FEBRUARY 2025

GEODE FACT SHEET

Energy Communities
A DSO Approach

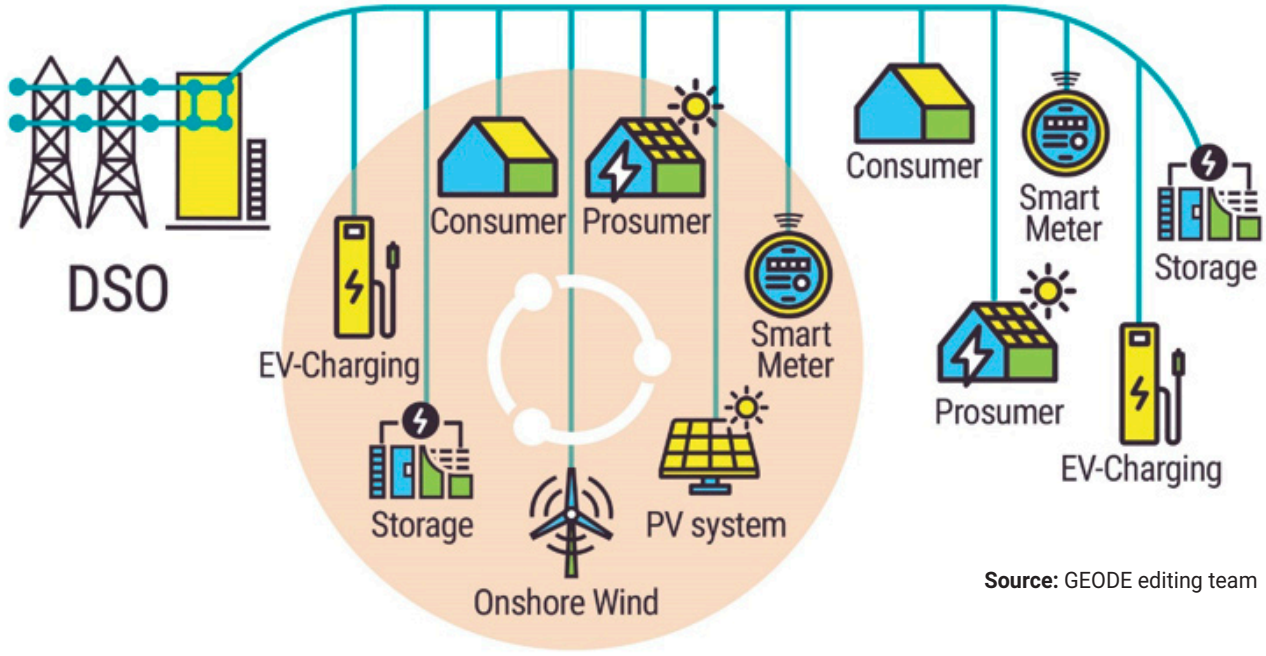
Introduction

In a context of an undergoing transformation of the energy system to phase out fossil fuels, Energy Communities (ECs) are a way for citizens, small and medium-sized enterprises, and/or local administrations to organize themselves to produce, manage, and use energy collectively and collaboratively.

They represent a pivotal force in driving the transition towards clean energy by facilitating collective and citizen-led actions, and in reshaping energy systems, shifting from centralized models to decentralized structures that prioritize community engagement and ownership.

By empowering consumers to actively participate in local energy initiatives, Energy Communities pave the way for tangible benefits, including energy efficiency, reduced energy bills, alleviation of energy poverty, and the creation of local green job opportunities.

This fact sheet aims to address the role of Local Distribution System Operators (DSOs) within ECs, raising the challenges and opportunities, while offering guidance and direction for local DSOs to effectively engage with and support ECs. Additionally, this fact sheet will showcase some of GEODE's members' experiences and best practices from different countries. For the purpose of this paper, we will refer to "Energy Communities" (ECs) as an overall concept, including both Renewable Energy Communities & Citizen Energy Communities.



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KEY FINDINGS FROM A DSO PERSPECTIVE

DSOs as key enablers of the energy transition are supporting the growth and integration of Energy Communities, important actors to make "consumer empowerment" a reality.

