European Commission

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Economies of Energy Communities

Review of electricity tariffs and business models

Energy Communities and self-consumption Task Force

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April 2021

LEGAL NOTICE

DOCUMENT INFORMATION

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- Shenja Ruthenberg, CLERENS, *BRIDGE Secretariat*
- Marcos Jareño, *ZABALA, BRIDGE Secretariat Coordinator*

Acknowledgements

The editors would like to acknowledge the valuable inputs from the BRIDGE projects consortia who filled in the questionnaire and the TF Energy communities and self-consumption members, as well as members of the Intensys4EU and the SPRING teams for their contributions to this BRIDGE Economies of energy communities Report. The authors are grateful for the cooperation and assistance provided by CEER member national regulatory authorities.

European Commission

- *European Commission – Energy Directorate-General, Unit B5 "Innovation, research, digitalisation, competitiveness"*
- *European Climate, Infrastructure and Environment Executive Agency - Unit C.C2 "Horizon Europe Energy"*

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1. Introduction

Democratisation of the energy sector and move towards easily accessible and affordable green energy in the EU has never been more important. While citizens' participation in the local energy market is not a novel concept in some Member States, with adoption of the Green Deal and Clean Energy Package the EU put focus on citizens' active and coordinated participation.

Within the Clean Energy Package, the recast of the EU Renewable Energy Directive (RED II) entered into force in December 2018, followed by the Internal Electricity Market Directive (EMD) which entered into force in 2019. Through definitions of energy communities, they introduced a legislative support for collective energy actions and citizens' active participation in energy markets. Even though the package recognises certain categories of energy initiatives as "energy communities", it has provided the Member States with the definitions of two notions i.e. "Renewable Energy Communities" (RECs) and "Citizens Energy Communities" (CECs). The previous BRIDGE report within Task Force for Local energy communities (Hannoset et al., 2019) reviewed the level of transposition of these directives. Even though, the EU Member States have until June 2021 to transpose these concepts into their national laws, in this report we briefly review the state of transposition.

The main focus of this report is the economic aspect of energy communities. The economic aspect is split into two parts: (1) electricity tariffing, with focus on a potential link between the implementation of a local flexibility market and energy communities and encouraging increase share of renewable energy generation through energy communities; and (2) business models and services offered by energy communities and wider collective energy actions across the EU. In total, 20 Member States (Belgium, Czech Republic, Croatia, Denmark, Estonia, Finland, France, Greece, Germany, Ireland, Italy, Lithuania, Luxemburg, the Netherlands, Portugal, Poland, Slovenia, Spain and Sweden) are reviewed to show the variation and similarities across EU.

The main part of the report investigates household electricity tariffs among different EU Member States in light of the creation of suitable framework conditions for energy communities. The paper argues that electricity tariffs are vital part of households' everyday consumption and production decisions and they have a strategic impact on creating incentives in a country. Even though the preconditions for corresponding tariff schemes differ between Member States, electricity tariffs in all analysed MSs have the same three main price components, i.e. energy costs, network charges, taxes and surcharges. The report analyses which part of the electricity costs can be used to incentivise specific system-relevant behaviour and local energy systems as well as what are the Member States plans in setting electricity tariff-based incentives.

The detailed analysis of the electricity tariffs is followed by an overview of existing and emerging business models for energy communities and wider collective energy actions in their national legislative environment. The business models of collective energy actions are presented by identifying their organisational forms, income streams and subsidies, offered services, participants and their motivation. Based on the presented business models it becomes obvious which models can be used for wider EU replication and which are dependent on locally available incentives.

1.1 Electricity tariffs for energy communities

Electricity tariffs are an important part of the everyday consumption and production decisions of households and the industry. The energy costs as well as the network charges can create incentives in a country. For example, the high electricity prices in Germany lead to an increase in photovoltaic integration, which goes hand in hand with increasing self-consumption in Germany. These market incentives strongly depend on the electricity price structure of the country. Because of the different price ranges and structures, the room for incentives strongly differs between countries. This also relates to social aspects such as energy poverty. Understanding the price composition and the possible incentives that can be set is very important for future policy decisions and can support economic analysis of potential energy communities.

Some EU Member States have adopted or are considering the introduction of local network/electricity tariffs or specific tariffs for self-consumption including Austria, Belgium, Portugal and France. Such tariffs can support the establishment of energy communities and should aim at reflecting the actual impact of energy communities on the electricity network system. The aim of Chapter 2 of this document is to give an overview of elements that are part of household electricity prices in different Member States and present some preliminary options for local tariff setting. This overview aims at facilitating the assessment of options for the modification of tariff structures. The preconditions for corresponding tariff schemes strongly differ between Member States due to huge differences in electricity tariffs. Nevertheless, each Member State has the same three main price components. These are the energy costs, the network charges and the taxes and surcharges. While the energy costs are largely up to the liberalised market, the other price components are mostly regulated or politically determined. In particular, the network charges can be adapted to incentivise specific system-relevant behaviour and local energy systems with a high degree of autonomy.

Where not stated differently, the electricity tariff information presented in Chapter 2 is based on expert consultations, including interviews with CEER and its members.

1.2 Energy communities' business models

Following the detailed analysis of the electricity tariffs among EU Member States, the Chapter 3 of this report gives an overview of existing and emerging business models for energy communities or collective energy actions. Based on desktop research and interviews with stakeholders from different Member States, services offered to the members of the Energy Community (EC) or collective energy actions have been analysed. The overview is provided for 12 Member States: Belgium, Croatia, Estonia, Greece, Germany, Italy, the Netherlands, Poland, Portugal, Slovenia, Spain and Sweden.

2. Electricity tariffs for Energy Communities

Member State's electricity bills have the three main price components: the energy costs, the network charges and the taxes and surcharges. The energy costs are dependent on the liberalised market, while the other price components are regulated. Specifically, the network charges can be adapted to incentivise specific system-relevant behaviour and local energy systems with a high degree of autonomy, such as ECs and collective energy actions.

2.1 Method and Process

Within this BRIDGE taskforce a set of interviews was made with regulators facilitated by CEER. The main issues discussed with the regulators were:

- How do they see the goal, the role, the uptake and potential benefits of ECs to the energy system? What are potential targets followed by the government (e.g. local self-supply, flexibility…)?
- Assessment of tariff setting in different Member States.
- What are the principles behind potential incentives and tariffs for ECs?
- Is a flexibility market for DSOs previewed?

2.2 Overview of household electricity tariffs in selected Member States

In Europe, there is a large difference in household electricity tariffs across the countries. While the lowest household electricity price in 2020 is 10 €c/kWh in Bulgaria, the highest is 30.4 €c/kWh in Germany[1]. These enormous differences arise because of diverse price structures across the EU. While some countries have high network charges, some others have high taxes or policy costs. In the following section, the structure and components of the household electricity tariffs in Austria, Belgium (Flanders), France, Spain, Greece, Portugal and Italy will be investigated and explained.

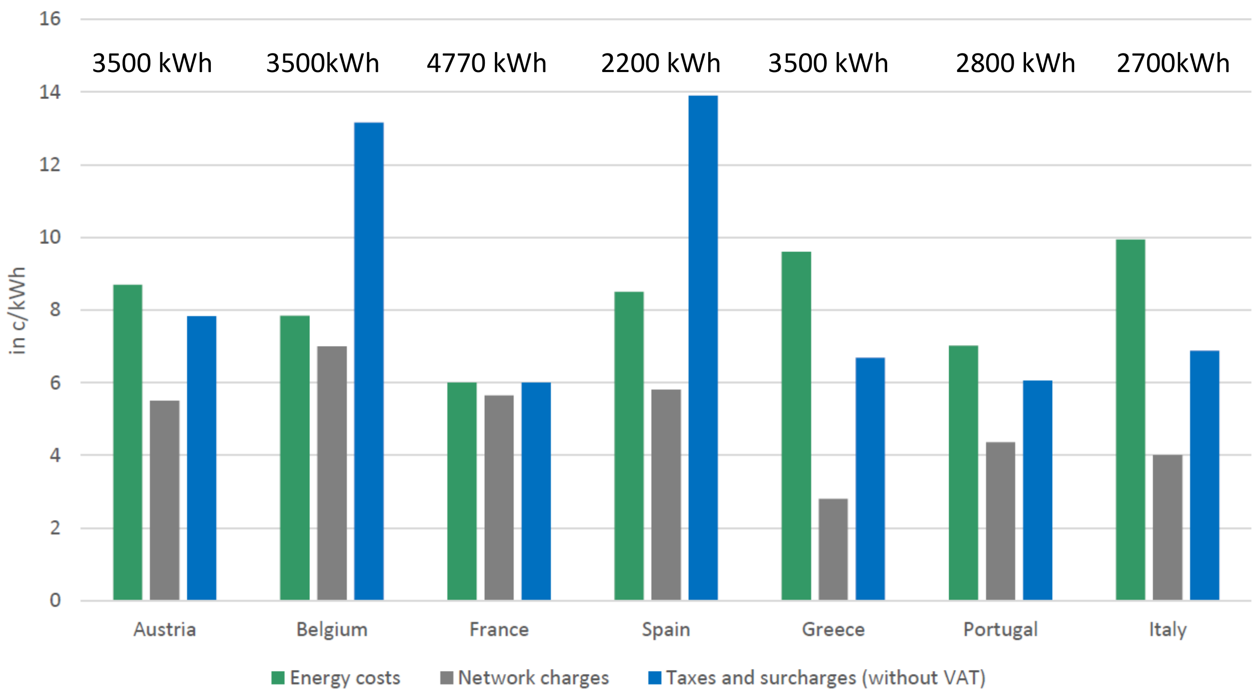
In the following section, the three main components of all seven countries are compared. The energy costs, network charges as well as the taxes and surcharges are presented in the following figure for seven European countries. Please note that, as presented above, the composition of the major tariff components strongly differs between countries. Therefore, absolute values only provide a rough indication on possible space for change in the future, for example for the creation of local tariffs. In addition, the electricity prices presented in Figure 1 for each country represent the costs for an average or reference electricity consumption in kWh. The average consumption in kWh for each country is given in Figure 1.

For the presented seven countries, the lowest energy costs are charged in France with 6.99 €c/kWh followed by 7.02 €c/kWh in Portugal. In comparison, the highest energy costs are in Italy with 9.94 €c/kWh.

[1] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20201124-1

The range of network charges spans from 2.81 €c/kWh in Greece to 7.0 €c/kWh in Belgium. The second lowest network charges are in Italy (4.01 €c/kWh) while the second highest are in Spain with 5.81 €c/kWh. One example to show the extreme differences across the member states is Greece. Although Greece has the highest energy costs, it has the lowest network charges. However, these low network charges do not allow much room for new incentives[2]. Finally, the taxes and surcharges are investigated. The highest taxes and surcharges are in Belgium (Flanders) with 8.36 c/kWh. Spain has the second highest taxes and surcharges at 7.88 €c/kWh which is only slightly lower than in Spain. In comparison to that, the lowest taxes and surcharges can be found in Austria with 4.17 €c/kWh. [3]

Figure 1 Cost components for the chosen member states (for average or reference household consumption[4])



To summarise, it can be said that energy costs and taxes and surcharges vary across the Member States. Especially, the structure of taxes and surcharges differ in all investigated countries due to different policy costs in the member states or other cost items that are charged within the electricity bill. In contrast, energy costs mainly depend on the energy mix of a country.

2.3 Options and plans for energy communities

2.3.1 Options for setting electricity tariff-based incentives

Due to the potential system benefits of ECs (i.e. reduced use of the public electricity network due to internal generation and balancing), corresponding support mechanisms are being investigated or are already in place. These include for example local electricity tariffs that aim to incentivise the use of the existing infrastructure rather than investing in parallel infrastructure (e.g. in Austria, see BMVIT 2018). The actual system impact of ECs

2 The references and a detailed discribtion for each country can be found in Chapter **¡Error! No se encuentra el origen de la referencia.**
3 Ibid
4 Sources:
Austria: https://www.e-control.at/konsumenten/strom/strompreis/was-kostet-eine-kwh
Belgium: VREG 2020: Tariefmethodologie 21-24
France: Selectra, 2020
Greece: Incumbent standard offer: GR-2018
Portugal: Portuguese General Directorate for Energy and Geology, www.dgeg.gov.pt. Data for 2019
Italy: https://www.arera.it/it/dati/ees5.htm

is heavily debated and importantly depends on the specific circumstances. In particular, whether the expansion of local renewable energy systems reduces or increases overall system costs cannot be answered generally. For instance, in the Netherlands, a new area with residential and commercial building is constructed, including the installation of local PV plants and storage systems. Due to the local generation, storage and energy supply, the electricity needs for larger consumers (e.g., supermarkets) can be satisfied while avoiding a local electricity network reinforcement. Such reinforcement would have been done by the DSO only in a couple of years and would be very costly. In Germany, since 2005, the potential system cost benefits of decentralised generation are considered by a reimbursement scheme for electricity producers injecting into lower electricity network levels. However, it turned out that decentralised generation is often not consumed locally and therefore requires the transmission system.

