria, and besides the ones already detailed or mentioned in the report or in other documents[78], it is possible to move to a very brief but useful analysis of some case studies. They were publicly presented on the occasion of the Roundtable on Energy Sharing and Energy Communities organized by CEER and held in Lisbon on 10th October 2024. Four national case studies were showcased – Czech Republic, Italy, Portugal and Luxembourg - and now they may be described as follows. But, before moving into details, it is important to note that these cases are sometimes different from each other whereas they may also have some features in common.

The Czech Republic case helps to understand the complexity of the subject by pointing out what electricity sharing really means for all the stakeholders involved. As a matter of fact, it is true that it brings savings to active customers and prosumers and it empowers them by increasing their awareness about electricity markets. However, bit increases at the same time both responsibilities and the need for new solutions and practices. For example, even though the amount of supplied and bought out electricity is lower, suppliers and traders remain fully responsible for imbalances that can be larger than in the past due to more complex forecasting. The evaluation and settlement of shared electricity may thus require additional IT capacities, infrastructure and system costs.

[78] As regards Spain and France, a recent Solar Power Europe report describes further case studies in these countries: https://www.solarpowereurope.org/advocacy/position-papers/framework-for-collective-self-consumption.

The electricity sharing model can be implemented in many ways, according especially to: 1) institutional and generation limitations; 2) size limitations; 3) regional limitations; 4) allocation model; 5) administration and settlement; 6) tariff savings.

Significantly, the Czech Republic is one of the two respondent countries where energy communities offer flexibility services.

As regards Italy, the virtual model in place is certainly worth noting. In detail, each customer within the widespread self-consumption configurations buys his/her own consumption. It is important to add that each participant remains connected to his/her own point of delivery and the electricity is shared through the public distribution grid. Customers' rights are guaranteed due to the fact that each participant can modify his/her own choices, both in relation to the participation in the collective self-consumption configuration (opt-in and opt-out) and in relation to the choice of the supplier for all the electricity withdrawn from the public grid (be it shared or not).

The contact person receives a "cash-back" corresponding to the self-consumed electricity and, if due, the incentive from GSE (the State-owned company which promotes and supports renewable energy sources in the country). The cash-back represents the recognized value of self-consumption and its amount is computed on a monthly basis by GSE and it is differentiated for each self-consumption configuration. It is specifically defined by the NRA on the basis of grid benefits (avoided costs) resulting from self-consumption.

In details, the amount of money received by the contact person (building representative, generation unit owner or energy community) consists of two parts: 1) a part is paid only for the self-consumed electricity and it covers the extra-valorisation (the above-mentioned "cash-back") defined by the NRA on the basis of grid benefits (avoided costs) resulting from self-consumption, i.e. a decrease of electricity transit costs and grid losses; 2) another part of it covers, when it is due, the incentive defined by ministerial decrees to promote renewable energy sources.

As regards especially the cash back, and due to the fact that each customer within the widespread self-consumption configurations buys his/her own consumption, or rather, as he/she pays all the electricity withdrawn from the grid, in the case of a REC the cash back covers the variable part of the transmission tariff expressed in €/kW (in Italy grid tariffs have a trinomial structure, consisting of three terms characterized by three metered quantities: a variable (also known as volumetric) energy-based (€/kWh), a capacity or power-based (€/kW/y) and a fixed term (€/PoD/y)). It means that it covers the amount of the tariff paid even though the electricity has not flown in the transmission network).

The allocation of the amount of money among the participants in the configuration is made according to a private agreement.

On the customer/producer side, the virtual model ensures flexibility for all participants and safeguards their rights as final electricity customers/producers in the framework of a fully liberalized retail energy market. On the grid side, this model allows the valuation of collective self-consumption without the need for any infrastructure interventions or meters: no private (and potentially inefficient) grids or micro-grids are necessary. On the system side, the virtual model makes it possible to separate the extra-valorisation of self-consumed energy (the "cash-back" defined by the NRA) from the incentive (defined by the Member State), without modifying the dynamics of the fully liberalized retail energy market. Moreover, it helps to reduce grid losses and transit costs.