This fact-sheet provides actionable recommendations to support enhancing the integration of Energy Communities (ECs):

1. **Enhance Grid Infrastructure:**
   - Upgrade distribution networks to accommodate decentralized renewable energy sources and address challenges like congestion and voltage fluctuations with flexibility provided by ECs.
   - Investments are needed for strengthening and smartening / digitalizing the power grid.
2. **Invest in Smart Grid Technologies:**
   - Deploy advanced smart meters and digital platforms for real-time data collection, sharing, and management to facilitate ECs' operations.
   - Ensure interoperability of devices and systems to support ECs' diverse energy setups.
   - Implement automation for greater grid monitoring and observability.
3. **Foster Consumer Engagement:**
   - Create user-friendly platforms that simplify EC participation and provide transparent energy data.
   - Provide accessible educational resources and technical guidance to empower consumers in their transition to ECs.
4. **Collaborate with Stakeholders:**
   - ECs should partner with local energy companies and third-party entities to streamline EC development and operation as they provide technical support and guidance to ECs.
   - Establish coordination centers or advisory offices to assist with regulatory navigation and community setup.
   - The use of the existing local distribution grid as an integrating element of the EC is considered a very effective and efficient way to connect ECs.
   - The collaboration between DSOs and ECs is crucial for realizing the full potential of the energy transition.

The European legal framework on Energy Communities

The concept of Energy Communities was introduced into European legislation in 2018, through the Renewable Energy Directive and later on in 2019 through the Electricity Directive part of the "Clean Energy for all Europeans package", which aimed to create a framework to support the development of projects based on collective renewable energy generation and to empower consumers to actively engage in the energy market, establishing new forms of citizen participation in the energy transition. More specifically, the concepts of Renewable Energy Communities (RECs) and the Citizen Energy Communities (CECs) were crystallized in the Renewable Energy Directive (EU) 2018/2001[1], articles 2(16) and 22 and the Electricity Directive (EU) 2019/944 articles 28(11) and 16, respectively.

[1] Amended by Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001 Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

Strengths of an Energy Community

Energy Communities are legal entities that empower citizens, small and medium-sized enterprises, and/or local administrations to produce, manage and consume their own energy. They can cover various parts of the energy value chain, including generation, distribution, supply and aggregation. Energy Communities may vary depending on their location, actors involved and energy services provided. In addition to self-consumption and the use of renewable sources, decentralisation and localisation of generation are fundamental concepts for these Energy Communities, which are based on cooperation between their members.

The main strengths of an Energy Community are their potential to enable the integration of renewable energy resources and to empower consumers to actively participate in the energy transition. In addition, Energy Communities contribute to promoting public acceptance of renewable project installations and the related infrastructure.

INTEGRATING RENEWABLE ENERGY RESOURCES

Over the past few decades, European economies are undergoing an energy transition, moving from economies mainly based on fossil fuels to economies that obtain their energy from renewable energy sources such as solar, wind and hydro. The European Union's commitment to enhance its renewable energy targets, with a binding goal of at least 42,5% by 2030 and further expected increases for 2040 and 2050, highlights the need for significant expansion in renewable energy resources and related grid infrastructure.

In this framework, Energy Communities represent a valuable approach to fostering investments in renewables, particularly for individuals who otherwise may find it difficult to contribute, benefitting from economies of scale by, for example, investing together in larger generation facilities at lower costs, representing a significant opportunity to stimulate the energy transition.

EMPOWERING CONSUMERS

Consumers can transition from having a merely passive role to one that is fully active and fundamental in the energy system. Consumers can choose to also become a producer (prosumer) and/or participate in self-consumption (collective or individual), have an electric vehicle, and use it as a battery system for their home, or opt for new contractual modalities based on demand management.

In this context, the Energy Community is an important actor to make "consumer empowerment" a reality. Members of ECs are no longer just consumers connected to the grid to receive services, but actively participate in energy generation, often consuming only part of the electricity they generate, while feeding the surplus into the grid or storing it in storage systems.

Prosumers within an Energy Community might also benefit from additional revenue streams by participating in local flexibility markets, through aggregation and demand response.

PROMOTING PUBLIC ACCEPTANCE OF RENEWABLE ENERGY PROJECTS

Energy Communities offer a means to promote public acceptance of renewable energy projects as they primarily seek to generate direct benefits for citizens, such as reducing electricity bills through self-consumption and / or improving energy efficiency, thereby alleviating situations of energy poverty. In this sense, these Energy Communities projects within the local community gain social acceptance, contributing to public acceptance of renewable installations.

Existing Practices: Energy sharing in Spain

Many Energy Communities emerging in Spain are based on energy sharing through collective self-consumption schemes, with energy being produced and consumed at low voltage. These projects are supported by a specific regulatory framework in place since 2019. Legislation allows participants in these projects to be exempted from paying grid fees and charges. For installations connected to medium voltage, reduced grid fees and charges apply.