Due to the particularities of the actual cases, some support (or compensation) mechanisms may thus take into account the specific local situation. Accordingly, the Electricity Market Directive calls for *"a transparent cost-benefit analysis of distributed energy resources developed by the competent national authority"* and an adequate contribution of Citizen Energy Communities to the overall cost sharing of the system. The Renewable Energy Directive refers to "*cost-reflective network charges*" and states that "*Member States shall take into account specificities of renewable energy communities when designing support schemes in order to allow them to compete for support on an equal footing with other market participants*".

In this context, several options for the consideration of a decreased use of the public network are possible. A general difference can be made between 1) fixed (local) tariffs that take into account standard assumptions on system impacts and 2) approaches that remunerate the actual impact of a local energy system. Possible approaches include:

Local network tariffs: In these cases, a generic reduction of the network tariff is applied. One approach, as discussed in Austria, is that entities that use only the low voltage network would only pay for the corresponding share of the network tariff. In case costs for higher voltage network levels remain the same however the remaining consumers would have to pay these.

Rolling cost models: The network tariff may be adapted periodically depending on the actual network usage over a certain period (e.g. based on the peak load). Thereby, a flexible incentive is set to reduce the network impact over time and to improve and maintain local balancing. Such an approach is thought of in Austria (BMVIT 2018).

Ex-post remuneration of (part of) the network tariff: This may be done in cases where it can be proven that network expansion has been avoided, such as in the above-mentioned case in the Netherlands or other benefits have been achieved to the system by introduction of the EC.

Dynamic tariffs: In case of dynamic tariffs, the flexibility services that the prosumers of an EC provide could be taken into account, but also the short distance that the electricity travels when being supplied to a community member within a regional cluster. Ideally, these shorter distances would lead to lower network tariffs, which can incentivise flexible consumer behaviour and provide a business case for ECs.

Policy measures related to network charges for ECs in EMD and RED II:

EMD (CECs):

- cost-reflective network charges in accordance with Article 18 of Regulation (EU) 2019/943, ensuring that they contribute in an adequate and balanced way to the overall cost sharing 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.

- If CECs are granted the right to manage distribution networks in their area of operation, they should be "subject to appropriate network charges at the connection points between their network and the distribution network outside the citizen energy community".

RED II (RECs):

- Renewable energy communities should be able to share between themselves energy that is produced by their community-owned installations. However, community members should not be exempt from relevant costs, charges, levies and taxes that would be borne by final consumers who are not community members, producers in a similar situation, or where public network infrastructure is used for those transfers.
- cost-reflective network charges, as well as relevant charges, levies and taxes, ensuring that they contribute, in an adequate, fair and balanced way, to the overall cost sharing of the system in line with a transparent cost-benefit analysis of distributed energy sources developed by the national competent authorities.
- Member States shall take into account specificities of renewable energy communities when designing support schemes in order to allow them to compete for support on an equal footing with other market participants.

2.3.2 Plans of Member States for setting network tariff-based incentives

Some EU countries are developing or have in place local electricity tariffs specifically for CEC and/or RECs or collective self-consumption (Austria, Portugal, Italy), while others have plans to develop new tariffs in the future (Spain, Belgium (Wallonia)). It needs to be noted that the reduced tariffs generally do not apply to the entire consumption of an energy community but only to the electricity exchanges/self-consumed within the community. These reduced tariffs thereby reflect for instance the fact that subordinate grid levels are used to a lower extent. In Portugal, the tariffs explicitly refer to self-consumption, not to energy communities. They, however, also apply to self-consumption within an energy community that has a self-consumption arrangement in place.

MS	Network tariff for EC / collective self-consumption	Other tariff elements	Additional incentives or self-consumption
Austria	Grid fees above the grid level of REC do not need to be paid	*Removal of consumption-based surcharges (electricity tax, RES support)*	
Italy	Refund of variable TSO network charge		*100-110 €/MWh for RES electricity self-consumed within EC*
Portugal	Grid fees above the grid level of the CSC scheme do not need to be paid for collective self-consumption	*Reduction of consumption-based surcharges (policy costs (CIEG): 100% for CSC, 50% individual self-consumption)*	

Figure 2 Overview of (planned) local tariffs in Europe

As Figure 2 shows several countries have plans to reduce network tariffs, as well as taxes and surcharges. While the EMD requires to set cost-reflective tariffs, the RED II foresees support for RECs. Reduction in network charges represents reduced electricity tariff, and can thus be expected to be in line with RED II as support for ECs. Therefore, in practice, the boundary between policy goals and energy market regulation cannot be drawn clearly.

Italy

In 2020, Italy has adopted a law on self-consumption and renewable energy communities (law N8/2020), providing a general regulatory framework. Within a subsequent consultation document by the Italian Authority for Energy, Networks and Environment (ARERA), two models are introduced:

- Collective self–consumers (CSC) of renewable energy with a focus on condominiums: natural persons or commercial actors, for whom generation and energy exchange is not the core business and that are located in the same building or condominium.
- Renewable energy communities (REC) involving natural persons, small and medium enterprises, local/regional authorities (e.g. municipal administrations), and private companies. Generation plants (individually not exceeding 200 kW) need to be located in the low or medium voltage network behind the same transformer station (MV/LV substation).

In 2020, Italy set up an incentive scheme targeting self-consumption of RES geographically limited to the same MV/LV substation or at condominium level (CSC of RES). In both cases, within a “virtual” model, RECs and CSC schemes can join and exchange electricity through the public low voltage electricity network. For CSC and RECs, the self-consumption is calculated on hourly basis as the minimum of aggregate production and aggregate consumption. 99.5%[5] of final users in Italy already have smart meters.

[5] https://www.arera.it/it/operatori/smartmetering.htm#elettricit%C3%A0

For the electricity shared through the public network, members receive a refund for the electricity exchanged within the community. This refund represents the consumption-based part of the transmission/distribution losses related costs and amounts to 0,822€c/kWh of self-consumed energy (sum of the transmission tariff for low voltage users, equal to 0,761 €c/kWh for the year 2020, and the higher value of the variable distribution component for other low voltage users, equal to 0,061 €c/kWh for the year 2020).

For collective self-consumers, the tariff is further reduced by the network losses charge (1,2% for medium voltage and 2,6% for low voltage; variable depending on the voltage level and the hourly zonal price of electricity. Taking as a reference, purely by way of example, the average single national price of 2019 would have a value equal to approximately 0,13 €c/kWh for the low voltage and approximately 0,06 €c/kWh for medium voltage). This reduction is however not applicable to RECs (ARERA 2020). In addition to the network tariff refund, self-consumers receive a subsidy on the self-consumed electricity. This incentive will be 110 € for energy communities and 100€ for condominiums for each MWh self-consumed. This incentive will last 20 years and it is thought to payback the renewable plant investment.

Italy currently has no short term plans to introduce local flexibility markets. There is a very advanced framework (Arera decision 300/2017 and subsequent decisions) for aggregators to participate on the ancillary market – currently at the system level –in the future maybe on the DSO level as well. At the moment there is no need for local flexibility markets yet as network reinforcements have been regularly made. This has been especially the case for period of 2011-2016 to deal with a steep increase in renewables (from 4GW to 30GW).

Portugal:

Portugal in 2019 introduced a framework for self-consumption of renewable energy on individual and collective level and by renewable energy communities (Comunidades de Energia Renovável) (Decree Law 162/2019). Thereby, the REDII was partially transposed. Previously, self-consumption was limited to the individual level (Decree-Law No. 153/2014). The 2019 decree does not yet include citizen energy communities. Since January 1st 2020, individual and collective self-consumption projects and projects for collective self-consumption in RECs are possible as far as they have an intelligent counting system and are installed at the same voltage level. The 2019 decree law adopts the major lines of the EU REDII in terms of membership, possible activities etc. and the need to form a legal person.

Network tariffs for self-consumption using the public network are already in place, currently regulated by the *Regulamento do Autoconsumo* establishing the methodology (RAC, Regulamento n.º 266/2020) and the Directive n.º 1/2021 establishing the specific tariff levels. For collective self-consumption schemes connected by the public grid the tariff for the self-consumed energy is calculated taking into account only the tension level used (for self-consumed energy e.g. within a REC on low voltage level only low voltage network tariffs apply). If a self-consumption installation is located at a voltage level where reverse flows occur (i.e. from lower to higher voltage levels), the deduction of network use tariffs of higher voltage levels might be only partial. However, in practice, this is so far negligible. In June 2020, a new law was published that exempts collective self-consumption schemes to different extents from paying an element of the network charges called CIEG (Custos de Interesse Económico Geral). For individual self-consumption projects, 50% of CIEG costs are discounted, for collective self-consumption (including in but not limited to RECs) 100%. The CIEG are the costs of energy policy, environmental or general economic interests associated with the production of electricity and the costs of sustainability of markets (Despacho n.º 6453/2020).

Spain

The Royal Decree-Law 23/2020 of June 2020 first introduced energy communities and aggregators, only defining their general purpose and nature (Government of Spain 2020). However, Spain has an advanced framework on self-consumption in place, allowing to share generation among customers connected at low voltage within a distance of 500m. Besides the actual development of the legal framework for energy communities, also the Spanish tariffs regarding the use of the public network and the compensation scheme are currently under revision. A new methodology for network charges will be applied in June 2021 to all consumers, including those with self-generation (CNMC 2020). This new methodology will allow more time dependent network charges and provide incentives to household consumers to reduce the contracted power in peak periods.

Austria

In September 2020, a legislative package on the expansion of renewable energy was published for public consultation (Government of Austria 2020). The package establishes the Renewables Expansion Law (Erneuerbaren-Ausbau-Gesetz, EAG). The legislative package establishes a framework for RECs, while also provisions on CECs are introduced.

Reduced network tariffs are foreseen for electricity sharing in RECs at medium and low voltage level. The tariff reduction will be defined on national level for low and medium voltage communities applying to all network areas. For the low voltage level, a reduction of more than 50% is discussed, for medium voltage communities a reduction of 30%.

For setting the level of reduction in principle, fees for using network voltage levels that are superordinate to the network voltage level in which the REC is located will be deducted for electricity exchanged within the REC. In addition, the volumetric tariff elements for surcharges are supposed to be deducted from the network tariff. The losses DSOs make because of reduced network fees to participants of energy communities, would have to be compensated by consumers not participating in Energy Communities. The development of local flexibility markets has not yet started in Austria[6].

France

Self-consumption in France is regulated in law 2017-2277 and decree 2017-676 (French government 2017) which contain provisions for individual and collective self-consumption. Collective self-consumption involves the public network. Collective self-consumers can choose between the standard distribution network tariff (TURPE – national Distribution Network Utilization Tariff) and CSC TURPE (Enedis 2019). Aim of the network tariff for collective self-consumption is cost-reflectivity, not incentivisation of self-consumption. There are different tariffs in summer/winter and peak/non-peak.

A new tariff for residential consumers is expected to be more accurate and allow consumers to benefit more from a lower tariff for the self-consumption part. So far, the higher levels of self-consumption, the more beneficial the collective self-consumption tariff is for consumers. The French DSO in 2020 launched tenders for local flexibility markets (experimental projects), Energy Communities could participate in these markets.

In 2021 a public consultation on a draft ordinance that would define RECs and CECs was launched[7]. Also the draft ordinance provides for expanding the scope of collective self-consumption. The injection and draw-off points of the projects will no longer be limited to the low voltage network but may be located on the entire distribution network, the low and medium voltage levels.

Figure 3 below shows the cost reduction effects of applying local tariffs for Austria, Italy and Portugal, for Austria these are not yet decided so the above mentioned assumptions for a LV energy community were applied. As shown in the figure, the possible reductions differ across the countries due to the different elements that are deducted.

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[6] Based on Frieden et. al 2020: Collective self-consumption and energy communities: Trends and challenges in the transposition of the EU framework

[7] http://www.consultations-publiques.developpement-durable.gouv.fr/projet-d-ordonnance-portant-transposition-de-a2288.html

While in Italy only the TSO part is deducted in Austria and Portugal also taxes and surcharges are reduced. It is important to consider, that these local tariffs are not an overall price reduction for energy communities or actors in a self-consumption scheme, but they are only applied to the electricity that is shared and consumed within the community.