As regards Portugal, it is first of all worth noting that the NRA has provided customers with information on regulations and good practices. Furthermore, it is interesting to point out the sharing schemes in place and the pilot project for dynamic and hierarchy sharing implemented by the distribution network operator (https://www.e-redes.pt/en/self-consumption-energy-sharing-models).

Surely, the regulatory framework has been a trigger for self-consumption growth with a fast and steady increase of the number of self-consumers and collective self-consumption. It is thus worth considering that self-consumers maintain their rights and obligations as electricity consumers and that data exchange works properly and timely due to the fact that the settlement of generation and consumption is calculated in 15 minutes periods.

As said, consumer education on energy communities and energy sharing is of great importance. To reach this goal, the NRA provides customers with information regarding regulations and good practices.

The cost-reflectivity of network tariffs takes into account the expected utilization of the public grid. If energy shared is using only the internal grid of a building, no network tariffs apply. If energy shared must use the grid beyond the internal grid, network tariffs are applied based on the voltage levels involved in transmitting energy from generation to consumption (e.g., if both are located in the LV grid, only the LV distribution tariff applies; if generation is located in MV and consumption in LV, the sum of MV and LV distribution tariffs apply). Therefore, if self-consumption does not use higher voltage levels of the public grid (e.g., transmission), it is exempted from the respective network tariffs for the use of the system. However, two caveats apply: (1) this partial exemption from network tariffs is subject to proximity criteria (i.e., if installations are too far apart, the exemption does not apply); (2) if inverted power flows become more dominant (i.e., energy flows from lower to higher voltage levels) this partial exemption will be reduced by decision of the NRA. Additionally, for new self-consumption projects and new energy communities' projects that have started activity between 1st of January 2023 and 31st of December 2024 there is a 100% exemption from costs of general economic interest (CIEG). This exemption is defined by the Member State.

Luxembourg can claim quite an experience in self-consumption and shared electricity. The NRA has been mandated by law to develop the practical modalities by which the grid operators should enable the sharing of electricity between grid users. The model in place distinguishes sharing groups between spatially limited small groups of grid users who share locally generated electricity within the same building ("collectively acting renewable energy self-consumers") and larger distribution groups ("energy communities"), which may share electricity across the country. Electricity is always shared every quarter of an hour, i.e., only what was generated at the same moment within a group can indeed be shared. It is worth considering that no taxies or levies are applied on self-consumption or shared electricity, or rather, while local sharing of electricity is exempt from grid fees, these must be paid by consumers if they receive energy from power plants which are located further than 300 meters away.

As regards sharing rules, the members of the sharing group define them in order to determine how the self-produced electricity is shared. But this does not impede them from modifying these rules at any time. Moreover, in the country a default three level structure exists: 1) the electricity produced is distributed among the members of the group according to a predefined order (priority criterion); 2) the household customer receives the same share of available electricity (percentage criterion); and 3) the electricity is shared between members of the group according to their momentary consumption (pro rata criterion). As far as the price for shared electricity is concerned, this is not regulated by law, i.e., the owner of a PV system can, for example, share it with other members of a sharing group free of charge or for a fee, i.e., it is at the discretion of the sharing group to determine the price for shared electricity.

The aforesaid case studies testify to the dynamism of the topic of decentralized energy, self-consumption and citizen energy communities. But, apart from differences, it is clear that the models depicted are bound to make it easier for citizens and small entities to become an active part of the energy transition and, thus, to play a central role in the generation and consumption of electricity.

Annex 2 – List of abbreviations

Term	Definition
ACER	Agency for the Cooperation of Energy Regulators
BRP	Balance Responsible Party
CEC	Citizen Energy Community
CEER	Council of European Energy Regulators
CEP	Clean Energy Package
DER	Distributed Energy Resources
DSO	Distribution System Operator
EMD	Electricity Market Design package: Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019; Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019
EV	Electric Vehicle
ESG	Environmental, social, and governance
ESO	Energy Sharing Organizer
HV	High Voltage
IMED	Internal Market Electricity Directive: Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019
LCOE	Levelized Cost Of Electricity
LV	Low Voltage
MV	Medium Voltage
NRA	National Regulatory Authority
POD	Point of Delivery
PV	Photovoltaic
REC	Renewable Energy Community
RED II	Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018
RED III	Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023
RES	Renewable Energy Sources
SME	Small and Medium-sized Enterprise
ToU	Time of Use
TSO	Transmission System Operator
VAT	Value Added Tax
VHV	Very High Voltage (or extra high voltage)

