Some lessons learned from Renewable Energy Communities in Austria

BY HELEN FISCHER, AMELA AJANOVIC, AND REINHARD HAAS

Helen Fischer, Amela Ajanovic, and **Reinhard Haas** are at TU Wien. Corresponding author Helen Fischer can be reached at fischer@eeg.tuwien.ac.at

Introduction

Citizen's involvement in energy supply has a long history in Austria since the beginning of the 20th century (Brazda, 2023). Back then, electricity cooperatives were founded in rural areas focusing on power supply and consumption. Some of them take advantage of Austria's geographical location and use renewable energy, such as hydropower, to supply rural communities with power. Until today, some founded energy cooperatives are running as grid operators and power suppliers. History shows that Austrian citizens have been a driving force behind using renewable energies as alternative generation forms. It can be said that energy cooperatives are the forerunners of energy communities (ECs) in Austria (Brazda, 2023). Both share fundamental principles such as decentralization, local and citizen engagement *(Boddenberg & Klemisch, 2018).* Renewable energy communities (RECs) aim to generate and consume renewable energy locally, increasing self-consumption and reducing the energy supply from the grid (Preßmair, Mayr, & Benke, 2024). All citizens, aside from living in a city or not owning a renewable energy source (RES) is given the chance and are engaged to actively participate in the energy transition and local energy concerns. At the same time, RECs locally may increase the use of RES and provide balance to urban regions with higher consumption patterns (Neubarth, 2020). The core objective of this article is to document the development of RECs in Austria and to discuss their future prospects.

Regulatory Framework

The Clean Energy for All Europeans Package (CEP) of the European Commission was introduced in 2019 and offers a legislative framework for ECs to strengthen their role in the energy system (European Commission, Directorate-General for Energy, 2019). The CEP determines a distinction between Citizen Energy Communities (CEC) and RECs. The main differences are that CECs can be engaged in different areas of energy supply and use, while RECs are focused on renewable energy and have stricter participation criteria and restrictions on fields of activity. Both aim to create an ecological and joint benefit. The European countries are obliged to transpose the supranational directives into national directives within two years. Since then, European countries have implemented the directives differently into national law. Austria is a pioneer in Europe since, in 2021, the international guidelines were almost entirely transposed into national law. Since then, registered ECs have risen to 675 RECs and 28 CECs (Status of June 2023) (see figure 1) (Energie-Control Austria, 2023).

In Austria, the Renewables Expansion Act (BMK, 2021) established a legal basis for ECs and determines a distinction between the following ECs: joint generation plant, REC, CEC. Since the creation of a legal framework for RECs, they are legally allowed to collectively generate energy (electricity, gas, or heat) from renewable sources across property boundaries and collectively consume, store, and sell it (BMK, 2021). In Austria, financial relief is provided for RECs, including the elimination of the renewable energy subsidy and electricity levy for the purchase of energy from RECs (RIS, 2010) (Cejka & Kitzmüller, 2021). Additionally, the grid tariff is reduced, and the reduction amount depends on whether it's a local or a regional REC.

Lessons learned from RECs in Austria

There are various motivations for founding or participating in an EC. The motivation to establish an EC is mainly based on ecological or economic reasons. However, RECs in Austria are allowed to be entrepreneurial, but their main purpose must not be financial gain. Most of the RECs surveyed stated they founded the REC for environmental reasons aiming to promote regional self-sufficiency and independence from energy supply companies. Some municipalities set specific goals for their town to spread renewable energy sources and save CO_2 emissions. However, economic reasons also play an essential role in founding and participating in an EC as, among others, financial incentives are created through low electricity procurement costs or increased feed-in tariffs generating an economic benefit. Besides that, RECs enable long-term stable prices and to some extent independence from the electricity market and supply companies.

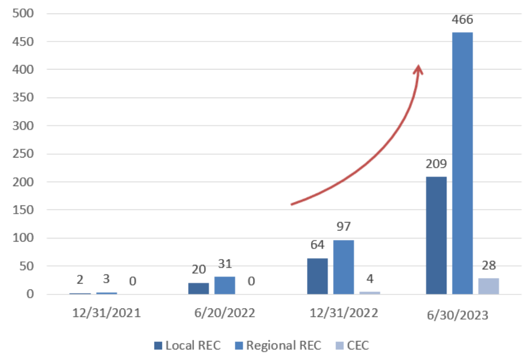

Fig. 1: Development of RECs in Austria

In the founding process a distinction is made between a local and regional REC, depending on the connected grid level. In Austria, regional RECs, which are connected to medium voltage levels 4 and 5 with voltages up to 37 kV, are established most frequently. Local RECs are connected to low-voltage level (6 and 7) with voltages up to 1 kV applies to local RECs. The founder of a REC can choose between the legal forms of association, cooperative, partnership, or corporation (BMK, 2021) (RIS, 2010). The non-profit nature of the REC should be a priority in the selection process. The results show that RECs mainly choose associations as their organizational form. There are also some cooperatives and a few limited liability companies. Experience to date shows that RECs are mainly set up by municipalities, followed by private individuals, companies, and small to medium-sized enterprises (SMEs). The participation structure is primarily made up of private persons, followed by companies, municipalities, and farms. The results show that the founding process varies greatly depending on the REC and can last from less than six months to two years. Generally, the start-up period lasts between 6 and 12 months.