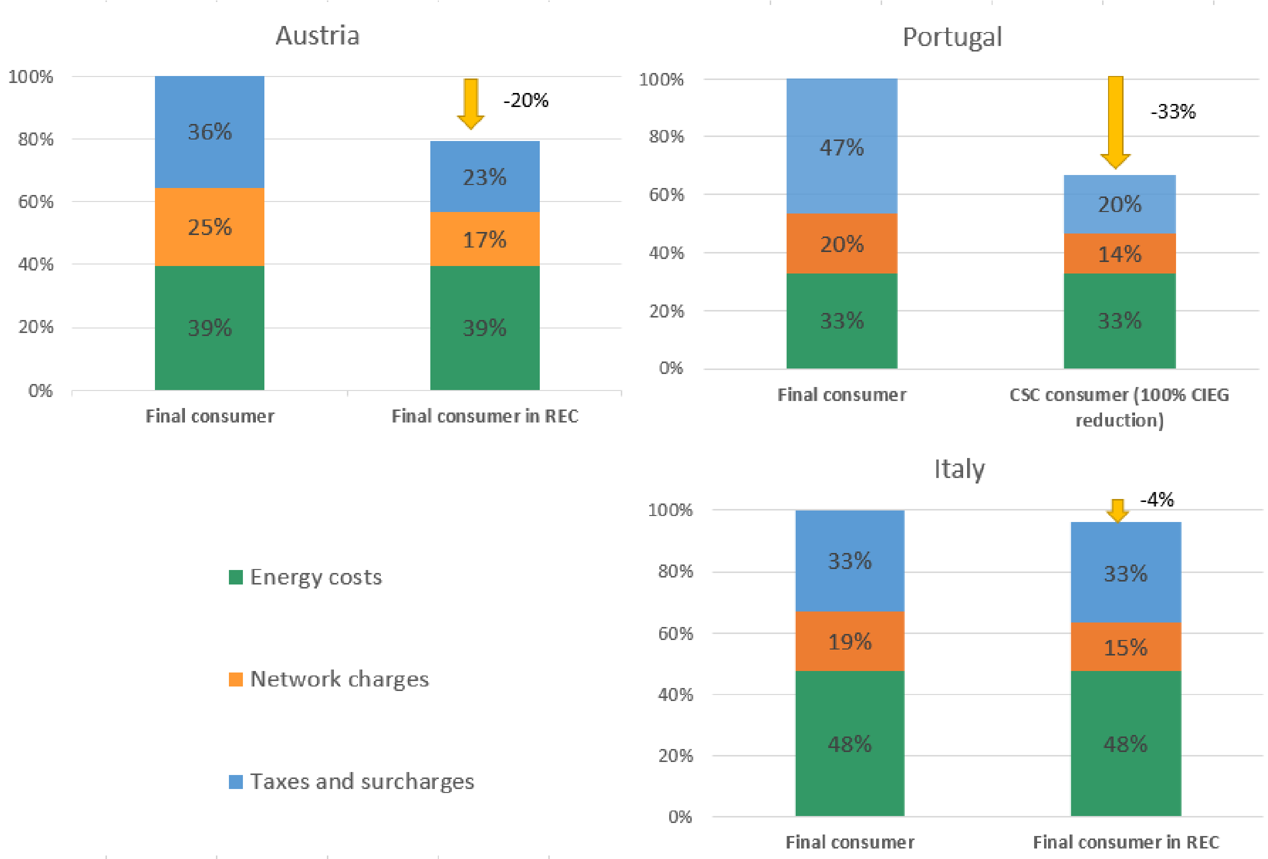
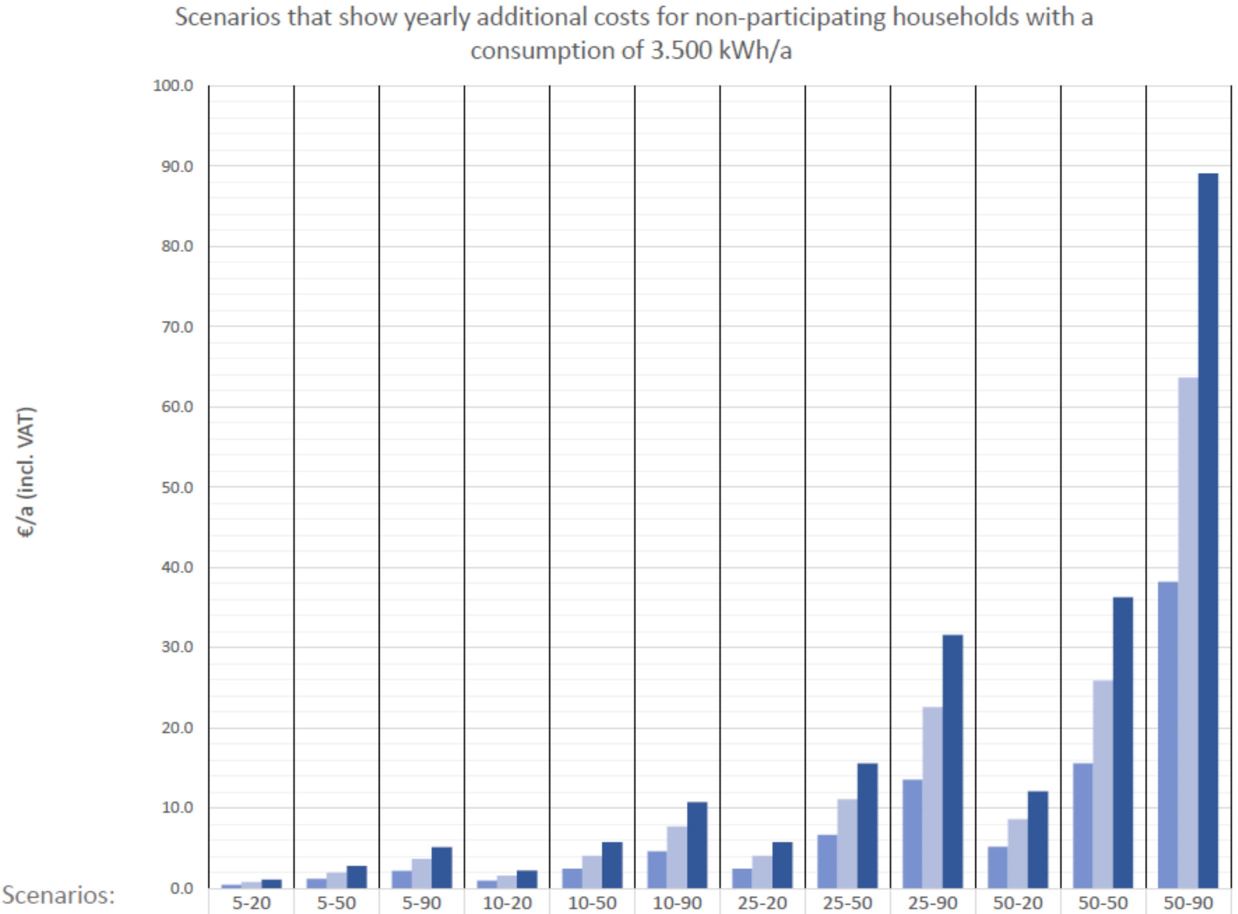


Figure 3 Effects of local tariffs for Austria, Italy and Portugal[8]

One important aspect in the local tariff setting debate concerns potential additional costs for non-participating households. DSOs may want to recover income losses. Figure 4 shows with the example of Vienna the bandwidth of these potential negative effects for the remaining customers. The assumption for the chosen scenarios is, that there are fixed costs for the energy system that are needed for the network provider to maintain the system. Therefore, we calculated the revenue losses for the DSO, depending on the participation rate of consumers in energy communities, the energy produced and consumed by the community and the height of the network fee reduction. These revenues losses are distributed across the remaining customers. The scenarios show that the additional yearly costs for the remaining customers at a yearly average consumption in Austria of 3500 kWh are rather small at a low deployment rate of energy communities. The bandwidth of the additional costs ranges from 0.47 EUR/a (30% network tariff reduction, 5% participation rate in the population and 20% of the energy consumed is produced by the community) to 89.10 EUR/a (70% network tariff reduction, 50% participation rate in the population and 90% of the energy consumed is produced by the community). The scenarios have been derived during the discussions with Austrian stakeholders to assess the impact of different tariff reductions and energy community uptake. However, the scenarios with more than 25% participation rate are considered as long

[8] The shown reductions on figure 2 and on tariff sheets.
Austria: Example for Vienna. Reduction of network charges and taxes and surcharges according to figure 2
Portugal: Differences between Tarifa simples for normal consumer in 2020 (source: Entidade Reguladora dos servicos enrgeticos, Diretiva n. 3/2020 p. 147) and tarifa simples for CSC (100% CIEG reduction) (source: Diretiva n. 14/2020, p.9) applied on the average household electricity price of 21.33 c/kWh (source: Eurostat)
Italy: Reduction of the variable TSO network charge (0.822 c/kWh)

run scenarios since such a high degree of participation will not be reached in the next few years (Frieden et. al 2020b).



Scenarios:	5-20	5-50	5-90	10-20	10-50	10-90	25-20	25-50	25-90	50-20	50-50	50-90
30% grid tariff reduction	0.47	1.20	2.20	0.95	2.46	4.62	2.46	6.67	13.55	5.19	15.56	38.18
50% grid tariff reduction	0.79	1.99	3.67	1.59	4.09	7.69	4.09	11.11	22.58	8.64	25.93	63.64
70% grid tariff reduction	1.10	2.79	5.13	2.22	5.73	10.77	5.73	15.56	31.62	12.10	36.30	89.10

Scenarios: % participation - % of energy generated by the community

Figure 4 Scenarios for potential negative spill-over effects on the example of Vienna

2.3.3 Results on tariff setting

The interviews with regulators illustrated that most countries do not foresee electricity network issues in the short term and therefore, for some, the benefits of energy communities are not clear. Energy communities however are seen as one of the options among others to increase investments in renewable energy and as a way to activate consumers and increase consumers' awareness. However, in the long term through activating consumers, increasing consumers' awareness and increasing the flexibility of the electricity system, ECs have a potential to reduce the need for network reinforcements.

Up to now, when setting incentives there is currently a high focus on promoting self-consumption. This is currently seen as the best measure to assure that there are no network issues in the long run due to expected high increase in renewables share by 2030.

Regarding the possible uptake of energy communities no clear direction could be found. Several countries regard the current transposition of the REDII/EMD as a pilot phase with the possible need for future adjustments.

Tariff setting in different Member States

Most regulators emphasised the aim to set cost-reflective tariffs. Some countries however also plan to reduce taxes and surcharges to incentivise the deployment of ECs. As reduced network fees may have a supportive element with respect to incentivising the deployment of ECs, the boundary between policy goals and energy market regulation cannot be drawn clearly. To extent to which the financial losses for the DSOs will be covered by non-participating consumers is dealt with differently in the Member States. While Austria plans to recover the financial losses of DSO caused by reduced network fees, Italy has no such plans.

In addition, too generic tariffs/incentives could prevent the needed tailoring (technologies, regions, type of community).

CBA considering all costs

Overall, there seems to be a lack of cost benefits assessments considering all costs (metering, digital infrastructure, local assets and operational management) versus all benefits as well as missing baselines with the risk of remunerating “business as usual”.

Flexibility markets for DSOs

The approach to flexibility services seems unclear. A few regulators did not see the need for such services at least in the short term. The transposition of ECs is too often regarded and developed independent from Article 32 of EMD on flexibility in distribution networks. The strong focus on self-consumption creates the risk of overinvestments in technology, conflicting with the EU ambition on a circular economy.

2.3.4 Country details on electricity tariffs

2.3.4.1 Austria

Share of energy costs, network charges, taxes and surcharges[9]

Austria has 13 network zones with different total household electricity tariffs ranging roughly from 17 to 24 €c/kWh[10] in 2020. For average households with a consumption of 3500 kWh/a, energy costs have a share of around 37.5% of the overall electricity price. The second component, the network charges (25%), depend on the location of the household. Every year the regulator E-Control recalculates the network costs. The presented numbers are based on the electricity prices in 2020. The lowest network charges are in the federal state of Vorarlberg with 3.76 €c/kWh while the highest are in a small area called Kleinwalsertal with 9.74 €c/kWh. The area Kleinwalsertal is a special case with a poor network connection. The second highest network costs can be found in the federal state of Carinthia with 7.56 €c/kWh. Thus, the potential for creating network charges related incentives even depends on the sub-national level.[11] The third cost component, (direct) taxes and surcharges (37.6%), contains of five different levies. Finally, Value Added Tax (VAT) is added, i.e. a form of indirect tax on goods and services[12].

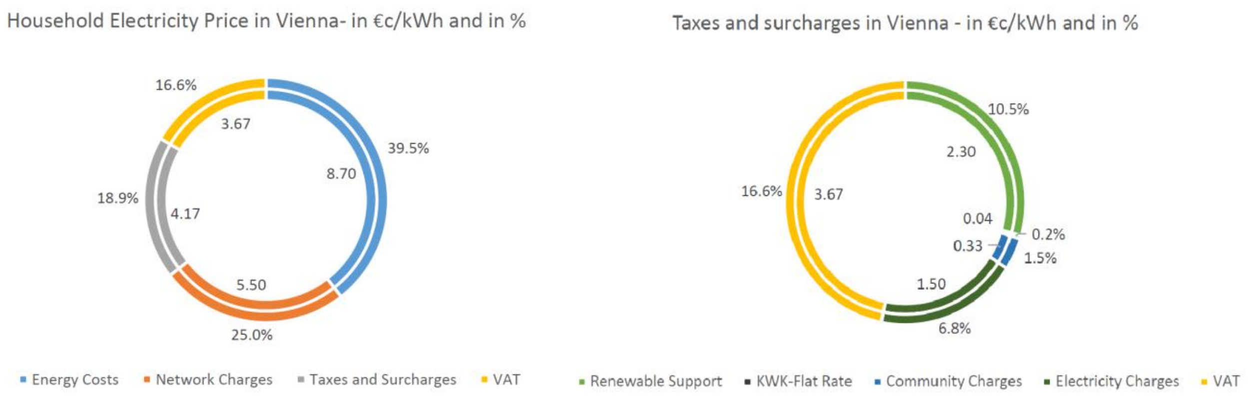


Figure 5 Electricity price components in Austria in % of the electricity bill.