Annex 3 – List of relevant legal terms on EU level

Term	Definition
‘imbalance settlement period’	Electricity Regulation 2019/943, 2(15), means the time unit for which the imbalance of the balance responsible parties is calculated.
‘active customer’	Electricity Directive 2019/944, 2(8), means a final customer, or a group of jointly acting final customers, who consumes or stores electricity generated within its premises located within confined boundaries or, where permitted by a Member State, within other premises, or who sells self-generated electricity or participates in flexibility or energy efficiency schemes, provided that those activities do not constitute its primary commercial or professional activity.
'energy sharing'	Electricity Directive 2019/944, 2(10a), means the self-consumption by active customers of renewable energy either: (a) generated or stored offsite or on sites between them by a facility they own, lease or rent in whole or in part; or (b) the right to which has been transferred to them by another active customer for a price or free of charge.
‘citizen energy community’	Electricity Directive 2019/944, 2(11), means a legal entity that: (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises; (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders.
‘demand response’	Electricity Directive 2019/944, 2(20), means the change of electricity load by final customers from their normal or current consumption patterns in response to market signals, including in response to time-variable electricity prices or incentive payments, or in response to the acceptance of the final customer's bid to sell demand reduction or increase at a price in an organised market as defined in point (4) of Article 2 of Commission Implementing Regulation (EU) No 1348/2014 (17), whether alone or through aggregation.

'right to energy sharing'	Directive (EU) 2024/1711, 15a, 1. Member States shall ensure that all households, small enterprises and medium-sized enterprises, public bodies and, where a Member State has so decided, other categories of final customer have the right to participate in energy sharing as active customers in a non-discriminatory manner, within the same bidding zone or a more limited geographical area, as determined by that Member State. 2. Member States shall ensure that active customers are entitled to share renewable energy between themselves based on private agreements or through a legal entity. Participation in energy sharing shall not constitute the primary commercial or professional activity of active customers engaged in energy sharing. 3. Active customers may appoint a third party as an energy sharing organiser.
'renewables self-consumer'	Directive (EU) 2018/2001, 2(14), means a final customer operating within its premises located within confined boundaries or, where permitted by a Member State, within other premises, who generates renewable electricity for its own consumption, and who may store or sell self-generated renewable electricity, provided that, for a non-household renewables self-consumer, those activities do not constitute its primary commercial or professional activity.
'jointly acting renewables self-consumers'	Directive (EU) 2018/2001, 2(15), means a group of at least two jointly acting renewables self-consumers in accordance with point (14) who are located in the same building or multi-apartment block;
'renewable energy community'	Directive (EU) 2018/2001, 2(16), means a legal entity: (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities; (c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.
'peer-to-peer trading'	Directive (EU) 2018/2001, 2(18), of renewable energy means the sale of renewable energy between market participants by means of a contract with pre-determined conditions governing the automated execution and settlement of the transaction, either directly between market participants or indirectly through a certified third-party market participant, such as an aggregator. The right to conduct peer-to-peer trading shall be without prejudice to the rights and obligations of the parties involved as final customers, producers, suppliers or aggregators.

Annex 4 – About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national energy regulators. CEER's members and observers comprise 39 national energy regulatory authorities (NRAs) from across Europe.

CEER is legally established as a not-for-profit association under Belgian law, with a small Secretariat based in Brussels to assist the organisation.

CEER supports its NRA members/observers in their responsibilities, sharing experience and developing regulatory capacity and best practices. It does so by facilitating expert working group meetings, hosting workshops and events, supporting the development and publication of regulatory papers, and through an in-house Training Academy. Through CEER, European NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

In terms of policy, CEER actively promotes an investment friendly, harmonised regulatory environment and the consistent application of existing EU legislation. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable Internal Energy Market in Europe that works in the consumer interest.

Specifically, CEER deals with a range of energy regulatory issues including wholesale and retail markets; consumer issues; distribution networks; smart grids; flexibility; sustainability; and international cooperation.

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