Legislation has introduced geographical limitations for energy sharing, with a maximum distance of 2 km for rooftop or canopy PV installations and 500 meters for ground-mounted PV and other renewable energies other than PV. A review of legislation setting these parameters is undergoing.

A remarkable project in Spain is COMPTEM Energy Community[2], promoted by the local energy company Enercoop Group in Crevillent (Alicante), which is currently the largest Energy Community in the country. By 2024, COMPTEM has developed 800 kWp of collective self-consumption installations on rooftops of buildings within the urban area of the municipality. Additionally, the first multi-megawatt solar tracking installation developed by an Energy Community in Spain, "Campillo" PV, with a capacity of 3.4 MWp and located 3 km far from the town, is in operation.

The Enercoop Group's approach to Energy Communities combines a social vision with a technological one, as within the framework of COMPTEM project, the "Realengo" Energy Community innovation living lab integrates a 120 kWp collective self-consumption installation with a 240 kWh lithium-ion energy storage system.

This project shows that ECs can enhance economic efficiency, mitigate the need for new network infrastructure, and ensure security of supply. It also improves supply quality and voltage stability by utilizing storage to generate reactive energy (inductive/capacitive), managing demand in an aggregated manner, and providing flexibility to the electrical system.

The Historical Italian Electricity Cooperatives

In many ways, the underlying model of an Energy Community closely resembles the model of "historical" Italian electric cooperatives ("cooperative elettriche storiche") established between the late 19th and early 20th century in Italian alpine regions, often in remote areas where these small cooperatives were the first to generate and distribute electricity through their own networks.

These cooperatives are engaged in self-production of electricity for their members. This means that the energy produced is primarily made available to the members of the cooperative without any additional commercial markup. By directly engaging with their members, the cooperative eliminates intermediaries, thus providing energy to its members at a reduced cost.

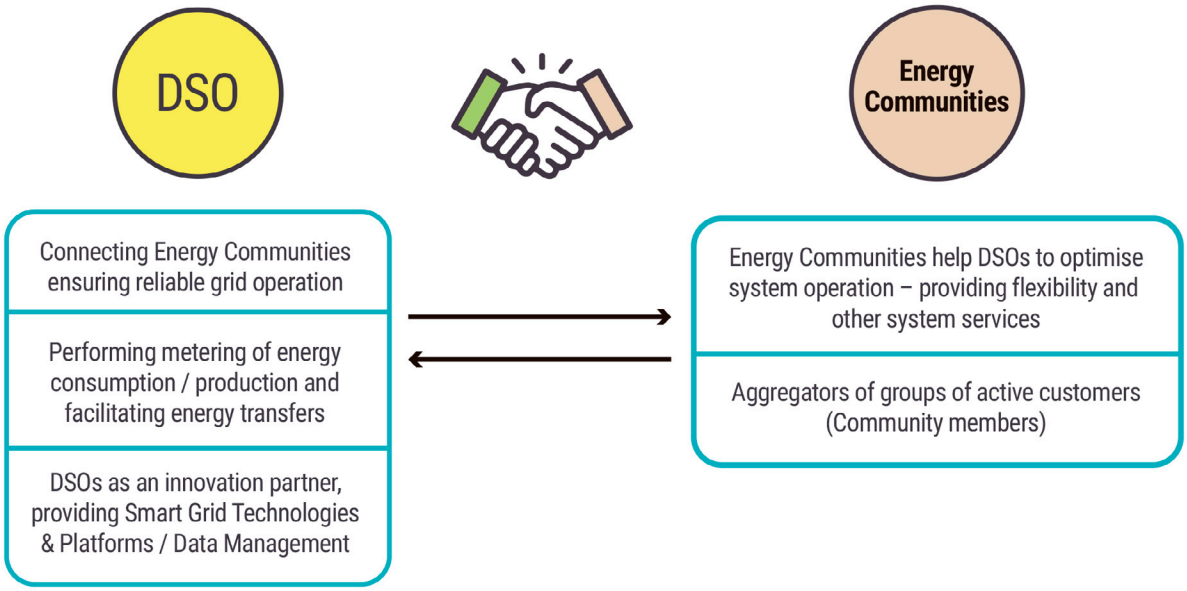
[2] https://www.grupoenercoop.es/conocecomptem/

Historical electric cooperatives, situated in remote areas, developed robust distribution networks to ensure energy access despite low user density and natural disaster risks, were the local DSO and essential partner since the start. Italian legislation grants them special status, enabling them to manage local distribution networks without charging members for certain services. This results in a substantial reduction in members' electricity bills (30% lower than the market average) and allows direct negotiation of prices without state set tariffs. However, these cooperatives are, and remain, very specific cases and not replicable.