Network charges

The network charges are composed of three elements. The first component is the network utilisation charge. Via the network utilisation charge, the network operators are reimbursed for the costs of the construction, expansion, maintenance and operation of the network. The network utilisation charge is fixed by the regulator E-Control and consists of a capacity rate and a consumption-based unit rate per kWh. The second part of the network charges is a charge for network losses, again consumption-based. The distribution of electricity across an area causes losses, which leads to costs for the network operator. Therefore, the consumer bears a part of these costs to compensate the network operator. The last part is the metering charge. Via the metering charge, the network operators recover the costs of the installation and operation of metering equipment and the costs related to their calibration and meter reading.[13]

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[9] Based on Frieden et. al 2020: Collective self-consumption and energy communities: Trends and challenges in the transposition of the EU framework,

[10] https://www.e-control.at/de/konsumenten/strom/strompreis/was-kostet-eine-kwh

[11] https://www.e-control.at/documents/1785851/1811582/SNE-V-2020-Vergleich-der-Netzebenen.pdf/959e4eda-1945-1a1d-f4ca-3c655453165b?t=1576846685632

[12] This applies for the assessment of the other countries as well, i.e. VAT is considered separately from taxes and surcharges

[13] https://www.e-control.at/konsumenten/strom/strompreis/preiszusammensetzung/netztarif

Taxes and surcharges

The last and biggest component of the electricity costs are taxes and surcharges (37.6%). This part consists of five different levies. The first and simplest one is the VAT, which is 16.7% of the electricity price and nearly half of the taxes and surcharges. The second one is the KWK-Flat Rate, which is necessary to finance the renovation and construction of highly efficient cogeneration plants ("Kraft-Wärme-Koppelungsanlagen", KWK). For households, the flat rate is 1.25 EUR per year. In addition, there is a renewable support charge, which has two components. First, the green electricity charge "Ökostrompauschale" (28.38 EUR per year and per household) which is a flat rate. Second, the green electricity contribution "Ökostromförderbeitrag", which is an additional percentage charge on the network utilisation charge and the charge for network losses. The last two components of the taxes and surcharges are the community charge and the electricity charge. The electricity charge is a fixed amount of 1.5 €c/kWh while the community charge depends on the area the customer lives in. Each municipality sets its own community charges.

2.3.4.2 Belgium – Flanders

Share of energy costs, network charges, taxes and surcharges

Electricity tariffs in Flanders are rather complex. In particular, the taxes and surcharges contain a high number of contributions and socialised costs. For a yearly consumption of 3500 kWh the average electricity tariff is 28.00 €c/kWh. The smallest cost component in Flanders is the network charges with 7.00 €c/kWh (25%), followed by the energy costs with a share of 7.84 €c/kWh (28%). For the energy costs, customers can choose a tariff where different prices for day and night electricity are charged. The biggest part of the electricity costs in Flanders are the taxes and surcharges incl. VAT with 13.16 c/kWh (47.00%)[14].

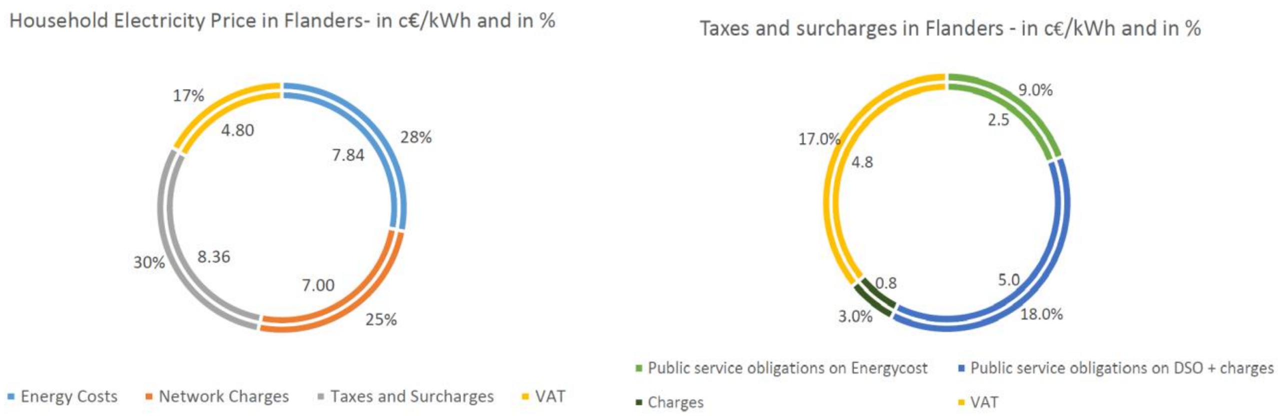


Figure 6 Electricity price components in Flanders in % of the electricity bill.

Network Charges

The network charges consist of the network costs and the costs for maintenance and operation of infrastructure, summing up to 7.00 €c/kWh on average.

Taxes and Surcharges

The electricity price in Flanders contains 23 different levies as part of the taxes and surcharges. In the second figure for Flanders, the six highest levies are presented while the remaining seventeen components are pooled in

[14] VREG 2020: Tariefmethodologie 21-24.

the variable “others”. The biggest component is the public service obligations of DSO plus charges with 18% (5.04 c/kWh), followed by the VAT with nearly 17% of the total tariff (4.76 €c/kWh). The third highest cost component is the obligations on energy costs with 9.00% (2.52 €c/kWh). Further examples are components like costs related to energy poverty, maintenance for public lightning or subsidies for rational energy use. The part of public lighting only contains the personnel costs for maintenance and reparation. It excludes material costs, the installation of new lamp posts, and the energy consumption of public lighting.

2.3.4.3 France

Share of energy costs, network charges, taxes and surcharges

The electricity price components in France have similar shares as in Austria. Thus, each of the three main components (energy costs, network tariffs and taxes/surcharges) represent around one third of the final price (4770 kWh per year).[15] The energy costs, which have the second biggest share of 35%, covers, for example, the costs of production (investment costs and operating expenses), marketing costs and procurement costs (electricity price on the wholesale market). The components network tariff and taxes/surcharges have a share of 29% and 36% respectively.

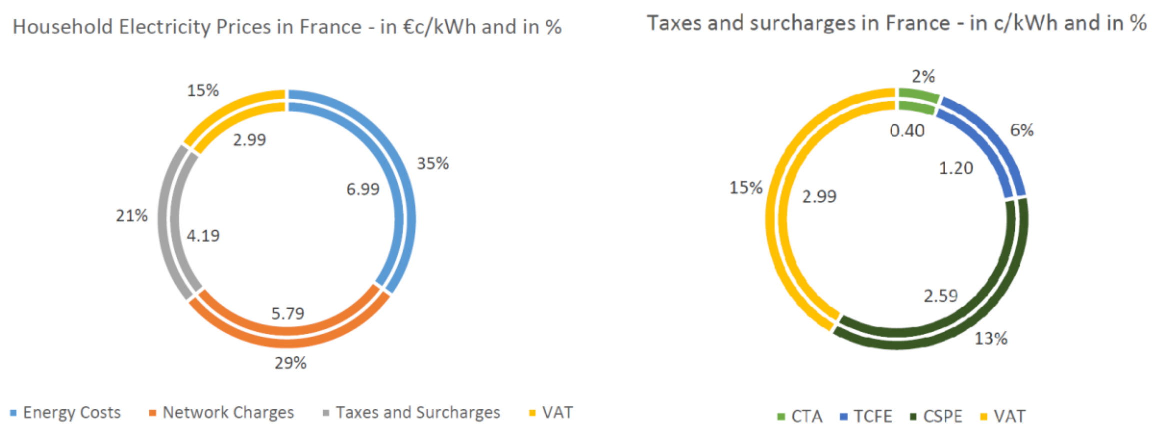


Figure 7 Electricity price components in France in % of the electricity bill.

Network Charges

One important part of the electricity price is the TURPE (Public Utilities Tariff). The TURPE covers the costs of operation and maintenance and the development of the network. The Regulatory Commission for Electricity (CRE) sets this tariff. Similar to the E-Control in Austria, the CRE is an independent administrative authority in charge of the proper functioning of the electricity and natural gas market in France. The CRE was created to support the opening of the energy markets in 2000.

Taxes and Surcharges

Finally, the taxes and surcharges have a share of 36% in the total electricity tariff. The smallest tax within the electricity bill is the CTA (Contribution Tarifaire d’Acheminement) (2%), with which the retired employees of the electricity and natural gas sector are financed. With 6% of the final electricity price, the local tax on final electricity consumption (TCFE) is the second smallest component. These costs depend on the location of a households and benefits the local authorities. The last two components are the Contribution for the Public Electricity Service (CSPE)

[15] https://en.selectra.info/energy-france/guides/electricity/tariffs#:~:text=With%20the%20average%20household%20in,€%20-%2075€%20per%20month.

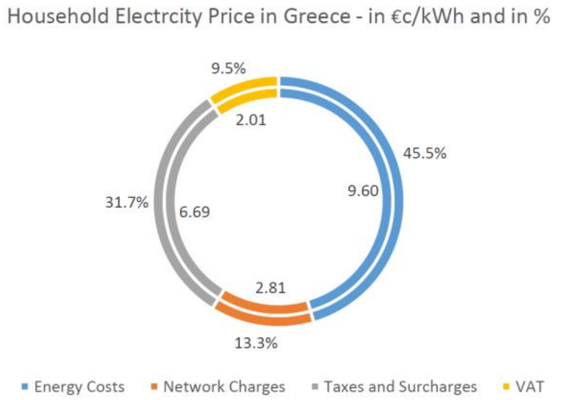
(13%), which covers the charges relating to the public service tasks of electricity, and the VAT (overall 15%), which is 5.5% on the subscription and 20% on the consumption part. [16]

2.3.4.4 Greece

Share of energy costs, network charges, taxes and surcharges

In comparison to the other countries in the EU, the household electricity price in Greece includes a different set of cost components. Although the overall cost structure in Greece for a yearly consumption of 3500 kWh is the same (three main components: Energy costs, network charges and taxes/surcharges), there are some significant differences within the components. For instance, the network charges only have a small share of 13.3%. The biggest part is the energy costs with 45.5% while the taxes and surcharge have a share of 41.2% inclusive VAT.

The figures below show an example for an average household with an annual consumption of around 3500kWh.



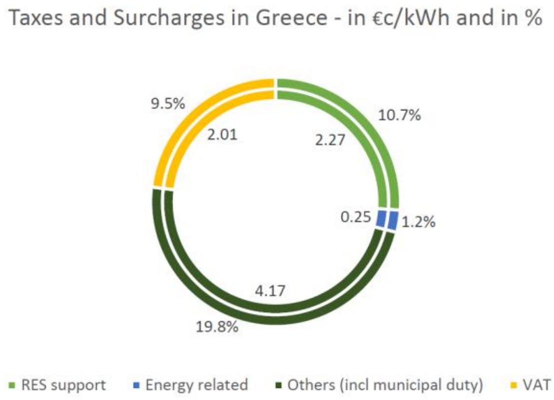


Figure 8 Electricity price components in Greece in % of the electricity bill.

Network Charges

The network costs are composed of the transmission charges and the distribution charges. Both, transmission and distribution charges contain fixed and variable costs. For both, the fixed costs depend on the contracted power while the variable costs depend on the electricity consumed. Overall, the transmission part has a small share on the electricity price (2.6%) while the distribution takes over 10.7% of the electricity price.

Taxes and Surcharges[17]

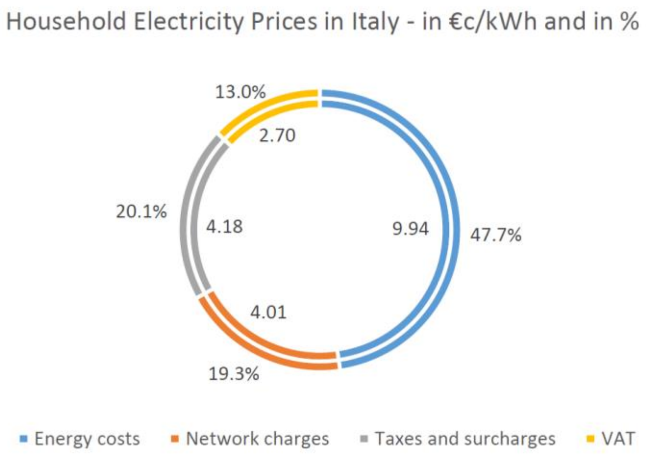
The taxes and surcharges in Greece have a share of 31.7% (excluding VAT) of the total electricity network tariffs. Overall, the electricity price in Greece contains six different levies. With a percentage of 19.8% the category *others* is the biggest component. This category includes taxes for the good operation of market, municipal taxes and duties, and a fee for ERT (Greek Radio and Television). Especially, municipal taxes and duties constitutes a big percentage, since they are calculated proportional to the floor area of each house. This is connected also with the fact that the owner-occupied housing ratio is still high in Greece, in contrast with other MS. Moreover, RES support tax is achieved through a special duty of greenhouse gas emissions reduction in order to compensate producers of RES units and promote RES units in society. In contrast with RES support, energy related taxes that include taxes

[16] https://www.connaissancedesenergies.org/fiche-pedagogique/tarification-de-l-electricite
[17] Source: DEH. https://www.dei.gr/en/oikiakoi-pelates/xrisimes-plirofories-gia-to-logariasmo-sas/logariasmos-kai-xrewseis/giati-stous-logariasmous-sas-uparxoun-duo-katigori/ruthmizomenes-xrewseis

for the non-interconnected islands, energy poverty households etc., are the smallest tax (1.2%). At last, VAT represents the 9.5% of the total taxes and surcharges.

