Legal measures to aid profitability for energy communities and their participants

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***Abstract*—Energy communities, as recently introduced by the European Union's 'Clean Energy for All Europeans Package' need to be transformed into the national laws of the member states until Mid of 2021. By integrating local energy producers and consumers, they aim for an improvement of energy efficiency, increasing integration of renewable energy sources, and a reduction of greenhouse gas emissions on a local level. Individuals will be enabled to take over an active part in the energy transition. While a number of remaining open issues were identified, this paper especially deals with profitability aspects for local energy producers and consumers, as well as for the community itself. As this topic will have a significant impact on the participation, the applicability and acceptance of energy communities will also be affected.**

***Index Terms*—energy community, renewable energy, profitability**

I. Introduction

Despite the COVID-19 pandemia having nearly suppressed the topic of climate change in media at the moment [1], it continues to remain as one of the most important challenges of our time. Following the 2015 United Nations Climate Change Conference in Paris [2], where nearly all countries of the world agreed to limit the continuing temperature rise by reducing greenhouse gas emissions, the European Union issued its 'Clean Energy for All Europeans Package' [3]–[5] mainly addressing the energy sector as one of the biggest sources of emissions [6]. Thus, European Union aims by 2030 to reduce the emissions of greenhouse gases by 40 %, to reach a share of 32 % of renewable energy sources in the energy mix, and to improve energy efficiency by 32.5 %.

To reach those goals, the directives of the Clean Energy Package introduce various measures; among them two kinds of energy communities, namely the Renewable Energy Community (REC) and the Citizen Energy Community (CEC) [7]. On a local level, they shall aid the mentioned goals, achieved by jointly producing, temporarily storing, sharing, consuming, and selling locally generated energy. To join an energy community, households and individuals do not necessarily need to possess and operate their own photovoltaic unit. Hence, everyone is able to join as a member in an energy community and thus take over an active part in the energy transition.

II. Energy communities

In previous work, we summarized the legal definitions of the two energy communities' types [7]:

A. Renewable energy community (REC)

- a legal entity, based on open and voluntary participation, and autonomous,
- controlled by its shareholders or members, which are natural persons, small or medium enterprises, or local authorities,
- shareholders or members are located in the proximity of renewable energy projects owned and developed by that legal entity,
- its primary purpose is to provide environmental, economic or social community benefits rather than financial profits.

B. Citizen energy community (CEC)

- a legal entity, based on open and voluntary participation,
- controlled by shareholders or members that are natural persons, small enterprises, or local authorities; but open for participation of other entities,
- its primary purpose is to provide environmental, economic or social community benefits rather than financial profits,
- it may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services.

C. Main differences

Those definitions contain apparent similarities as well as differences, while neither one of those is a strict subset of the other [7], [8]:

- As contained in the Electricity Directive, the application area of CECs is restricted to electricity, but not necessarily to renewable electricity only. An REC, however, may be involved in any type of renewable energy (e.g., heating, cooling).
- The geographical area of an REC's operation is restricted to a nationally defined proximity to renewable energy projects of the community. CEC's participants may be widely spread – optionally also over member states' borders.
- Furthermore, the legal definition of CEC's enumerates possible energy services they could provide, while for REC's an explicit enumeration does not exist.

D. Open questions

There are several open issues, for example, the definition of proximity regarding the REC's operational limits, the choice of a suitable organizational and legal form (including questions such as the desired minimum or maximum size of a community, a specification about the desired or required mix of producers and consumers within a community etc.), or privacy aspects [7]. The directives require to create a legal entity for the energy community to be specified by national law. Basically, any form is possible as long as it can act in its own name, exercise rights and be subject to obligations. Thus, some legal forms might be excluded, some forms might be disadvantageous, for example, regarding the liability of its members, or due to tax law policies. Questions on the 'environmental, economic, or social community benefits', but – nevertheless – also financial advantages for the community itself, its participants, and the general public will have a strong impact on the acceptance of potential participants and thus whether the concept of energy communities will be successful.

E. Community structure

The energy community as a legal entity is able to operate its own generation units, as well as a central community battery storage. Additionally, producers and consumers (e.g., households) join the community as members. They could also be "prosumer" (producer and consumer in one), i.e., households with their own attached photovoltaic unit, sharing their own excess energy with the other community members.

III. Profitability

According to the directives, the primary purpose of energy communities shall be "to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits." That means that an energy community should be a non-profit organization tending to follow charitable objectives. As a further aspect, the ongoing trend to favor regional products, e.g., in grocery stores, could thus be allocated to the energy system. However, financial profits, for example, for potential members to make them join, cannot be neglected.

Note that this section provides only simplified assumptions for costs. For the moment, we will only observe the energy costs per se, and disregard additional costs for the grid usage, taxes and fees.

A. Producer perspective (Fig. 1)

Assuming that a producer is currently able to feed in its produced (excess) energy to all available purchasers $p \in P$ for x_p per kWh, then it is financially profitable to be part of the energy community, if it is possible to feed in energy to the community for $y \geq x_i \ \forall i \in P$; consequently $y \geq x_{max}$ for the purchaser paying the best (i.e., the maximum) price ($x_{max} = max(\{x_i\})$).

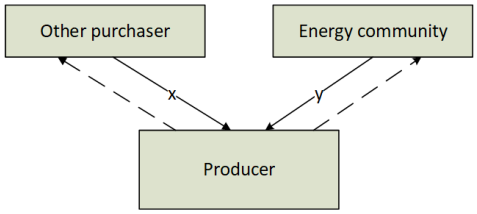

Fig. 1. Producers' view.
The energy flow is shown in a dashed line, the cash flow using a continuous line.