Cooperatives established in recent decades (not considered "historical") that produce, buy and/or sell electricity, are treated in the same way as electricity companies operating under a legal regime other than the cooperative, hence not benefitting from the particular legal framework of historical electricity cooperatives. Currently, there are 32 historical electric cooperatives, mainly in Trentino-Alto Adige (22), with some in Valle d'Aosta (2), Piedmont (1), Lombardy (3), and Friuli (2). In Trentino Alto Adige, 19 out of 22 companies are in Bolzano province, each serving less than 100 customers on average. These cooperatives generate about 400 million kWh annually from hydropower, serving 60 municipalities and 65,000 users, including households and businesses, with around 30,000 being cooperative members, serving a population exceeding 300,000.

DSOs as enablers of Energy Communities

DSOs play a crucial role in connecting Energy Communities, ensuring reliable grid operation and facilitating the integration of Renewable Energy Sources (RES) within the ECs to the distribution grid. By modernizing their infrastructure and investing in smart technologies, DSOs enhance grid resilience and allow seamless connections for ECs' renewable installations like solar and wind. DSOs also facilitate the implementation of demand response programs and energy management systems that empower ECs' local users to optimize energy consumption and production contributing to grid stability. Additionally, DSOs provide technical support and guidance to help Energy Communities navigate regulatory frameworks and access financing.



MANAGING GRID CHALLENGES

This increasing connection of RES to the grid directly impacts the operation of distribution grids, making the integration and optimal management of distributed generation one of the most complex challenges for DSOs today. However, Energy Communities are an opportunity for DSOs to manage the grid with more flexibility.

To accommodate this significant share of RES, upgrading distribution networks is essential, as the distribution grid faces congestion and voltage volatility issues already today, due to intermittent electricity generation at various points. This scenario requires an active role from DSOs to manage their grids as active system operators to facilitate renewable integration.

Additionally, implementing smart grid technologies accompanied by a large number of sensors in the low voltage infrastructure will enhance this integration by enabling management optimization, allowing real-time monitoring and adjustment of energy flows, helping to maintain grid stability while maximizing the contribution of renewables to the energy mix.

At the same time, targeted investments to improve the capacity of the network to accommodate exponentially growing connection requests are starting to be critical. While the growth of distributed energy resources is a positive and necessary step for the energy transition, it must go hand in hand with the investments needed for strengthening and smartening the electrical grid and the promotion of local energy consumption through Energy Communities, to avoid higher congestion risk.

ENABLING SMART GRID TECHNOLOGIES & DATA MANAGEMENT

DSOs are an innovative partner for Energy Communities, providing Smart Grid Technologies & Platforms to facilitate data management.

The use of advanced management platforms will be crucial in facilitating the interaction between Energy Communities and DSOs and other stakeholders involved. These platforms or software must incorporate the digitalization of processes to improve observability and optimize both the technical and economic aspects of their operation. It is essential that such tools enable the management of Energy Communities with various energy supply companies, allowing the “Energy Sharing Facilitator-Manager” to maintain centralized communication with the DSO, independent of the energy suppliers for each community member.

Smart Grid technologies enable the monitoring and management of the electricity distribution grid and the connection of generation sources and users of the Energy Community in a more efficient and secure manner. These technologies are fundamental within Energy Communities because they allow each member to monitor their consumption, generation and supply of energy so they can choose when to best consume the energy produced.

In order for this to take place, major digitalisation of the distribution grid is needed to promote the development of new services within Energy Communities and to facilitate in a user-friendly manner community members’ access to information. By

increasing observability over its low voltage grid, the DSO can gather enough information to predict incidents, detect flexibility activation, and offer information to the customer on the status of the grid in their area.

A fundamental element of smart grid technologies is the smart meter. Even today, in many EU countries smart meters and telecommunication infrastructure (mostly owned by the DSO) often lack the ability to measure and share electrical data with the level of detail required for the applications mentioned above. Full deployment of smart meters and improving this capability is essential for enabling the local DSO to take on a more active role as a system operator. Energy Communities need near real-time data from the meter to distribute incentives fairly, match generation with consumption, and keep customers informed of benefits. Measuring the amount of energy consumed and/or produced from renewable sources, with hourly or quarterly measurement granularity, is essential to provide information and potentially enable citizens to make informed decisions.