2.3.4.5 Italy

Share of energy costs, network charges, taxes and surcharges



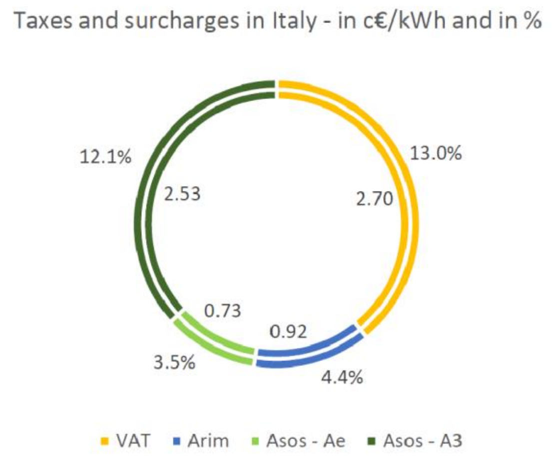


Figure 9 Electricity price components in Italy in % of the electricity bill

The electricity price for an average household with a yearly consumption of 2700 kWh and capacity of 3 kW in Italy is 20.83 c€/kWh (March 2021) and has the following cost components: 47.7% (9.94 c€/kWh) of the electricity price is for the energy provision, which is divided in two parts. While 81% of the energy costs are charged for the production and delivery, 19% are used for marketing and other managerial costs. The network costs are 19.3%, which is equivalent to 4.01 c/kWh. In addition, there are taxes and surcharges of 4.18 c€/kWh (20.1% of the electricity price) and the VAT 2.7 c/kWh (13%).[18]

Network Charges

The network charges in Italy take 19.3% of the whole electricity price, which corresponds to 4.01 c€/kWh. It covers the transmission, distribution, and metering costs, the components necessary to cover the imbalances of the equalisation systems' costs for the energy transport and cover a part of the costs incurred by the system to reward the companies that manage the transport and distribution networks for actions that lead an improvement of the service quality (or penalise them in case of inadequate quality of service in respect of ex-ante standards set by the Regulatory Authority)[19].

Taxes and Surcharges

Overall, taxes and surcharges are 33.1% (6.88 c€/kWh) of the electricity bill in Italy, where 13% (2.7 c€/kWh) are the VAT and the remaining 20.1% (4.18 c€/kWh) are system charges. These system charges contain two blocks: the so-called Arim and ASOS. The ASOS covers general charges relating to sustainability, i.e. the support of renewable energy and can be divided in two parts. The first one (ASOS – A3) is for incentives for renewable sources and are 12.1% of the total electricity bill (60.54% of the system charges) and the second one (called ASOS-Ae) is for concessions to companies with high consumption of electricity and takes 3.5% of the electricity bill (17.54% of the system charges). The Arim is 4.4% of the total electricity bill (21.92% of the system charges) and cover the

[18] https://www.arera.it/it/dati/ees5.htm
[19] https://www.hindawi.com/journals/ijp/2020/3605498/

remaining general expenses, which can be split in seven parts. Generally, these components cover costs for the promotion of energy efficiency, nuclear safety and territory compensation, support for system research, compensation for minor electricity companies, special tariff schemes for universal rail and freight services, the electricity bonus and incentives for the production of energy from non-biodegradable waste.[20]

2.3.4.6 Portugal

Share of energy costs, network charges, taxes and surcharges

The Portuguese electricity tariff is on average 21.33 €c/kWh as shown in Figure 10 (for an average household with a yearly consumption between 2500 and 5000 kWh in 2020).

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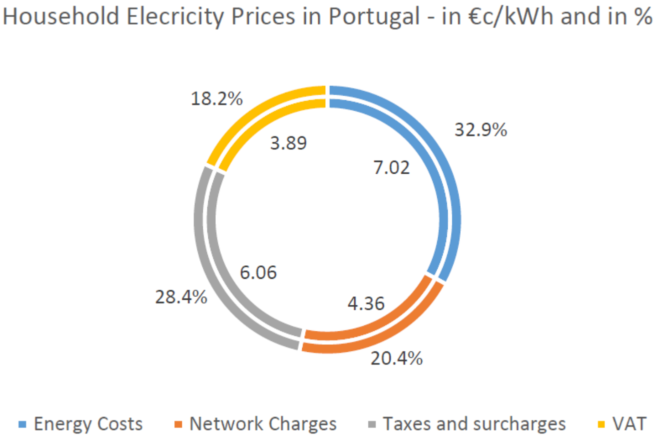

Figure 10 Electricity price components in Portugal in % of the electricity bill.[21, 22]

[23]

The figure above shows that taxes and surcharges have a share of 28.4% (incl. VAT) of the average total electricity tariff. The second highest component of the electricity price, with 32.9% (7.02 €c/kWh), is the energy component. With 20.4% (4.36 €c/kWh) of the household electricity tariff, the network charges have the smallest share within the electricity price (besides VAT)[24]. The share of the VAT is 18.2% of the electricity price.

Taxes and Surcharges

The taxes and surcharges in Portugal can be largely attributed to the CIEG (Custos de Interesse Económico Geral), namely the Costs of General Economic Interest.

[20] https://www.arera.it/allegati/schede/200326st.pdf
[21] Eurostat 2020: Electricity prices for household consumers - bi-annual data, 2nd Semester 2020

[22]https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_price_statistics#Electricity_prices_for_household_consumers

[23]https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_price_statistics#Electricity_prices_for_household_consumers

[24] Eurostat, 2020

The CIEG include the following components:

- cost associated with the payment of FiTs to generation classified as Special Regime Generation (as wind, solar photovoltaics, biomass, residues, small hydro, thermal cogeneration…), corresponding to the difference between the FiT and the wholesale market price;
- recognised costs of generation companies for the conversion of long term PPA contracts that were in place before market opening in Portugal in 2007. The conversion served to maintain pre-existing contract obligations while assuring market participation of the producers;
- recognised costs of electricity companies of the Azores and Madeira archipelagos in order to ensure that local end consumers pay the same regulated end-user tariffs as the regulated end-user tariffs in mainland Portugal;
- costs related to energy efficiency, claimed by, e.g., retailers or distribution companies, energy agencies, consumer protection associations and approved by the Regulatory Agency.

2.3.4.7 Spain

Share of energy costs, network charges, taxes and surcharges

Spain has a unique set of electricity tariffs for all the territories. The average price for households with a yearly consumption of 3500 kWh in Spain was 28.21 €c/kWh in 2018[25]. For the electricity tariff applied to average households (Tariff 2.0A), energy costs have a share of 30.1% of the total electricity bill, which covers the costs of producing the electricity and the commercialisation margins. Network charges, of which the aim is to recover distribution and transmission costs, have a share of 20.6% of the total electricity bill. Finally, the major part of the electricity bill is due to taxes and surcharges, which have a 49.4% share. Every year, the Spanish regulator (CNMC) recalculates network costs and surcharges. Figure 11 shows the electricity bill breakdown for Spain for households.

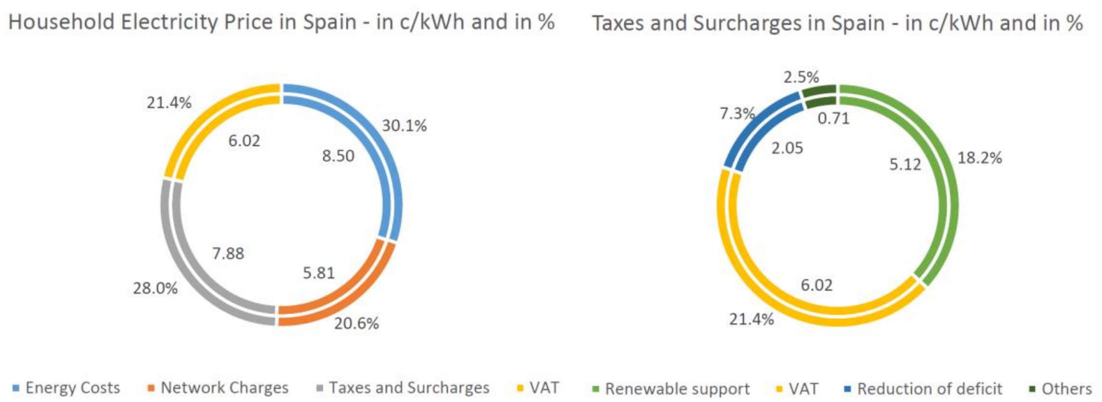

Figure 11 Electricity price components in Spain in % of the electricity bill.

Network Charges

[25] https://www.cnmc.es/sites/default/files/2820666_0.pdf

The network charges recover operation and maintenance costs of transmission and distribution networks. Distribution network costs represented 75% of total network costs in 2018, while transmission costs accounted for the 25% of the total. In an average household electricity bill, network charges are 5.81 €c/kWh. The Spanish regulator has the task of designing the network charges to efficiently recover network costs.

Taxes and Surcharges

The biggest share of taxes and surcharges in Spain is the VAT with a share of 21% of the total electricity bill. Renewable support levies are used to increase the renewable generation development in the country, accounting for 18.2% of the total electricity bill[26]. The third component of taxes and surcharges is the reduction of deficit from past years. Finally, other charges are formed by the costs of maintaining the same rates for the electrically isolated systems and interruptibility service costs (i.e. service provided by big industries to reduce consumption as requested by the system operator), among others. The Spanish government, through the Energy ministry, has the task of designing the charges to recover these regulated costs.

[26] https://www.cnmc.es/sites/default/files/1880908_7.pdf

3. Collective energy actions' business models

Energy Communities as CECs and RECs defined in the EU legislation are in the process of being transposed in EU countries, as discussed in the beginning of this report. Prior to implementation of energy communities, various collective energy actions have been implemented in EU member states. The below aims to give an non-exhaustive overview of such collective energy actions, including energy communities. The focus is on their business models and the services that are being offered to participating end-consumers. An overview is presented per EU Member State, covering the following member states: Belgium, Croatia, Estonia, Greece, Germany, Italy, the Netherlands, Poland, Portugal, Slovenia, Spain and Sweden. The presented information is collected through desktop research and focused interviews with relevant stakeholders directly involved with the implementation of energy communities in their member state. The list of institutions whose representatives were interviewed for this report is given at the beginning of this report.

The country profiles presented below give answers to the following questions:

- What types of energy communities or collective energy actions are in use in the country?
- What is their business model?
- What are the services that they offer to end-consumers?
- Do these actions receive any incentives/subsidies?
- Which stakeholder initiates the formation of energy community or collective action?

Most of the below presented Member States are in the process of implementation of energy communities as part of the transposition of the Clean Energy Directive. Increase in share of renewable energy, increased share of self-consumption and a more active participation of end-consumers in the energy market are within the focus of the transposition and hence supported by national policies, incentives and regulation. Though, the goals of more renewables and improved engagement can reached through energy communities, collective self-consumption at building level or various ways of collective (purchase) actions.

3.1 Belgium

Energy communities, energy efficiency and renewable energy implementation are regionalised affairs in Belgium, i.e. they are handled by the Flemish, Wallonian and Brussels regions. The draft implementation for the concepts of REC and CEC is being finalised, while awaiting crucial aspects for market preparation such as the cost-benefit assessment by the regulator in Flanders (VREG).

Considering those developments, collective energy actions in line with the Clean Energy Package are still in early stage in Belgium despite numerous existing projects such as Energent, Ecopower, Wasewind, Enbro and others.

In Wallonia, business parks have been putting emphasis on the energy community concept to leverage their attractiveness. While no commercial project exists, some concepts are being tested within regulatory sandboxes (e.g. Zelda or E-Cloud). In Wallonia, ECs, as self-producers, are exempted from the traditional suppliers' obligations to buy renewable certificates, hereby, creating savings on the electricity cost. Those allow for the creation of several potential business models with savings to be shared between the energy producers, the EC manager and private companies providing technical support to the EC manager (such as community consumption profile simulation, administrative and operational management such as invoicing, participant registration, dispatching rules and surplus management).

In Flanders, the actors driving the emergence of collective energy actions projects are numerous, being either energy cooperatives, business parks and also private companies. Today, aside from the cooperatives acting as suppliers, the different projects remain largely dependent on subsidies, and their own contributions. A wide range of services are currently experimented, awaiting on the legislation to settle. Those includes for example collective self-consumption for apartment buildings, energy management system provision, collective purchase services, energy efficiency services, etc.