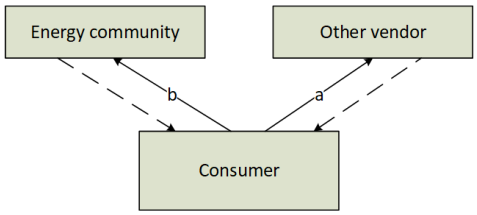

Fig. 2. Consumers' view.
The energy flow is shown in a dashed line, the cash flow using a continuous line.

B. Consumer perspective (Fig. 2)

Assuming that a consumer is currently able to consume energy from all available vendors $v \in V$ for a_v per kWh, then it is financially profitable to be part of the energy community, if it is possible to consume energy from the community for $b \leq a_i \ \forall i \in V$; consequently, $b \leq a_{min}$ for the vendor selling for the best (i.e., the minimum) price ($a_{min} = min(\{a_i\})$).

C. Community perspective (Fig. 3)

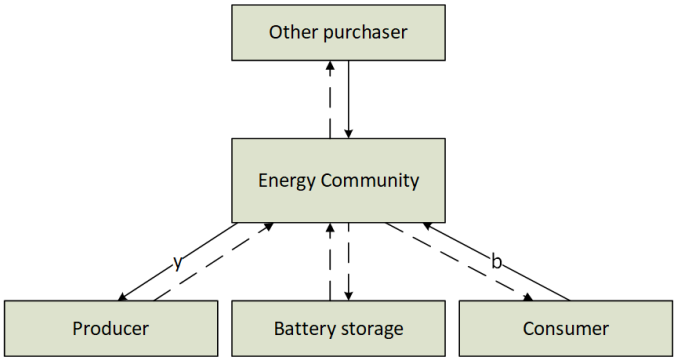

Fig. 3. Community's view.
The energy flow is shown in a dashed line, the cash flow using a continuous line.

The energy community is not required to make a profit; however, its activities should be cost-effective. Thus, the income of the energy community from its consumers needs to be at least as high as the payments to its producers, i.e., $b \geq y$. Additional income could result from selling excess energy that is not consumed within the community at the given time. However, a limited amount may be stored temporarily in the community's optional battery storage.

D. Results and feasible reactions

Resulting from the previous subsections, we conclude:

$$a_{min} \geq b \geq y \geq x_{max} \tag{1}$$

Consequently, the price to be paid to consume energy from the cheapest vendor should be higher than the price for selling energy to the best-paying purchaser ($a_{min} \geq x_{max}$). While this seems to be the case in theory, observations from current prices in Austria show that the assumption does not necessarily hold (e.g., vendors accepting to buy energy only from their own consumers, legally promoted prices for bigger renewable energy producers, etc).

However, until now we described only a simplification of what consumers need to pay and what producers will get paid. In fact, in the deregulated energy market, energy fees consist of three components:

- the real energy costs, which varies according to the competing market:
  - in case of a consumer, the energy consumption costs EC_v are paid to the vendor;
  - in case of a producer, the energy selling costs EC_p are paid to the producer by the purchaser;
- the grid usage costs GC, paid to the grid operator (i.e., distribution system operator) who has a monopoly; therefore, grid tariffs are fixed by law or by an authority, such as the regulator;
- taxes and fees TF (e.g., energy tax according to European Union's directive 2003/96/EC, green electricity surcharge, and VAT).

Thus, more precisely, the consumer has to pay:

$$a'_v = EC_v + GC + TF \tag{2}$$

Consequently, the producer receives:

$$x'_p = EC_p - GC - TF \tag{3}$$

Main financial benefits for producers as well as for consumers could be achieved by a legal promotion of the legally defined costs for participants of energy communities. Thus, it is reasonable to reduce grid costs, taxes and fees for the amount of energy purchased or consumed within the energy community, s.t.,

$$GC_{comm} < GC \text{ and } TF_{comm} < TF \tag{4}$$

Hence, the consumer in the energy community has to pay:

$$b' = EC_{comm} + GC_{comm} + TF_{comm} \tag{5}$$

While the producer in the energy community receives:

$$y' = EC_{comm} - GC_{comm} - TF_{comm} \tag{6}$$

In result, the reduced values GC_{comm} and TF_{comm} need to be chosen (i.e., legally defined) accordingly, s.t. the profitability conditions (cf., equation 1) can be fulfilled. Some initial simulations on cost savings for members of energy communities using different scenarios and involving a central battery storage have already been carried out in [9].

E. Plans in Austria

While a draft for the national transposition of the directives is not yet available, discussed plans indeed aim to reduce grid costs, taxes and fees. For the grid costs, the proximity aspect of RECs is planned to be defined by a restriction to certain low voltage grid levels. As other grid levels will thus not be used by the community's energy flow, no costs for higher levels need to be included. As grid costs are partly calculated flat-rate, partly per consumed/fed-in kWh, only the latter ones might be reduced. Regarding the taxes and fees component, it is planned to waive the energy tax, as well as the green electricity surcharge that are currently charged for each kWh, as well as the VAT. Accordingly, all of those reductions will most probably only be granted for RECs, and only for the amount of energy that was indeed consumed from the community.

IV. Conclusion

By joining energy communities, everyone is able to take an active part in the energy transition, regardless whether they possess their own photovoltaic unit. Those energy communities have been introduced by the European Union's 'Clean Energy for All Europeans Package', of which the national implementations are due within the next 12 months. A reduction of costs for the participants will mainly influence how energy communities will be adopted and accepted as well as whether the concept of those communities will be a success. We have shown that the national transpositions should include legal measures on reduced grid costs, taxes, and fees as those reductions might be required to reach the profitability of members and for communities overall.

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