Implementation of self-consumption and energy communities in Austria's and EU member states' national law: A perspective on system integration and grid tariffs

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Abstract

Energy Communities and different forms of self-consumption, as introduced by the European Union's 'Clean energy for all Europeans package', may become an important elements of future energy systems. Their acceptance and implementation will importantly depend on their transposition into member states' national law. In this paper, we investigate the ongoing national transpositions, in particular regarding their integration in the electricity network structure and related grid tariffs. As an example, we focus on the corresponding draft laws in Austria, and undertake a comparison with other EU member states. Actual implementations may be either supported or hampered by details of the legal framework. Accompanying support measures necessarily need to take the national structure of the energy system into account.

1 Introduction

The European Union's 'Clean energy for all Europeans package' (in the following Clean Energy Package) introduced different types of self-consumers and energy communities as new players in the energy market [8]. They are defined in two directives, which need to be transposed into the national laws of the EU member states.

Figure 1 depicts the possible structure of an energy community and the involved other market participants: The energy community merges the energy production of participating producers with the demand of participating consumers. In this regard, the energy community is responsible for the energy allocation. Excess energy is sold to a traditional energy purchaser outside of the community or, optionally, energy could be temporarily stored in a community battery storage. In case of a consumer's energy demand that cannot be met by the producers, the remaining energy demand needs to be purchased from a traditional vendor outside of the community. Figure 1 already indicates the energy community as an autonomous entity, required by the directives to be incorporated in some kind of legal form.

In previous work, the authors addressed both the policies included in the EU directives as well as the status quo of national transpositions (e.g., [1, 3, 9]). However, by the time of writing, the transposition process is not yet finalised and a number of questions on the details of most national frameworks remain open, including

- the spatial and system-related boundaries applying to renewable energy communities (REC),

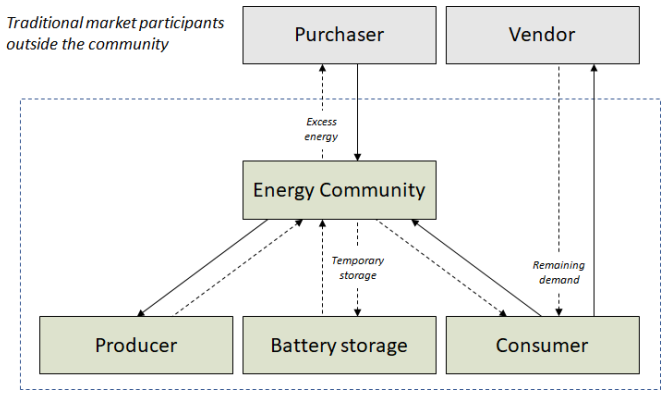

Fig. 1 Energy Community Structure
The dashed lines show the energy flow, while the solid lines show the cash flow.

- the option for a citizen energy community (CEC) to act as a distribution system operator (DSO),
- the optionally permitted operation of a community over member-state borders,
- membership in more than one community at the same time,
- advantages for participants to join, not limited to financial incentives,
- the legal form of organisation of the community, and
- possible simplifications in administrative procedures.

This paper focuses on system-integration and related boundaries as well as on grid tariffs which may come along with economic advantages for participation. After introducing the

Clean Energy Package and some of the new actors (Section 2), this paper especially discusses the proposed implementation of energy communities in Austria (Section 3.1). Furthermore, a comparison to the transposition in other member states of the European Union will be undertaken (Section 3.2). We focus on the electricity sector, while in particular RECs may equally include other forms of renewable energies, such as heat.

2 Clean Energy Package

The Clean Energy Package was first proposed in 2016 and came into force in 2018/19. It consists of eight legal acts, four of which are regulations that are directly applicable in the EU's member states and four directives which require national transposition acts. Of those four directives, the main focus for the scope of this paper are:

- the Renewable Energy Directive (EU) 2018/2001 (RED), and
- the Electricity Directive (EU) 2019/944 (ED).

2.1 Actors and their area of operation

Newly introduced related actors of the Clean Energy Package can be related to three evolution levels with increasing collaboration of participating individuals, as well as an increasing possible operation area [3]:

Level 1 (Single houses): the 'renewables self-consumer' (RSC), who is 'a final customer [...] who generates renewable electricity for its own consumption, and who may store or sell self-generated renewable electricity'.

Level 2 (Apartment buildings): the 'jointly acting renewables self-consumers' (JRSC), who are 'a group of at least two jointly acting renewables self-consumers [...] who are located in the same building or multi-apartment block'.