- E-Cloud is a collective consumption initiative, which started in Wallonia in July 2019. The concept focuses on creating a community of consumers in a pre-defined area, supplied by local renewable energy systems. It brings together several businesses recruited beforehand by the Picardy Wallonia's development agency. In order to encourage the companies to consume local and green electricity, they are incentivised by two distinct network tariffs: a preferential rate for renewable and local self-consumed electricity and a classic tariff for the electricity provided by the supplier. A local DSO and market facilitator, organises the exchange of information between the participants
- ThermoVault is a Belgian company, which has developed an all-in software and hardware platform for energy services, helping electricity consumers to save money while integrating more renewable energy sources. Its main goal is to modernise residential customers' existing electric water heaters, space heaters and heat pumps into energy-saving energy storage devices. Today, ThermoVault controls over 1.5 MW of flexible power in Flemish households, combining network services with energy savings.
- DuCoop is a sustainability cooperative offering sustainable services to inhabitants of 400 new apartments as well as to industrial and commercial buildings in De Nieuwe Dokken (Flanders). The cooperative has designed and build a local energy system with integration of direct high voltage lines and the use of a virtual private network. An intelligent monitoring and management system has been implemented in collaboration with an utility company and a cloud platform developer, to manage and control collective (industrial) energy consumption. DuCoop also improves energy-awareness in an urban energy community through information feedback and involvement.

The Flemish implementation will not provide any reductions on taxes, levies, DSO and TSO costs, nor on VAT (Vat is a federal matter), unless the regulator would rather unexpectedly identify cost savings through the behaviour of energy communities and collective self-consumption. As a consequence, the margin for such actions compared to standard supply and injection contracts, is in the commodity part of the tariff compared to the injection value: a typical 2 to 4 cents per kWh extra compared to the 3.5 to 4 cents for injection. While banks, energy suppliers and many potential service providers (including software companies) have spent considerable budgets on R&D for the to-be-expected market, most realise that it will be challenging.

3.2 Croatia

Energy communities (RECs or CECs) as defined in the EU directives have not yet been defined in the Croatian legislation. Currently there is a public consultation on the new Electricity Market Act which transposes EMD and, with it, CEC into national legislation. Collective self-consumption is not yet possible based on existing regulation.

Since 1 January 2016, new renewable energy projects in Croatia are supported through a premium tariff and a fixed feed-in tariff (for installations of less than 500 kW) allocated through tenders. However, only one tendering procedure has been completed (by end of 2020) due to the delays in adoption of the necessary secondary legislation.

Currently collective energy actions in Croatia have been implemented through energy cooperatives (zadruge) or informal initiatives. There are eight energy cooperatives in Croatia[27]. The main business activities of cooperatives is the facilitation of the collective investment in the renewable electricity generation projects, mainly PV and wind. They can be focused on a geographical area, such as an island or can be actively supporting different projects across the country. The cooperatives are usually initiated in close cooperation with the local government or municipality.

[27] https://www.enu.hr/ee-u-hrvatskoj/tko-je-tko-ee-rh/energetske-zadruge/

The green energy cooperative ZEZ is an example of a Croatian cooperative. They are involved in two types of projects:

- A project involving collective, citizen and municipal, investment in renewable electricity generation. The benefit from the self-consumption of generated electricity for the municipality's buildings is shared with citizens involved in the financing of the investment. Due to the lack of crowd-sourcing legislation in Croatia, the cooperative played a significant role in the realisation of the project. There is no feed-in tariff for renewable energy in Croatia.
- Collective purchase of PV panels in order to decrease the initial investment cost. The generated electricity is used for 1:1 prosumer net-metering which has been implemented since 2019, for household prosumers28 (businesses/ industry prosumers (commercial sector) receive renumeration for electricity injected to the grid)

Other means of support, such as loans granted for implementation of RES-E[29] projects, are also available. These loans are part of the "environmental protection" loan scheme by the Croatian Bank for Reconstruction and Development (HBOR) in cooperation with commercial banks. The Environmental Protection and Energy Efficiency Fund (FZOEU) offers financial incentives (interest-free loans, subsidies, financial assistance, donations) for the use of renewable energy sources.

3.3 Estonia

Estonia is currently working on the transposition of the REDII Directive and has a draft legislation that is expected to be approved in 2021. However, the definition of Renewable Energy Community (REC), Renewable Self consumption (RSC) or Citizen Energy Community (CEC) has not yet been specified in the national law (the Electricity Market Act). That being said, the Estonian law allows certain models of collective energy actions.

In Estonia, apartments are privately owned and relations between apartment owners in a building and common areas are managed through apartment associations. Currently, apartment associations are being used as a predecessor of future energy communities. Apartment associations are allowed to act as an electricity supplier within their association as they are *"non-profit organizations who sell and convey electricity to their members solely for the purpose of supplying energy to the apartments, cottages, garages or private dwelling houses which the members own or occupy"*. According to Estonian law, every real estate is required to have one apartment association.

This is not a new concept as heating and domestic hot water expenses are organised in the same manner. Heating of apartment buildings is usually based on one boiler unit in a building and one domestic hot water heating unit, where heat (and/or hot water) is produced or bought by the apartment association and then divided (and billed) among the different apartments.

However, future energy communities in Estonia focus on electricity. Heating is provided by a well-developed district heating system based on wood chips and imported natural gas (used for peaks in district heating and in local boilers). One of the potential benefits of involving heating in energy communities could be addressing the security

[28] End consumers that use RES or high-efficient cogeneration to produce electricity and consume it within their installations sign a contract with their electricity supplier that covers purchase of excess electricity. The supplier is obligated to purchase electricity according to some minimal conditions prescribed in the Renewable Act, or can offer better conditions. This scheme has been in place since 2016. Since 2019, there has been a subgroup of those prosumers – those that use "self-supply". They can only be household consumers and the excess energy that they inject to the grid in one year must not be greater than the energy they consume in that year. The benefit of that status is that they have net-metering (on a monthly basis) that is applied to energy, network cost and levies.

[29] Electricity from renewable energy sources.

of supply of gas. However, very strict requirements for both heating production and distribution, make it difficult for energy communities to compete with the already-established firms.

With regards to electricity and organisation of energy communities through apartment associations, the main business model focuses on two facts:

- First, collective consumption of electricity is cheaper for the consumer because the more electricity consumed the cheaper it is. Therefore, the savings come from cheaper electricity tariff.
- Second, there is a potential for collective self-consumption of locally produced PV based electricity. The PV produced electricity had an incentivised price until 2020. Now the injected electricity receives the market price, making self-consumption more interesting for end consumers.

Up to now it was possible but rather uncommon to have only one electricity contract per apartment association. However, this solution has recently become more popular, as new buildings can connect with the DSO with one meter and organise their own metering and billing by the building association. If an apartment association plans to apply this model, it can be implemented technically during a deep building retrofit. The national renovation grant for innovation, funded by the state can cover about 30-40% of deep renovation costs.

The disadvantage of such business model is that it does not motivate occupants towards energy saving behavior. As electricity prices are rather low in Estonia (14 c€/kWh) and a potential reduction on it does not weigh substantially on it, the energy communities concepts are not that popular. As a result, Estonians are not showing significant interest in additional services, such as energy management.

Some initiatives try to incentives end-consumers towards more renewable energy and a higher energy efficiency. The Tartu Region Energy Agency (TREA) is one of those, founded over 10 years ago by the City of Tartu, as an energy consultant and agency. The initiative is led by the local government and with active involvement of Tartu's citizens and its main objectives are to: achieve climate neutrality of the city by 2050, reduce CO_2 emissions by 40% by 2030, reach new levels of renewable energy production. TREA's ambition is to install PV panels on roofs of public and apartment buildings to establish a citizen-owned PV park. TREA engages buildings and end-consumers as pilots in several local, regional, national, interregional and European projects.

3.4 Greece

In January 2018, Greece introduced a law on a new type of energy cooperatives within the wider framework of Social and Solidarity Economy. The legislation was adopted without the REDII and EMD in mind. The Greek law, according to which an energy community can exercise a variety of activities, including the ones foreseen by REC and CEC but also additional ones (such as energy poverty reduction or innovation), distinguishes two concepts of energy collective actions:

- non-profit cooperatives,
- for-profit cooperatives.

Both models can operate on the heating and electricity market based on renewable energy or high-quality cogeneration, and are open to any entity other than large companies. The law explicitly stimulates the involvement of municipalities and vulnerable households. For energy communities certain requirements relating to licensing and administration fees are relaxed and they receive priority treatment in production licensing and network connection procedures.

Most energy communities in Greece focus on electricity from renewable sources, PV or wind. There are three most typical models of collective energy actions, covering both electricity and heating, for mainland Greece:

- Energy community where members are investing in a PV system, as an energy cooperative, and receiving incentivised price for selling renewable energy, without necessarily using this electricity for their own consumption. Such energy communities also have priority in connection to the grid. This system is currently being revised by the government.
- Collective investment in local PV system where produced energy is used for virtual net metering. Collective investment is organised by consumers that use the same supplier.
- Offering of specific energy services (i.e. smart thermostats, refurbishment of boilers for energy efficiency, etc.) aimed at a community approach by involving a municipality or utility company. This allows for value stacking and offering additional soft energy services such as comparison among similar consumers.

The first two collective energy actions focus on electricity from renewable energy and in most cases, it is focused on solar energy. In the Greek mainland, there are very few examples of fully operational energy communities, while there is more than 400 registered Energy communities since 2018[30]. A good example of a collective action with use of virtual net metering is Hyperion organised in Athens[31].

- Hyperion was established in 2020 as not-for-profit energy collective action with a goal to create community of citizens interested in sustainable energy transition. Hyperion currently has more than 30 members who have organised to collectively invest in a solar electricity generation of 60 kWp with aim to use generated renewable electricity for collective self-consumption through regulatory allowed virtual net metering. The process is organised by the supplier and the excess energy is planned to be used to mitigate energy poverty in Athens. Moreover, Hyperion plans on organising awareness raising of citizens to encourage replication of such process.

In comparison to mainland Greece, Greek islands have been working on collective actions relating to not only energy, but also water and waste management as an integrated approach. The main approach of collective energy action on the islands has been to promote renewable electricity generation while involving the local community. In addition, to assure long lasting implementation of energy communities on the Greek islands, Greek island organisation Dafni has developed a guide for the establishment of energy communities on the islands. The guide suggests to use integrated utility management through collective action, as well as to involve the local DSO and single supplier.

The business model of such energy community would involve providing renewable energy to the end-consumer and in some cases may involve other energy services, such as shared electric mobility. The most known energy community concepts are formed on Sifnos and Kythnos islands, while they are still in the pilot phase defining the main working models though pilot projects. An example of pilot test of electrification of island mobility is a project realised on Island Astypalaia realised in collaboration with Volkswagen.

- Sifnos Island Cooperative was founded in 2013 by 53 members (public and private entities and citizens), as the first Greek energy cooperative, and has been advancing ever since towards realisation of the energy autonomy plan, referring to a Hybrid Power Station that consists of a wind park and a pump storage plant. According to the project, the electricity will be generated from RES installations jointly owned by the prosumers.

While a sustainable energy approach is important for Greek islands, the local population has been increasingly confronted with water shortages, waste management issues and land-use conflicts. Therefore, the potential of energy community projects has not been fully explored.

[30] https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf
[31] https://genervest.org/project/hyperion-energy-community/

3.5 Germany

Collective energy actions have a long tradition in Germany, as private individual ownership of renewable energy dates back to the early 1970s. Estimates show that individual citizens and communities put in place 34% of the total installed PV capacity. Collective energy actions in Germany take various forms:

- energy cooperatives,
- collective self-consumption,
- citizen energy companies.

Energy cooperatives, which are based on a form of democratic governance, distribute profits and losses in a way that surpluses are reinvested to support its members and the community. Direct financial profits can be distributed amongst the members through dividends and/or lower energy prices. To date, there are around 800 energy cooperatives operational in Germany. They provide services such as local distribution system operation, energy supply, ownership of local renewable power plants and energy efficiency services. They are usually initiated by citizens/communities.

- Elektrizitätswerke (EWS) Schönau eG is a multi-utility cooperative founded in 2009, but its origins date back to the late 1990s when it took over the network as well as electricity supply to the local community. In 1999, after the deregulation of the German electricity and gas markets, the cooperative started selling energy at a national scale. Today, it owns local solar and wind plants and its activities include the supply of electricity from renewable energy sources, heating (natural gas and biogas) as well as energy services and energy management advice. This model is partially replicable in other Member States – owning and operating parts of the network may not be feasible across the whole European Union.

Collective self-consumption models are widely popular schemes on building scale but don't yet allow for energy sharing among consumers. Germany introduced the concept of "Mieterstrommodell" in 2017[32]. In such model, the plant operator in a multifamily house, having the status of an electricity supplier, can sell locally produced electricity to residents living in direct proximity. If the operator of the PV plant has a maximum capacity of 100 kW and is installed in a residential building, it can receive a self-consumption support from the DSO of 2.1 – 3.7 Cent/kWh for PV electricity, depending on the plant size, for a period of 20 years (Bundesnetzagentur 2017)[33]. In order to receive support, the plant operator can sell the electricity to either:

- tenants of the building,
- owners of apartments in the building.

According to the German law, in case storage is used, the self-consumed electricity after storage rather than the stored electricity defines the self-consumption subsidy. For electricity fed into the network, the plant operator still receives a feed-in tariff/premium. Collective self-consumers, as opposed to simple self-consumers, have to pay the "EEG surcharge".

This surcharge is part of the retail electricity price and finances the German renewables support scheme (EEG). In a proposal for an amendment of the EEG in 2021, the self-consumption support and capacity limits would be increased to between 3.79 €Cent/kWh (up to 10kW) and 2.73 €Cent/kWh up to a size of 500 kW (Federal Government of Germany 2020).