Establishing RECs also involves several challenges in the founding process. The main difficulties in the founding process concern regulatory challenges, stakeholder engagement and economic interest, smart meter installation, operation, and energy pricing. Potential founders of RECs see this process as very complex and challenging as there are numerous portals to register and apply. In the first steps, REC's struggle to decide what legal form to choose and what tariff structure to determine. Additionally, the communication with gird operators is described as laborious, and participants may lack in understanding of the concept of RECs and the steps to participate in one. Both difficulties demand persistence and patience in the founding phase.

Further, it is necessary for each member to have a smart meter in order to operate the RECs. The results show that most RECs have a smart meter, or at least some members have one. Only a few RECs do not yet have a smart meter, what is perceived as a challenge as it makes the start-up process even longer until the smart meter installation is finished. The main reasons for the non-establishment of RECs are high efforts in founding and administration and a lack of acceptance and understanding among citizens.

Besides the founding process and its challenges, the evaluation gives insights into the structure and characteristics of RECs in Austria, showing that the primary type of electricity generation is PV systems (see figure 2). Furthermore, many ECs combine PV systems and hydropower plants for electricity generation. In contrast, the following generation types account for smaller shares: Wind, PV and biogas, PV and geothermal. The generation capacities vary depending on the RECs and range from a few kW to more than one MW. The different structures of the RECs are also reflected in the number of members and generation units. There are energy communities with three members or up to 100 members and generation units of one to

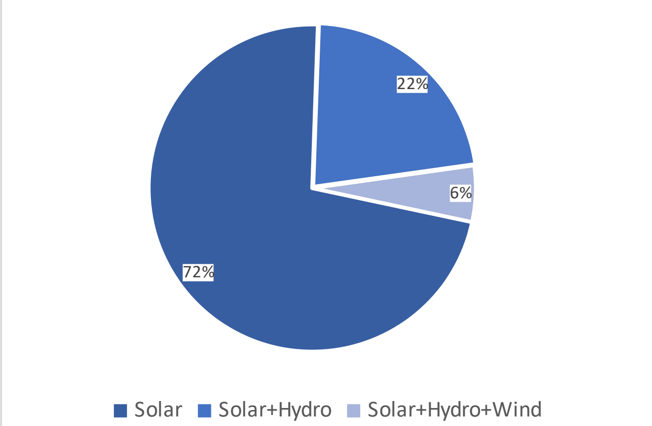

Fig. 2: Energy source of RECs in Austria

50 units per REC. Looking into the flexibility option of RECs, the characteristics of the RECs to date show that most of the RECs have not yet integrated storage and that some RECs are planning to integrate storage in the future or are already in planning an integration. So far, only a few RECs have coupled the electricity and heating systems. However, this may play an essential role for some RECs in the future or is already being examined. Today, e-mobility only plays a subordinate role for RECs, but some RECs are considering integrating e-mobility in the future or are already planning to do so. Large consumers such as heat pumps, electric heating systems, and small businesses can be found in almost all RECs, thus showing the potential for future adapted consumption behavior.

As RECs determine the tariff structure within their community, it is out of interest what the general tariff design looks like. The evaluation shows that most RECs in Austria have the same feed-in and consumption price for consumers and prosumers. This usually is between 18 and 20 ct/kWh. When setting the price, incentives should be created for both consumers and prosumers. For this reason, the RECs set the price between the feed-in tariff (set by OEMAG, the clearing office for green electricity in Austria) and the average consumer electricity prices. Some RECs in Austria create tariff models that make it possible to provide community energy more cheaply for financially weaker households or to keep the tariff at the same level in the long term. Thereby, RECs create social benefits and reduce energy poverty, which affects 3% of the population in Austria.