Level 3 (Local, regional or even broader communities): the 'renewable energy community' (REC) and the 'citizen energy community' (CEC). They are expected to gain importance in the next years and to become an essential element of future energy systems [11]. While those two types share commonalities, there are also some significant differences between them [3, 9]. Commonalities in their activities are the generation, consumption, storage and sale of energy, including via the public grid. While RECs are limited to renewable energy (including electricity and heat), CECs are limited to electricity (technology neutral, i.e. not necessarily renewable).

While (jointly acting) renewables self-consumers as well as RECs are defined in the RED, CECs are part of the ED. The RED restricts the operation of JRSC to 'the same building or multi-apartment block', whereas the local character of RECs remains rather vague. The REC definition refers to 'local areas' of operation and requires RECs to be 'effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects'. The concrete definitions remain open to the member states. Many member states define general geographical or system-related boundaries for RECs or for the involved installations but put less emphasis on the governance-related proximity requirement as stated in the RED [9]. For the proposed Austrian implementation, as described in more detail in Section 3.1, possible structures and operational limits are shown in Figure 2.

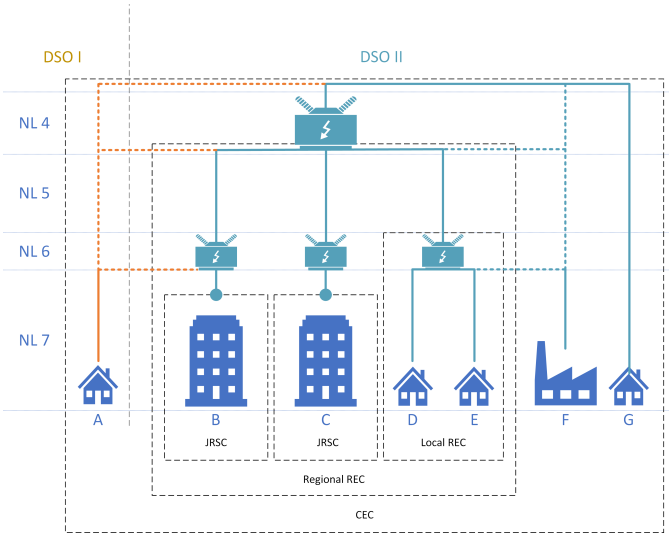

Fig. 2 Operational scope of the different actors in the electricity system as planned in Austria (based on [2])

3 Implementations in the member states

EU directives need to be transposed into the national law of the member states. By the deferred time of the CIRED conference (September 2021) the deadlines have already passed:

- for the ED: in December 2020,
- for the RED: in June 2021.

However, at the time of writing (February 2021), the member states are in different states of their legislative processes and only a few have already introduced energy communities to the proposed full extent. In many cases, national transposition follows a step-wise approach, including learning and review phases, partly explicitly expressed in the legal frameworks (e.g., Austria, Portugal) [9].

3.1 Austria

A first draft of a "Renewable Energy Expansion Act" (*Erneuerbaren-Ausbau-Gesetz*) was proposed in September 2020, initially planned to come into force in January 2021. Numerous statements from individuals, companies and interest groups were yielded during the legislative evaluation procedure. Until now (February 2021) no updated proposal or legislative draft is available. Thus, the following description can only be based on the first draft; changes are likely but cannot

be foreseen in detail at this moment. Figure 2 is based on the proposed situation in Austria [2]. Due to Austrian constitution laws, the act will require a $2/3$ consent majority. Furthermore, some parts of the act require the acceptance by the European Commission, as it will contain regulations on subsidies for several renewable energy sources.

Network Levels: In Austria, the electricity grid is divided into seven network levels (NL) based on the voltage level. Of those, the NL 4-7 are of highest relevance for the scope of this paper (cf. Figure 2):

- NL 4: transformation from high to medium voltage,
- NL 5: medium voltage (1 kV to 36 kV),
- NL 6: transformation from medium to low voltage,
- NL 7: low voltage ($U \leq 1$kV).

Electricity costs: Electricity costs in Austria can be divided into three components, each of which account for approximately a third of the sum for a typical household customer [5]:

- grid fees (to be paid to the concessionary DSO in a geographical monopoly),
- energy costs (to be paid to a freely chosen energy vendor),
- taxes and surcharges.

JRSC: Preliminary to the Clean Energy Package implementation, Austria introduced an equivalent to JRSC already in 2017. This scheme is physically restricted by excluding a transfer of the produced energy over the DSO's property. For example, in Figure 2 the apartment buildings B and C could internally organise a JRSC scheme each, but not together since that would require to use DSO infrastructure. In 2020, there were 291 of those in operation [6].

REC: In the following we discuss RECs' activities in the electricity sector which is the focus of the Austrian framework. It should be noted, however, that RECs in the heating sector are equally foreseen. For RECs, a partial reduction of the electricity grid fees, taxes and surcharges is proposed for electricity exchanged between members of the REC via the public grid ("local tariff"). This reduction builds on the logic that

1. higher network levels are not used for the local electricity exchange (cost reflectiveness according to the ED), and
2. the renewable energy generation by RECs is acknowledged, e.g., by reducing renewables support surcharges and the energy tax.