In 2017, Germany introduced the concept of "Bürgerenergiegesellschaft", or '**Citizens' Energy Company**' (CEC), into its national law (Renewable Energy Source Act) and linked it the financial privileges in the wind power auctions. CECs consist of a minimum of 10 natural persons and 51% of voting rights need to be held by natural persons

[32] https://www.bmwi.de/Redaktion/DE/Downloads/M-O/mieterstrom-gesetzbgbl.pdf?__blob=publicationFile&v=4
[33] https://www.unendlich-viel-energie.de/media/file/3591.89_Renews_Spezial_Community_energy_LECo.pdf

that – prior to submission of the bid – are located in the urban or rural district in which the onshore wind farm is to be developed. Their main activity is focused on electricity production from wind. The CECs may benefit from two privileges: the reduction of the financial security deposit from 30 cent/kWh to 15 cent/kWh and a clearing price instead of a bid price, which implies that the premium subsidy is set at the highest successful bid of an auction round.

3.6 Italy

Italy has recently adopted measures on renewable energy communities and incorporated them into national law (Law8/2020[34]), introducing the following two models for collective energy actions on a temporary basis until directive (EU) 2018/2001 is fully implemented at the national level:

- collective self-consumers (CSC), and
- renewable energy communities (REC).

Collective self-consumers (CSC) model focuses on condominiums, i.e. natural persons or commercial actors, for whom generation and energy exchange is not the core business and that are located in the same building or condominium. The initiative aims to include low-income and vulnerable residents.

Renewable energy communities (REC) involve natural persons, small and medium enterprises, local/regional authorities (e.g. municipal administrations), and private companies. Generation plants (individually not exceeding 200 kW) need to be located in the low or medium voltage network behind the same transformer station. It is noteworthy that the main objective of a renewable energy community is to provide environmental, economic, or social benefits to its members/ local area, rather than any financial profits. Such community is allowed to carry out aggregation activities and act as a balancing service provider.

These models offer to their consumers services based on energy monitoring and management. In general, such actions can be initiated by energy suppliers, energy service companies or citizens, without prejudice to the strict membership requirements set by directive (EU) 2018/2021.

- Comunità Solare Locale (Local Solar Community) of Casalecchio di Reno, is an energy community founded in 2014 by a group of Bologna University researchers. To date, over a dozen of public buildings and spaces have been identified (schools, the town hall etc.) and made available by the local authorities for shared photovoltaic plants, covering an area of around 4500 square meters[35]. Those who are seeking to join the project are offered an access to a common network, where they can consult energy experts and can exchange their best practices. It is an innovation project that has been based on significant funding and does not represent a commercial example.

While these concepts are defined, although under the provisional scheme introduced by Law 8/2020, there are not many acting energy communities yet. Currently active concepts focus on existing energy cooperatives. These cooperatives, that do not qualify as energy communities under the provisions of Law 8/2020 or directive (EU) 2018/2001, are not necessarily geographically limited and focus on shared investment in renewable energy projects and supply of renewable electricity.

[34] https://www.gazzettaufficiale.it/eli/id/2020/02/29/20G00021/sg
[35] https://pubmed.ncbi.nlm.nih.gov/30711741/

3.7 The Netherlands

The Netherlands has been active with collective energy actions prior to the publication of RED II and EMD directives. The concepts of RECs, collective self-consumption and CECs have not been transposed to Dutch regulation.

Dutch regulation since 2015 defines energy cooperatives and associations, as the main form of collective energy actions. Energy cooperatives focus on electricity from renewable sources, including electric heating and mobility. Dutch law allows for energy cooperatives to receive a possibility to organise a regulatory sandbox for a limited period of time where exemption from regulation related to the network operator, tariffs, electricity generation, measurement device requirements, supply, smart grids and data management are organised. While this concept is optimal for testing new concepts in a controlled way, there are comments on the non-replicability of several of the tested concepts.

In the Netherlands there are over 600[36] energy cooperatives. Some of them are expected to grow into energy communities. Moreover, many neighborhoods initially organise to jointly monitor energy consumptions and compare among themselves and only later start with organised collective energy actions.

The business model of energy cooperatives includes joint investment in renewable energy projects, annually balanced community self-consumption of locally generated electricity from PV (postal code arrangement), aggregation of available capacity to be offered at the energy market (requiring capacity of 1 MW for participation) and potential energy services. Net-metering is only available per end-consumer and is expected to be phased out starting from 2023.

The initiative for organising energy cooperatives and associations comes mainly from citizens or municipalities. The motivation for organising such collective actions is usually based on willingness to become more self-sufficient and increase share of local renewable energy generation.

- Grunneger Power is a local energy cooperative founded in 2011 in the city of Groningen, and it has now over 1000 members. The cooperative focuses on developing energy projects in cooperation with the municipality, which contributes financially or by providing ground for rent. In addition, by using crowdfunding, loans and strategic marketing techniques, Grunneger Power created several energy projects based on solar energy production and heat production. It is noteworthy that important citizens' participation has led to a social acceptance of the cooperative's initiatives[37].

3.8 Poland

Poland is currently working on the transposition of the REDII Directive and to date, the definition of Renewable Energy Community (REC) or Renewable Self consumption (RSC) has not yet been specified in the national law. Moreover the concept of Citizen Energy Communities (CEC) defined in the EMD has not been defined either. However, Polish legislation recognises two concepts of energy collective actions:

- energy clusters, since 2015 and
- energy cooperatives, since 2019.

Energy clusters are civil law agreements between different stakeholders including local and/or regional authorities, scientific units and consumers, which aim at creating synergies and greater local value propositions contributing to creation of a competitive advantage. Energy clusters can cover the area of one region or five municipalities and

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[36] https://www.rescoop.eu/news-and-events/news/february-success-story-the-rising-tide-of-dutch-cooperatives#:~:text=Today%2C%20the%20Netherlands%20are%20home,623%20energy%20cooperatives%20%5B1%5D.
[37] https://www.interregeurope.eu/policylearning/good-practices/item/3393/grunneger-power/

while they do not have legal personality, they are represented by a coordinator who can claim their legal right and fulfill their legal duties and responsibilities. Initially 66 energy clusters were formed by initiatives from municipalities in collaboration with suppliers or DSOs and received a certificate from the national government. While the formation of clusters was assumed to be followed by targeted incentives or financial support this was not the case. More than 10 energy clusters still exist and they are organised in close collaboration between the supplier or DSO and the municipality. However, an energy cluster is a community proposition to tackle energy issues jointly but there is no specific commercial business case that is known or specific service that is offered to the consumer.

- **Bioenergetic Cluster in Słupsk** - founded in October 2017 by 19 stakeholders, all generators and users of energy and waste producers, and has been managed by Słupsk Waterworks. The cluster generates electricity, heat and biofuels in both conventional and renewable energy installations. On top of that, it works on the "distribution, balancing and storage of energy for members, waste recycling and local reuse, energy efficiency and renewable vehicle and transport system improvements across the cluster, and research, marketing and education programs related to spreading their model to other regions"[38]. The Cluster was planning to complete a new energy distribution system (including 20 participating businesses and city facilities, 40 000 electricity users and 120 000 wastewater customers), by 2020.

Energy cooperatives, as opposed to energy clusters, are legal entities and can be applied with the same rules as prosumers. A cooperative can consist of maximum 1000 members and can operate in the area of rural or urban-rural municipality or in the area of no more than 3 such municipalities directly adjacent to each other. The foreseen business case for cooperatives is self-consumption of locally produced energy and net-metering of some of this energy. Energy cooperatives are allowed to exchange the surplus of energy produced under favorable conditions for gaps in energy production. For energy cooperatives the net metering ratio is 1 to 0.6. (for single prosumers and their micro-installation, the ratio is 1 to 0.8 for capacity up to 10 kW and 1 to 0.7 in the case of micro-installations between 10 and 50 kW). In the case of electricity generation, the total installed electrical capacity of all RES installations may not exceed 10 MW (electric capacity), and in the case of heat energy not higher than 30 MW, in the case of biogas production 40 million m3 / year). It must enable covering not less than 70% of the own needs of the cooperative and its members during the year.

While the provisions have already been adopted, none of the energy cooperatives were able to start work before the secondary regulation was put in place. There is currently one functioning energy cooperative in Poland - "Nasza Energia", composed in 2014. The government is looking into ways to combine the effort done by energy clusters and the concept of energy cooperatives to arrive at the optimal transposition of energy communities.

- **Cooperative Our Energy (Spółdzielnia Nasza Energia, SNE)** – founded in 2014 in southern-eastern Poland by Bio Power Sp. z o.o., Elektromontaż Lublin Sp. z o.o. and four municipalities. The cooperative generates energy locally, using the agricultural potential, and plans to build 12 interconnected biogas power plants ranging from 0.5 to 1 MW to deliver electricity to all public buildings, street lighting and many households. Nasza Energia is open to all private and legal persons who are willing to pay an entrance fee of PLN 1000. One share costs PLN 500.

Along energy clusters and energy cooperatives, Poles are more and more investing in PV installations on multi-family buildings, for collective self-consumption or RSC concept. Currently, electricity generated that way can only be used in the common parts of the building and not in individual apartments. The Ministry of Energy is currently working on introducing two models of collective self-consumption that could overcome this issue: virtual self-consumption and collective self-consumptions.

[38] https://www.bonusreturn.eu/policy-briefs/policy-brief-slupsk-bioenergy-cluster-a-new-paradigm-for-a-local-circular-economy-in-renewable-energy-and-waste-recycling-in-poland/

In collective self-consumption consumers/prosumers will be able to carry out joint investments in renewable energy installations and secure their energy needs and maintain a given type of energy at the cost of production.

3.9 Portugal

In the legislation published in 2019, Portugal has partially transposed the RED II, introducing a framework for (collective) self-consumption in the electricity sector, also including definitions and rules for Renewable Energy Communities (RECs). However, the Citizens Energy Community (CEC), as defined in the EMD, has not yet been transposed and a legal framework does not exist yet on this aspect.

While currently there are no operational Energy Communities in Portugal, collective energy actions can be realised through energy cooperatives and self-consumption management entities (Entidade Gestora do AutoConsumo, EGAC). Both of these collective energy actions are expected to be a basis for development of energy communities in Portugal.

Energy cooperatives are currently organised with a goal to provide members the possibility to invest in the renewable energy generation projects, receive electricity from renewable sources and affect sustainable development through participation in development projects. Energy cooperatives are not geographically limited and can invest in projects realised across Portugal. In addition, there are legacy energy cooperatives implemented to assure energy supply to remote areas in mainland Portugal. These, however, do not generate energy themselves and are also responsible for operating the local distribution networks.

- Coopernico is a renewable energy cooperative organised by citizens in 2013. The main goal of Coopernico is to increase the share of renewable energy and help to achieve environmental goals in terms of CO2 reduction. Its members can participate in decisions and investments of supported renewable energy projects, be supplied with renewable electricity, and receive energy services, such as support to participate in or prepare energy projects. The renewable electricity is fed into the network and receives an incentivised price. The benefits received are split between members and reinvested in additional projects.

Self-consumption management entities (EGACs) were defined by regulation in 2020, but have not yet been implemented. Energy cooperatives are not yet using this concept in their business model, but its use is expected to be applied for future energy communities. In case a REC includes self-consumption, the creation of an EGAC is mandatory. The business model as such would be dependent on the subsidies for the sale of generated renewable energy or the regulation for the collective self-consumption and its related tariff regime.

Energy service companies are expected to be able to collaborate with energy communities and provide collective energy services. They could also provide consulting services (technical, legal, etc.) at the initiation stage or during the operation phase on various subjects (energy efficiency, flexibility, electric mobility, etc.).

3.10 Slovenia

RECs and CECs concepts as defined in the RED II and EMD directives are yet to be transposed in Slovenian legislation. A draft legislation of Energy Law is prepared and is expected to be adopted by mid-2021. Collective self-consumption has been closely regulated and implemented since May 2019.

Currently collective energy action in Slovenia focuses on Renewable Energy Source Community (RESC) recognized under the law and further regulated. Aside from single user net-metering, RESC allows for collective self-consumption and community self-consumption through net-metering. Net-metering is currently counted on an annual basis. For collective self-consumption the PV installation has to be up to 80 % of the total power capacity of all connected consumers.

While collective energy actions are still few, the business model of RESC is based on locally generated PV electricity being used for self-consumption or annual net-metering and collective installation of PV or other smart energy technologies. RESCs do not have a specific legal form and can involve citizens, a municipality, utility company or DSO. However, up to now the implementation of collective energy actions involved community management initiated and organised by a municipality, supplier or DSO.

- A neighborhood in Kranj, Slovenia is an example of a RESC with community self-consumption. It is a funded pilot case used for testing optimal collective energy actions. The energy of a neighborhood, where users are connected to one low voltage line, is collectively managed. This community is organised and managed by an energy supplier, organised by Petrol. End consumers in this neighborhood have PV, storage and heat pumps that have been installed to test multiple innovative energy services including behind the meter EMS and neighborhood energy balance by a supplier using a neighborhood battery and aggregating flexibility. The supplier takes over the responsibility for the losses and net metering is organised at one connection agreed with the DSO.