DSOs are responsible for measuring the energy consumed and produced, ensuring the smooth transfer of electricity within the Energy Community. They do this by monitoring, collecting, validating, and sharing metering data with community members, consumers, and market participants.

To find the best way to exchange data between the Energy Community and its participants, the use of advanced management platforms will be crucial as a means of facilitating the interaction between Energy Communities and DSOs.

This challenge requires the full realization of the smart grid that requires DSO investments in automation, real-time systems, big data and data analytics as well as overcoming technological barriers, starting with the interoperability of different devices and systems, such as smart meters, distribution networks and energy management devices.

Best Practices: The Austrian EDA user portal

The Austrian Energy Data Exchange (EDA) - an independent and open information and service platform, aiming to provide all market participants with free access to the energy market, reliable, secure and efficient communication, and standardised information exchanges - has developed an "EDA user portal"[3] specifically for Energy Communities, providing easy access to energy data to facilitate participation or for the creation of an Energy Community. It offers a standardized form of data exchange for all participants in the Austrian energy industry. In the course of participating in an Energy Community, all participants are provided with transparency of their energy data from the DSO.

[3] https://www.eda.at/anwenderportal

Best Practices: ELECSUM Energy Sharing Facilitator / Manager

Another interesting case is the role of the Energy Sharing Facilitator/Manager in Spain ("Gestor de Autoconsumo Colectivo"), introduced by the Ministry of Energy's IDAE (Institute for Energy Saving and Diversification). This entity, appointed by the Energy Community, acts as the organizer, representative, or manager on behalf of the Community and its members. It primarily supports member onboarding, advises on optimal energy sharing coefficients, prepares necessary contracts, and provides monitoring systems and apps to display energy, economic, and environmental savings. Additionally, this role consolidates communications with regulators, DSOs, and energy suppliers, simplifying and accelerating the energy sharing connections for all communities by providing a centralized and trusted channel for them.

The Energy Sharing Facilitator/Manager role is fulfilled by ELECSUM, a company within the same group as our Spanish member, ELECTRA CALDENSE. ELECSUM is currently managing and integrating over 20 MWs of renewable power in very diverse energy sharing projects across Spain. ELECSUM has also developed its own AI-embedded software to streamline the onboarding of community members and allocate energy sharing coefficients, minimizing surplus energy to avoid grid constraints. Such digital management is essential for unlocking the flexibility and demand response potential of all Energy Communities and the Energy Sharing Facilitator/Manager can also serve as a trustworthy partner to mobilize and engage flexible assets in support of the DSO's grid needs.

COLLABORATION BETWEEN DSOS & ENERGY COMMUNITIES IS KEY

DSOs need to improve and develop their customer care and customer contact models to address direct interactions with Energy Communities and their prosumers, which they were not previously used to. Automation and faster and simpler connection processes is an essential part.

Looking into the best forms of collaboration between Local Energy Companies and Energy Communities, one successful practice is the possibility of a third party taking the lead in the development of the Energy Community, whereby consumers within the Energy Community work closely with the Local Energy Company, both the DSO and the supplier. Energy communities are complex structures and through this partnership, the Local Energy Company would provide comprehensive support to citizens in the creation, establishment and operation of the Energy Community, while fostering active citizen participation in the energy system.

Regarding the role of local DSOs, it is worth noting that the use of the existing local distribution network as an integrating element of other subsystems is considered a very effective and efficient way to connect Energy Communities.

In addition, the establishment of coordination / information centers as a point of contact and information for participants or future members of Energy Communities is important to help participants with initial uncertainties, different interpretations of the legislation and their lack of technical knowledge of the needs and market processes to implement an EC.

Best Practices – The Austrian Coordination Office

In Austria, since the legal framework for Energy Communities was adopted, they have been promoted in the media as an easy way to set up and operate. However, it soon became apparent that setting up an Energy Community is not as easy as promoted. Disruptive requirements and ambiguities resulted in initial uncertainties. The incorrectly conveyed image has led to an unexpectedly high number of inquiries for new renewable generation. To support this, the Austrian Coordination Office[4] was created simultaneously with the introduction of ECs in the law, as a point of contact for Energy Communities. The office is a national actor and provides relevant information for founding and operating Energy Communities to support participants as well as service providers.