Two types of RECs are proposed, with the physical location of the involved installations being defined utilising specific network levels:

- a 'local REC', able to span over NL 6 and 7 only, and
- a 'regional REC', also including NL 5 and only the bus bar of NL 4.

As a result, a regional REC could integrate much more members. This is also shown in Figure 2, where a 'local REC' could be formed by the members D and E, while a 'regional REC' could also integrate B and C, connected with each other on a medium voltage network layer. In this context, it is important to note that it is not permitted to be a member of two RECs at the same time. The proposed savings in grid fees would be lower in a regional REC as compared to a local REC, as the reduction is defined by the involved network levels. However, a member which is excluded from the perimeter due to a grid topology change is allowed to continue its membership.

The installations of a REC may only span over the concession area of one DSO (cf. A in Figure 2, whose installations cannot be part of a REC). This is of high relevance in Austria due to the very heterogeneous structure of DSOs. The concession areas of some DSOs do not exceed the area of a rural valley, while only a few DSOs span over a large city and its surroundings. In 2013, Austria had 138 DSOs, while only 13 of them served more than 100,000 customers [7, 10]. Furthermore, in Figure 2, industry F is excluded as the membership to RECs is restricted to natural persons, small or medium enterprises, or local authorities, while G does not meet any proximity criteria.

CEC: A CEC is, in line with the ED, not limited in its expansion on national level; it may span over the concession areas of several DSOs, though not over Austrian borders. Thus, in the case of Figure 2, all interested parties are able to participate in this energy community. DSOs are required to establish the data exchange needed for the attribution of shared electricity. However, CECs – in general – will not reduce the grid load as the participants may be widely spread. Therefore, no reductions of grid fees, taxes nor surcharges are intended.

Decision for the "right" type of community: In result, a decision on which organisational format to choose will, among others, depend on the intended area of operation, involving different levels of cost savings. For the energy produced and consumed within the community, different conditions apply:

- for JRSC: No grid fees occur, as no infrastructure of a DSO is used.
- for a local REC: Grid fee deductions of $\sim$60 % are expected for electricity shared via the public grid. Table 1 shows that, by including the proposed deductions in taxes and surcharges, savings of one quarter up to a third of the accumulated electricity costs are possible.
- for a regional REC: Grid fee deductions of $\sim$30 % are expected for electricity shared via the public grid.
- for a CEC: Grid fees are not reduced, as possibly all network levels and even the infrastructure of multiple DSOs may be used.

Smart meter rollout as the missing link: The DSO (or possibly multiple DSOs in case of a CEC) is required to attribute shared electricity to the individual members, generally based on quarter-hourly smart meter data. Thus, the roll-out of

Table 1 Possible savings for households consuming energy that is generated and consumed within the local REC (prices in Eurocent/kWh based on [5]). It cannot generally be expected that producers within the energy communities will offer their energy to other members at a significantly lower price than a traditional vendor [1]; accordingly, energy cost deductions are not indicated.

	grid fees	**energy costs**	**taxes and surcharges**	**electricity costs** $\sum$
2020 mean prices	6.02	7.08	7.31	20.41
expected savings	–60 %		electricity tax: 1.50 renewables surcharge: 1.30 VAT: ?	
calculated prices	2.41	*7.08*	< 4.51	< 14.00

energy communities further depends on the availability of smart meters to its members. Austria legally requires to equip 80 % of the metering points until 2020, 95 % until 2022. While those deadlines have already been extended in 2017, it is still not expected that those targets will hold. The latest available numbers (2019) of the Austrian regulation authority expect the roll-out to reach only 31 % by 2020 and 75 % by 2022 [4].

Improvements worth considering: During the consultation process for the Austrian draft act, numerous statements noted that the positioning of energy communities in the energy market remains quite open. On the positive side, this leaves a lot of room for creative business models, but it also leaves uncertainty about how to integrate RECs into the existing energy system. Some experience has already been gained with JRSC. However, since these schemes are not operating within the public grid system, it has not yet been possible to evaluate problems associated to system integration. According to the responsible ministry, a future amendment of the national electricity act (ElWOG 2010) is intended to define the market role of energy communities. Since a clearer assignment of the RECs' market role would avoid initial legal uncertainties, this is a favourable development.

Knowledge about the existing grid infrastructure will be an essential prerequisite for the planning of RECs. Additional obligations of the DSOs in the preliminary establishment stage would simplify project planning and establish uniform standards. The limitation of RECs to the concession area of one DSO may significantly constrain implementation. On the one hand, RECs, involving more than one DSO, would require additional organisational effort for both the RECs and the DSOs. On the other hand, since CECs can span over several concession areas, corresponding structures, in particular for data exchange, will need to be established anyway.