RECs also decide on a static or dynamic allocation method. The surplus electricity is fed into the grid depending on the selected allocation key. With static allocation, a fixed amount of generated energy is agreed upon for each participant, allocated every quarter of an hour (Cejka & Kitzmüller, 2021). The defined amount of generated energy is allocated to the consumer for consumption, and the amount of unconsumed energy is fed into the grid. For this reason, this allocation method has a lower amount of self-consumption, as the allocated energy is not adapted to the consumption behavior (Energiegemeinschaften, n.d.) (Bundesministerium für Wissenschaft, Forschung und Wirtschaft, 2017). In Austria, most RECs use a dynamic allocation key, in which the participants are allocated an individual energy share adapted to the respective consumption of all participants in the EC (Bundesministerium für Wissenschaft, Forschung und Wirtschaft, 2017). If a participant requires less community energy than they are entitled to, the surplus energy is allocated to another member who has a higher demand. The efficient use of energy provides more targeted support for the idea of energy communities to maximize self-consumption (Bundesministerium für Wissenschaft, Forschung und Wirtschaft, 2017). In addition, however, a more complex contract or settlement is required (Bundesministerium für Wissenschaft, Forschung und Wirtschaft, 2017). Each REC must determine the shares of the locally produced energy quantity to the participants based on the allocation key and inform the distribution system operator of the selected allocation key In this way, the grid operator can adjust the members' meter readings and divide each participant's electricity flow into the allocated generation share for the local electricity bill within the EC and the residual electricity demand purchased from the individual supplier (de Villena et al., 2020). Due to the high administrative expenses, the majority of RECs use a service provider for services such as billing. Analyzing several RECs' electricity generation and consumption data shows that successful RECs are characterized by the highest possible indicator of kWh saved per participant. The higher the kWh saved per participant, the higher the emissions and costs saved per participant. An EC's generation and consumption structure are directly reflected in indicators such as the degree of self-sufficiency and self-consumption. The quantitative indicators are changed by influencing factors such as a dynamic growth and loss of members or the installation of new generation systems. Additionally, the energy crisis, starting in 2022, impacted the dynamics of RECs. The high electricity prices meant that more and more citizens were interested in participating in RECs due to lower electricity prices within the RECs. On the other hand, a reduced interest on the part of prosumers was observed. This was partly due to the very high feed-in tariffs of the energy supply companies, which far exceed the feed-in tariffs of RECs. In addition, the RECs stated that they had invested more in new PV systems during this period and were able to attract new members.

Future Perspectives and Conclusion

Most participants see RECs as a successful model as economic and ecological goals can be achieved and as an essential instrument for increasing the participation of citizens in the energy transition and decarbonizing the energy system. However, there are still some improvements that would further improve both the foundation and the ongoing operation. There are two leading suggestions for improvement from the RECs' point-of-view. Firstly, the founding effort should be reduced. Secondly, communication with the network operator should be simplified and accelerated.

Many RECs have been operating well for over a year, and are planning future activities. These plans include PV expansions within the REC and the admission of new members with PV systems. Other plans of RECs are mostly in line with the optimization of self-consumption via storage systems and electricity and heat coupling. The evaluation shows that most RECs, especially those with PV-only electricity generation, cannot exploit their full potential and have a low self-consumption rate. Increasing the number of participants can improve the values of the community indicators. It also reduces the surplus energy, which supports the idea of local use of the generated energy. The evaluation of previous experience has shown that small-scale flexibilities such as heat pumps, electric heating systems, electric cars, and storage systems are already present in most RECs. It can be assumed that, due to the further electrification of energy services, the number of electrical consumers such as those mentioned above will continue to increase, thus increasing the flexibility potential (Neubarth, 2020).

Flexibilities such as load shifting can be used to increase self-consumption further and actually reduce consumption from the grid. Until now, there has been no load shifting, and the energy flows in the grid stay the same, as the surplus energy of the prosumer is subsequently allocated to the consumption of the REC participants (Preßmair, Mayr, & Benke, 2024). By integrating e-mobility into the RECs, the surplus electricity of the prosumers could be used to charge the members' electric vehicles. The integration of a storage system enables self-consumption to be increased further by storing surplus electricity and consuming it at times of low electricity generation from RES. The storage unit could be purchased collectively within a REC, and the investment costs could be implemented in the tariff structure. A further possibility has opened in Austria from January 2024, in which multiple participation in EC is permitted by law (RIS, 2010). This makes it possible to make surplus electricity available to another EC instead of feeding it into the public grid. A participation factor determines the share of generation or consumption in the respective EC. Multiple participation will initially only be possible at five ECs simultaneously.