Additionally, it serves as an intermediary between Energy Communities, legislative bodies (as it interacts with regulatory authorities as the Austrian Ministry of Climate Action and Energy,), network operators, (DSOs/TSOs) and anyone interested in learning more about Energy Communities. Additionally, the Coordination Office sets up funding programs for the establishment of Energy Communities and hosts events.

The Austrian DSOs, in cooperation with the Coordination Office, have gradually minimized the Energy Community participant knowledge gap, and the administrative burden which arose through these early uncertainties has been resolved step by step.

Best Practices - Energy Cooperative Schwerte

The Energy Cooperative Schwerte has been established by Stadtwerke Schwerte, a German municipal energy utility. With a strong emphasis on community engagement and sustainable development, the cooperative is committed to leading the way towards a greener future while involving citizens at every stage. Indeed, the cooperative aims to make renewable energy accessible and beneficial for the city and its residents. This is because, as a municipal utility, Stadtwerke Schwerte recognizes the importance of collaboration and community participation in achieving their goals.

Through this, individuals can financially contribute as members and actively engage in renewable energy projects, ensuring shared benefits. This inclusive approach has sparked significant interest, with hundreds of residents joining and contributing.

Looking ahead, Stadtwerke Schwerte aims to meet 80% of the city's electricity needs from renewables by 2030. With a diverse investment strategy and collaboration with local industries and farmers, the cooperative is well-positioned to achieve this goal.

Best Practices – Energy Community Manual

Elenia, a Finnish DSO, collaborated with experts from VTT Technical Research Centre of Finland to develop an Energy Community Manual[5]. This manual aims to provide consumers with clear and comprehensive information about the opportunities offered by Energy Communities.

The manual primarily focuses on existing types of Energy Communities in Finland and potential legislative amendments to expand these options. It includes detailed definitions and models of Energy Communities, presented in an accessible and informative manner. This initiative serves as a valuable example of consumer education and,

[4] https://energiegemeinschaften.gv.at/

[5] https://www.elenia.fi/tulevaisuuden-energia/sahkontuotanto-ja-kulutus/energiayhteisot

by fostering consumer understanding of Energy Communities, this initiative also benefits Distribution System Operators by promoting more informed and engaged consumers who can contribute to the stability and efficiency of the grid. The handbook has received a lot of positive feedback and is frequently used as a reference in the industry, highlighting its value and practicality.

Additionally, Elenia facilitates the establishment of Energy Communities through a user-friendly platform for customers named Elenia Aina, where they can manage their daily tasks regarding their network agreement, as well as finding Elenia's solar energy and EV charging calculators.

Conclusion

Local Distribution System Operators within GEODE support the development of Energy Communities, which bring numerous benefits to society and system operators alike. The collaboration between DSOs and Energy Communities is crucial for realizing the full potential of the energy transition.

GEODE members contributing to this paper showcase how DSOs from different European countries are already seeking solutions to better engage consumers and through various means. Finnish DSO Elenia is highly advanced in educating its customers and serving them through user-friendly platforms. Stadtwerke Schwerte in Germany is promoting public acceptance of renewable energy sources by engaging citizens in energy cooperatives, while in Austria, the process of creating or joining an Energy Community is simplified by the DSO driven EDA user portal, which provides all participants with transparent information and energy data from the DSO. The largest Energy Community in Spain, COMPTEM, was developed with the support of local Energy Company Enercoop Group. ELECSUM, part of the ELECTRA CALDENSE group, plays a key role in managing energy sharing projects and advancing digital solutions for Energy Communities.

GEODE and its members are committed to sharing experiences and engaging in discussions with relevant stakeholders to foster effective cooperation and address the remaining challenges to ensure the implementation of Energy Communities across Europe.

Acknowledgements

GEODE would like to thank the experts from our editing team who kindly gave their time and expertise to contribute to this fact-sheet:

- Joaquín Mas Belso (Distribución Eléctrica Crevillent S.L.U., ES)
- Matteo Möschen (SEV - Südtiroler Energieverband, IT)
- Carlota Pallejà (ASEME, ES)
- Martina Theil (Wiener Netze GmbH, AT)
- Sara Vieira, Natalia Fano & Carles Rodriguez (Estabanell y Pahisa Energia, S.A.U., ES)
- Kjersti Vøllestad, (Elvia AS, NO)

And GEODE members that shared their best practice:

- Distribución Eléctrica Crevillent S.L.U., ES
- Electra Caldense S.A., ES
- Elenia Verkko Oyj, FI
- Stadtwerke Schwerte GmbH, DE
- Wiener Netze GmbH, AT