Regarding the membership in RECs, the RED does not require all members to be located in the proximity of the installations; this criterion only applies to those members that exercise effective control. Such a criterion is not included in Austria's draft law. In the draft law, membership is associated to the location of the installations. A further specification of proximity (e.g., the potential distance to the installations) or a limitation of this restriction to members exercising effective control is not included. As a consequence, membership in general may be restricted to participants connected to the same grid segments as the involved installations. This would, for instance, prevent participation of more remote individuals whose prime purpose of participation is not the internal sharing of electricity (e.g., participation in financing, management, marketing or other). Provided that the location of the involved installations is defined already, it would be preferable to limit the restriction for membership to the governance-related proximity as provided for in the RED. This may additionally require a definition of proximity, e.g., in terms of distances to the involved installations, a geographic area or other. The general exclusion of larger companies and utilities in RECs is, while strongly debated, already indicated by the directives, and thus no decision at national level.

A 'one-stop-shop' for all aspects of energy communities was announced in the government program 2020-2024, but is not contained in the proposed act. However, a supplement has already been announced by the ministry. One-stop-shops would be particularly welcome for the consulting of energy communities. They may accelerate the acceptance, since the above mentioned number of established JRSC indicate that they are not yet well employed.

3.2 Comparison to other EU member states

Regarding the physical boundaries of RECs, several EU member states follow approaches comparable to Austria, referring to network levels or transformer stations. However, to our knowledge, Austria's distinction of local and regional RECs is unique in the EU. Other member states include criteria such as distances or administrative structures, e.g., municipality or district borders. For now, in Portugal and Belgium (Wallonia, Flanders), physical boundaries of RECs are not clearly defined and the recognition of a REC is rather decided on a case-by-case basis. For instance, Wallonia introduced so-called "local perimeters", located downstream of one or more MV/LV transformer stations but also representing a "technically, socially, environmentally and economically optimal" section of the grid to promote local self-consumption [9].

Several other EU member states implement frameworks including a reduction of grid fees and potentially other elements of the electricity bill. This is partly motivated by the

cost-reflectiveness requirement of the ED. Countries applying "local tariffs" to RECs, besides Austria, include Portugal, Belgium, and Italy. Some countries establish expanded JRSC schemes equally allowing for the use of the public grid. France, Portugal and Spain apply reduced tariffs also to these JRSC initiatives. While most of these approaches apply lump-sum reductions of fees, in Wallonia and Flanders, the governments demand a cost-benefit analysis investigating the impact of energy communities on the distribution network. This includes avoided investments in the network. Only based on this assessment, specific tariff reductions may be applied, in Flanders even to both, RECs and CECs [9].

4 Conclusion

The use of the public grid is a major element in energy communities and partly in JRSC schemes. Given this high importance of the public grid and thus the important role of DSOs in this context, the different situation regarding grid structures in the different member states lead to strongly differing preconditions for energy communities (and JRSC where applicable). The high number of DSOs, for example in Austria, in a heterogeneous structure (e.g., rural or urban areas) introduces specific restrictions for RECs (e.g., only one concession area) and increases coordination efforts for CECs. In particular in countries with just one DSO, the situation is much less complex. Resulting from different implementations of the Clean Energy Package's directives, there will also be differences in the acceptance and adoption of the concepts in the individual member states.

It should be highlighted that the proximity requirement in RECs refers, according to the RED, only to the effective control by the members. It does not address the right for membership, nor the physical expansion of a REC as such. Thus, the local character of RECs is only indirectly embedded in this criterion. In addition, the RED refers to a 'local area' which is not further specified. Nevertheless, the interaction with the DSOs and, in particular, the definition of local grid tariffs may, from a practical perspective, require the national definition of system-related boundaries (e.g., in relation to the network levels). However, such technical, system-related limitations should be clearly differentiated from questions of membership and effective control. This distinction is not fully made in many member states, including Austria.

The Austrian approach comes along with clear definitions of the involved grid segments and concession areas/DSOs for RECs and CECs, referring to the involved installations. This entails different implications for the recognition of RECs and CECs, related costs, as well as the technical and administrative implementations. With this, Austria follows a strict approach as compared to some rather loose definitions of physical expansion. Both approaches have advantages and disadvantages; strict restrictions on the network and DSO level may lead to a lack of flexibility as well as unexpected and surprising constraints, for instance, if a municipality spans over several concession areas. The rather loose, case-by-case approaches such as followed in Portugal or Belgium may provide more flexibility and adaptability to actual project realities but lack planning certainty on the level of the initiatives.

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