An open point of discussion (Preßmair, Mayr, & Benke, 2024) (Fina, 2021) is the reduced grid tariffs for RECs and whether these are justified, as so far RECs do not yet provide grid and system services However the reduced grid tariffs create a financial incentive for establishing ECs. The Austrian supervisory and regulatory authority e-control will carry out and publish a cost-benefit analysis in the first quarter of 2024, as stipulated in §79(3) the Renewable Energy Expansion Act, which should ensure that the RECs and CECs participate appropriately in the system costs (grid costs and balancing energy costs) (BMK, 2021). The results could lead to a possible change in the cost structure (Energiegemeinschaften, 2024, FAQs). Other challenges are that RECs have an impact on energy suppliers. The energy supplier only serves as a residual electricity supplier to cover the residual load of the members, especially in the morning and evening when exchange electricity prices tend to be high. In the sunny hours of the day, when the electricity exchange prices tend to be lower, most RECs can cover their consumption and sell the surplus electricity to the energy supplier. For the energy supplier, this results in a loss of revenue for customers with a fixed price tariff per kWh. One possibility is the introduction of dynamic tariffs for consumers and prosumers of RECs. According to Preßmair, this could lead to higher balancing energy costs for the energy supplier due to the changed load behavior and the more difficult scheduling (Preßmair, Mayr, & Benke, 2024). This shows that a new dynamic pricing and tariff system will be needed, taking into account the power component of feeding electricity into the grid as well as drawning from the grid.

In conclusion, the REC concept has been successfully implemented and launched in Austria. However, there are still some hurdles that need to be overcome in order to establish a fully functioning and coordinated operation. RECs offer many opportunities, including the involvement of citizens in the energy transition, the spread of RES, and the use of small-scale flexibilities. The next few years will reveal the extent to which the full potential of RECs can be exploited in Austria.

Literature

BMK. (2021). EAG-Eerneuerbaren-Ausbau-Gesetz. BMK Bundesministerium fuer Klimaschutz, Umwelt, Energie, Mobilitaet, Innovation und Technologie 2021. Retrieved November 3, 2021, from https://www.parlament.gv.at/PAKT/VHG/XXVII/BNR/BNR_00348/index.shtml

Boddenberg, M., Klemisch, H. (2018). Bürgerbeteiligung in Zeiten der Postdemokratie – Das Beispiel der Energiegenossenschaften. In: Radtke, J., Kersting, N. (eds) Energiewende. Energietransformation. Springer VS, Wiesbaden. https://doi.org/10.1007/978-3-658-21561-3_9

Brazda, J. (2023, July 1). Energiegemeinschaften (-genossenschaften) in Österreich: Energy communities (cooperatives) in Austria. Zeitschrift für das gesamte Genossenschaftswesen, 73(2), 93-104. https://doi.org/10.1515/zfgg-2023-0006

Bundesministerium für Wissenschaft, Forschung und Wirtschaft. (2017). More Solar Power for Austria: Innovations of the "Small Renewable Energy Act" [Report]. Edited by Michael Losch, Michael Fuchs, Benedikt Ennser, Maria Baierl, Stefan Dür, & Bettina Hohenwarter. Vienna.

Cejka, S., & Kitzmüller, K. (2021). Rechtsfragen zur Gründung und Umsetzung von Energiegemeinschaften.

European Commission, Directorate-General for Energy. (2019). Clean energy for all Europeans. Publications Office. https://data.europa.eu/doi/10.2833/9937

Energie-Control Austria für die Regulierung der Elektrizitäts- und Erdgaswirtschaft. (2023). Imprint [Impressum]. E-Control. Retrieved February 20, 2024, from https://www.e-control.at/documents/1785851/1811582/E-Control-EAG-Monitoringbericht-2023.pdf/2104d8ca-4a61-d1da-3fde-d90ff7628b35?t=1696968629725

Energiegemeinschaften. (2024.). FAQs - häufig gestellte. Klima- und Energiefonds. Retrieved January 23, 2024, from https://energiegemeinschaften.gv.at/faqs/

Energiegemeinschaften. (2024). Measurement and Allocation [Measurement and Allocation]. Klima- und Energiefonds. Retrieved February 20, 2024, from https://energiegemeinschaften.gv.at/messung-und-aufteilung/

Fina, B., & Fechner, H. 2021. Transposition of European Guidelines for Energy Communities into Austrian Law: A Comparison and Discussion of Issues and Positive Aspects. Energies 2021, 14, 3922. doi:10.3390/en14133922

Manuel de Villena, M., Mathieu, S., Vermeulen, E., & Ernst, D. (2020). Allocation of locally generated electricity in renewable energy communities.

Neubarth, J. (2020, June 16). Energiegemeinschaften im zukünftigen österreichischen Strommarkt: Erforderliche Rahmenbedingungen für eine erfolgreiche Umsetzung [Energy communities in the future Austrian electricity market: Required framework conditions for successful implementation]. Report by e3 consult GmbH. Retrieved from https://www.e3-consult.at

Preßmair, G., Mayr, M., & Benke, G. (2024, February 14-16). Welchen Beitrag liefern Energiegemeinschaften zur Energiewende? Eine Kritische Diskussion. Paper presented at the 18. Symposium Energieinnovation, Graz, Austria.

RIS. (2010). Elektrizitaetswirtschafts- und organisationsgesetz 2010. Rechtsinformationssystem des Bundes 2010. Retrieved December 14, 2023, from https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20007045