3.11 Spain

Similarly to Germany, Spain has a long tradition of energy cooperatives, which have been created since early the 1920s. While the Member State has already adopted a regulation defining collective self-consumption, the concept of energy communities - even though mentioned in the Royal Decree-Law 23/2020[39] - has not been further regulated. For this reason, the current form of collective energy actions mainly revolves around the concept of energy cooperatives.

Energy cooperatives deal with various activities such as the distribution system operation, supply, proving energy services, and management of their members in the local energy environment. They can be divided into two main types:

- Energy cooperatives owning the distribution networks (in minority), and
- Energy cooperatives without ownership of the infrastructure (in majority).

Energy cooperatives owning the distribution networks were created already in 1920s, mostly in remote areas, where they were motivated by security and quality of supply. Such initiatives are owned by citizens and they cover both the electricity distribution, supply and other potential energy services. Their benefits are reinvested into the community to maintain them and increase renewable self-consumption. The DSO both supplies and installs PV systems for the collective self-consumption. Injection of PV generated electricity into the network is not incentivised, therefore it is more financially beneficial to apply collective self-consumption.

- Enercoop is a local electricity cooperative founded in Crevillent in Southeast Spain, a part of the country that is particularly vulnerable to climate change. The initial phase of Enercoop's project MERLON, funded by the EU, aims to install 120kW PV panels that will provide energy to 70 households. Its storage system will allow citizens to produce energy that can be used later on, and rely on off-grid electricity in case of power cuts. For the time being, Crevillent's municipality is made public facilities' rooftops available to install the cooperative's solar panels, and soon private owners will join the initiative. It is noteworthy that Enercoop is not only a seller of electricity but also a distributor, which makes it a good business case.

39 https://www.compile-project.eu/news/new-working-paper-by-compile-partners-collective-self-consumption-and-energy-communities/

Energy cooperatives without ownership of the infrastructure were created in the last decade. They focus on the supply of electricity from renewable sources and management of the community. Their main goal is to increase the rate of community self-consumption in Spain. Such energy cooperatives are usually initiated by a community manager, who is also acting as a supplier. Like energy cooperatives owning the distribution networks, the manager both supplies and installs PV systems for the collective self-consumption. Also here, injection of PV generated electricity into the network is not incentivised, therefore it is more financially beneficial to apply collective self-consumption.

- SOM ENERGIA is a Catalan energy cooperative founded in 2010 by 150 citizens and it has now grown to 47 000 people. Thanks to the cooperative, its participants can join their forces and invest together in renewable energy projects – something that couldn't be achieved if they were acting alone. Som Energia started with buying local green energy from regional sources, and has recently built its own solar power installations as well as a citizens' owned 500 kW biogas plant.

Further, energy cooperatives can also provide other energy services to their members by using an energy service company (ESCo). It is noteworthy that the market for services offered to energy cooperatives has been rapidly growing. Energy service companies offer to energy cooperatives different type of services including:

- smart grid management: IT solutions for the management, optimisation, and control in real-time of the assets to provide a constant supply to the customer (directed to cooperatives owning their own network),
- community management: solutions and services for the management of self-consumption between members, consumer characterisation to improve electricity purchase, performance of demand-side management campaign, administration and billing, etc.,
- appliances and asset control: through the implementation of own equipment that makes the asset pilotable,
- mobility Management: organisation and maintenance of charging points for electric vehicles up to the full operation of mobility services,
- energy efficiency services: estimation of energy efficiency potential, suggestion of energy efficiency measures, optimisation of electricity and gas bills, etc.

Finally, flexibility and aggregation electricity markets in Spain are not yet sufficiently defined nor mature in the legislation to currently act as a business model for cooperatives or energy communities. Such markets are however tested in local regulatory sandboxes developed within innovation projects (e.g. IREMEL), but cannot serve yet as viable business models for energy communities without subsidies.

3.12 Sweden

Legislation proposing transposition of RED II and EMD has been drafted and proposed to the government. It is expected to be adopted by end of 2021. The Energy Market Inspectorate has proposed the draft of the legislation[40][41].

Currently collective energy actions are only possible if they involve the management of the local distribution network and are aligned with the exceptions for requiring network concession (IKN)[42]. Before 2007, IKN could be used to organize community self-consumption based on PV generation, while today it can only be used if the PV generated electricity is used for consumption within the same building.

[40] https://www.regeringen.se/4afc14/contentassets/8d350a3c57644a9faf9ffe7678743961/eir2020_06_kapacitetsutmaningen-i-elnaten.pdf

[41] https://www.regeringen.se/informationsmaterial/2021/01/propositionsforteckning-varen-2021/

[42] https://www.ei.se/sv/for-energiforetag/el/Natkoncession/undantag-fran-kravet-pa-natkoncession-ikn/#hanchor2

- Orebro smart city[43] is a pilot site testing innovative energy solutions on the concept of energy community with focus on renewable electricity, management and e-mobility. The goal of the pilot is to show how locally produced electricity from PV in addition with home battery systems and electric vehicles can be used for community self-consumption.

[43] https://extra.orebro.se/byggorebro/tamarinden.4.4ffbbf5616ac98ac8f49fb.html
https://www.obo.se/smart-stad/

4. Summary

The purpose of this report was to analyse the economic aspects of energy communities (Renewable Energy Communities and Citizen Energy Communities), but also including the other collective energy actions that have been implemented in Member States. Two main economic aspects of energy communities have been analysed: electricity tariffs and services offered to end consumers.

While all analysed Member States have three main components of the electricity tariff for households (electricity costs, network charges, taxes and surcharges) significant difference in electricity tariffs should be noted. The differences arise due to diverse share of the three tariff components. While some Member States have high network chargers, others have high taxes or other costs.

As discussed in Chapter 2, few Member States, including Austria, Belgium, Luxembourg, Portugal and France, are considering local electricity tariffs for energy communities or (collective) self-consumption. While such tariffs could be beneficial to development of Energy Communities, the aspect of cost-reflectiveness should be kept in mind. The discussion with national energy regulators resulted in clear view that most Member States do not see short term issues with existing low voltage networks and that the benefits of energy communities to energy system are not currently clear. On the other hand, many Member States are finding ways to support renewable energy and therefore actions are taken to incentivise self-consumption and energy communities as collective way to encourage use of renewable energy.

Due to yet unclear benefits of energy communities to energy system and economic benefits to consumers, Member States are more active in transposing the concept of Renewable Energy Communities. Chapter 3 reviews possible services offered to members of energy communities in different Member States, but expands the focus to collective energy actions to understand the motivation and business models behind all collective actions.

Review of existing collective energy actions, shows that some Member States have recognised the need for energy communities before the directives, such as Germany, Netherlands, Spain and Greece. Moreover, most Member States currently have at least one form of collective energy action, where those focused around collective investment and/or supply from renewable energy, such as in Netherlands, Belgium, Spain, Portugal, Poland, Greece, Germany, Austria, Italy and Croatia, or collective self-consumption, such as in Slovenia, Greece, Spain, Germany, Estonia and Sweden, are the most prominent. Existing collective energy actions in reviewed Member States focus on electricity with very few pilot examples including electrical mobility and even less non-electricity based heating.

While renewable energy or collective self-consumption drive most of these initiatives, the main driver is political support for easier procedures and financial support through incentives, tax benefits or tariffs that support most business models. The main difference between collective energy actions in different Member States is in the stakeholders that initiate the most successful collective actions. In Netherlands, Germany, Belgium and Croatia such actions are mainly initiated by consumers/citizens or non-governmental organisations representing them. In Slovenia, Italy, Portugal, Spain, Greece, Austria, Poland and Estonia they are organised by energy service companies or suppliers and DSOs in coordination with local municipalities.

Therefore, further development of Energy Communities, especially as an economically beneficial option strongly depends on the clarity of policy and regulation, especially related to cost-reflectiveness of electricity tariffs, incentives and support schemes, support for self-consumption versus development of flexibility markets. Current lack of clarity regarding flexibility services and clear and complete cost benefit analysis of energy communities, leads Member States on an unclear path for need for implementation of Energy Communities.

Abbreviations and Acronyms

RED II	Recast of Renewable Energy Directive
EMD	Electricity Market Directive
CSC	Collective Self-Consumption
CEC	Citizen Energy Communities
REC	Renewable Energy Communities
VREG	Vlaamse Regulator for Electriciteit en Gas

List of Figures

References

Hannoset A., Peeters L., Tuerk A., 2019: Energy Communities in the EU: task force energy communities URL: https://www.h2020-bridge.eu/wp-content/uploads/2020/01/D3.12.d_BRIDGE_Energy-Communities-in-the-EU-2.pdf

BMWI, Federal Ministry for Economic Affairs (2017): Gesetz zur Förderung von Mieterstrom und zur Änderung weiterer Vorschriften des Erneuerbare-Energien-Gesetzes vom 17. Juli 2017. Bundesgesetzblatt Jahrgang 2017 Teil I Nr. 49, ausgegeben zu Bonn am 24. Juli 2017.

D. Menniti, A. Pinnarelli, N. Sorrentino, G. Brusco, L. Mendicino, and M. Mercuri, Analysis of the Power Cloud Framework Benefits and the Role of the City Energy Provider in the New Italian Electricity Tariff Scenario, International Journal of Photoenergy, 2020, https://doi.org/10.1155/2020/3605498

CNMC, Informe de supervision del Mercado Minorista de Electricidad, 2018, URL: https://www.cnmc.es/sites/default/files/2820666_0.pdf

CNMC, Informe sobre la propuesta de orden por la que se establecen los peajes de acceso de energia electrica para 2018, URL: https://www.cnmc.es/sites/default/files/1880908_7.pdf

Greenpeace, Mapping of Energy Communities in Greece 2020, URL: https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

Renewz Spezial, Community energy in Germany: More than just climate change mitigation, 2019, URL:https://www.unendlich-viel-energie.de/media/file/3591.89_Renews_Spezial_Community_energy_LECo.pdf

S. Moroni, V. Alberti, V. Antoniucci, A. Bisello, Energy communities in the transition to a low-carbon future: A taxonomical approach and some policy dilemmas, Journal of environmental management, DOI: 10.1016/j.jenvman.2019.01.095

D. Frieden, A.Tuerk, C. Neumann, S. d'Herbemont, J. Roberts, Collective self-consumption and energy communities: Trends and challenges in the transposition of the EU framework, Compile, 2020a, DOI: 10.13140/RG.2.2.25685.04321

Frieden et. al 2020b: "Analyse von Ortstarifen für Energiegemeinschaften und ökonomische Auswirkungen auf nicht teilnehmende Haushalte". Study fort the Viennese chamber of commerce.

VREG 2020: Tariefmethodologie 21-24. https://www.vreg.be/sites/default/files/Tariefmethodologie/2021-2024/publieke_toelichting_consultatie_tm_21-24.pdf

Web links

https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20201124-1

https://www.arera.it/it/operatori/smartmetering.htm#elettricit%C3%A0

http://www.consultations-publiques.developpement-durable.gouv.fr/projet-d-ordonnance-portant-transposition-de-a2288.html

https://www.e-control.at/de/konsumenten/strom/strompreis/was-kostet-eine-kwh

https://www.e-control.at/documents/1785851/1811582/SNE-V-2020-Vergleich-der-Netzebenen.pdf/959e4eda-1945-1a1d-f4ca-3c655453165b?t=1576846685632

https://www.e-control.at/konsumenten/strom/strompreis/preiszusammensetzung/netztarif

https://www.connaissancedesenergies.org/fiche-pedagogique/tarification-de-l-electricite

https://www.arera.it/it/dati/ees5.htm

https://www.hindawi.com/journals/ijp/2020/3605498/

https://www.enu.hr/ee-u-hrvatskoj/tko-je-tko-ee-rh/energetske-zadruge/

https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

https://genervest.org/project/hyperion-energy-community/

https://www.gazzettaufficiale.it/eli/id/2020/02/29/20G00021/sg

https://www.rescoop.eu/news-and-events/news/february-success-story-the-rising-tide-of-dutch-cooperatives#:~:text=Today%2C%20the%20Netherlands%20are%20home,623%20energy%20cooperatives%20%5B1%5D.

https://www.interregeurope.eu/policylearning/good-practices/item/3393/grunneger-power/

https://www.bonusreturn.eu/policy-briefs/policy-brief-slupsk-bioenergy-cluster-a-new-paradigm-for-a-local-circular-economy-in-renewable-energy-and-waste-recycling-in-poland/

https://www.compile-project.eu/news/new-working-paper-by-compile-partners-collective-self-consumption-and-energy-communities/

https://www.regeringen.se/4afc14/contentassets/8d350a3c57644a9faf9ffe7678743961/eir2020_06_kapacitetsutmaningen-i-elnaten.pdf

https://www.regeringen.se/informationsmaterial/2021/01/propositionsforteckning-varen-2021/

https://www.ei.se/sv/for-energiforetag/el/Natkoncession/undantag-fran-kravet-pa-natkoncession-ikn/#hanchor2

https://extra.orebro.se/byggorebro/tamarinden.4.4ffbbf5616ac98ac8f49fb.html

https://www.obo.se/smart-stad/

This report has been developed within the EC Contract on "Support office for ETIP SNET and BRIDGE" N300003009.

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