LocalRES

Empowering local renewable energy communities for the decarbonisation of the energy systems

D1.5 – Business models shift from passive consumers to RECs

09 June 2023

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Executive summary

This deliverable summarises the results of the business modelling task in LocalRES. It is the final step of a process consisting of regulatory assessment, use case setting, energy system modelling and cost-benefit analysis. The assessment has been performed ahead of the implementation of the energy communities in the project and serves thus as an advice on how to pre-assess and setup the whole process of the development of community-energy systems. Although the solution of renewable energy communities (RECs) is still quite new, several approaches along with those in this project have been already developed and should serve other communities to follow the example.

The report consists of three main chapters answering the following questions: What is the starting point of the energy community? What needs to be taken into consideration? How to design the process of planning and development for an energy community? How does the service provision and the business model look like at the end of the day? A variety of methods has been applied to answer these questions. The report analyses the change of the underlying value chain, the needs of involved or concerned stakeholders and requirements from their perspective. To assess the way how to become an energy community, a method developed by Di Nucci et al. for the assessment of planning and implementation processes in the energy planning of communities has been applied. The business model has been assessed in terms of the services to be provided by the communities and by applying the Canvas model for the identification of key aspects and the value proposition in the future entities. In order to go beyond the desk research, stakeholder consultation workshops have been organized and surveys have been distributed to the stakeholders involved.

Energy communities provide new possibilities for citizens to collectively design and manage their energy supply. Once applied, the organization of the energy community changes the value chain for the energy supply where the energy supply companies had the major role up to now. The organisation and influence of the stakeholders will vary in each energy community. In LocalRES, for example, the municipality has the highest influence, responsibility, and decision-making weight in Berchidda. At the same time, in Ispaster it is the owner of public assets and energy community participants which hold the highest importance on those aspects. Motivations and desires of stakeholders are often ambiguous and difficult to translate into energy community actions. To evaluate these aspects, specific questions were placed during the stakeholder's consultation meeting. The answers revealed that environmental and energy savings were the most prominent motivation between all communities. A key observation is that the financial aspect is not the main motivation for the participants to start an energy community, but rather a core value that holds them together.

In all energy communities the municipalities provided the initial push to engage in projects related to energy savings. To be able to do that they needed to contract external energy experts. From this public private partnership, the four energy communities started. They are called the project initiators, which encompass the stakeholders responsible for the formation of the energy community. Throughout all phases of a project from decision to operation the municipalities were engaged, identifying key stakeholders from the public and private sphere with whom they need to

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cooperate, including other public agencies and departments, private developers, utilities, housing associations, research groups, construction companies, etc.

Due to the need to work with existing infrastructure the main challenge will be the access to data. Municipalities only have access to data for facilities that they own. Currently, the LocalRES pilot sites work with local private companies. A key challenge will be around trust and the relationships between these private companies and the relationships they have with the homeowners.

The list of relevant services for the four pilot communities is comprehensive and aims at showing the final stage of the implementation in the future. The implementation and provision of the services is a long-term process and requires different aspects that need to be fulfilled / possible for the service to be offered. Some of these services require a particular infrastructure to be in place or offerings from external partners that are not being provided at the time being. Exemplary for this limitation are services that can be provided to a DSO. The key services identified include building energy management & optimization, power-to-heat, EV-infrastructure provision, collective self-consumption, blackout strategies, demand response and the optimization of the energy flows.

The key to each business model is the value proposition which in the case of LocalRES energy communities include the energy self-sufficiency, the self-governance but also economic (e.g. distribution of costs and responsibilities), environmental and social values. In general, the main value proposition of energy community is the opportunity for end users to participate in the energy generation process as well as to increase local generation and self-consumption. Most end users have limited investment funds and their participation may be hindered by the economic barrier. The economic value remains the primary concern for the participants of the energy community.

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List of acronyms and abbreviations

aFRR	Automatic frequency restoration reserve
BM	Business model
BMC	Business model Canvas
CBA	Cost-benefit analysis
CEC	Citizen energy community
DH	District heating
DH&C	District heating & cooling
DHN	District heating network
DHW	Domestic hot water
DSM	Demand-side management
DSO	Distribution system operator
EE	Energy efficiency
ESCO	Energy service company
EV	Electric vehicle
FCR	Frequency containment reserve
FSP	Flexibility service provider
G2V	Grid-to-vehicle technology
H2P	Heat-to-power
LECo	Local energy community
MEVPP	Multi-energy virtual power plant
mFRR	Manual frequency restoration reserve
N/A	Not applicable
NGO	Non-governmental organization
P2H	Power-to-heat
P2P	Peer-to-peer
PIP	Planning and implementation process
PPA	Power purchase agreement
PV	Photovoltaics
REC	Renewable energy community
RES	Renewable energy sources
TSO	Transmission system operator
UC	Use case
V2G	Vehicle-to-grid technology

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1/ Introduction

1.1. Purpose of the report

Building upon the results of the analysis of the regulatory framework in Task 1.1 and the use case definition in Task 1.2, this task designs different business models for the deployment of services by energy communities. Basis for the business models will be the applicability of the use cases under the conditions of each demonstration site of the project. The proposed business models will address ways to unlock the investments in Renewable Energy Sources (RES) in a post-subsidy era and practical approaches to decarbonize the local energy system. Appropriate finance tools have been reviewed. These will be crucial to the evaluation of business models and the process of community development. The report also outlines services that are practical given the technical constraints and the existing regulatory framework. The report should serve the involved communities but also to other communities as a guidance to develop a specific business model.

1.2. Contribution of partners

Table 1 shows the main contributions from participant partners in the development of this deliverable:

Table 1: Contribution of participant partners

Partner	Contribution
Demo sites representatives (OLLERSDORF, R2M/ AEC, FLEXENS, BARRIZAR)	Provide information based on their expertise about the use cases. Participation and collaboration in Stakeholders Consultation Meeting. Overall review and validation.
RINA-C	Provide CBA results of each demo site.
PASSAU	Provide detailed description of the black-out strategy service.
DOWEL	Review and comments of draft.
Energy Cities	Collaboration in identification of enablers, advantages and barriers of Energy Communities
Centrica	Alignment with Task 3.3, provision of inputs related thereto

1.3. Relation to other activities of the report

Table 2 shows the relation of the present report with other deliverables of LocalRES project, which should be considered along with this document for a proper understanding of its contents.

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Table 2: Relation of current report to other deliverables

Deliverables	Relation
D1.1	Report describing the assessment of regulatory feasibility. Regulation in force and regulatory conditions have been checked for the services identified for the use cases and listed in
D1.2	Report outlining the underlying use cases.
D1.3	This report deals with the decarbonization scenario assessment for the study cases. The services identified within D1.2 have served as inputs for D1.3
D1.4	This report contains a cost-benefit analysis performed for the use cases from D1.2.
D3.3	Report explaining the implementation of the MEVPP.

2/ Literature review

The European Union established the legal framework for RECs in 2018 with the Renewable Energy Directive (2009/28/EC) revised in 2018 and in 2021 (*Renewable Energy Directive*, n.d.). The directive introduces additional provisions that allow citizens to play an active role in renewables development by enabling RECs and self-consumption of renewable energy. In summary, an energy community means the energy generated locally can be absorbed by different end-users within the same portion of the distribution grid. By switching from individual to collective consumption and generation, local resources can be used to their fullest potential. This potential can be explored in different ways: by sharing the ownership of the local generation the most efficient location to install the generators can be chosen instead of being constraint by the own location; and, by consuming the energy locally to reduce the import energy from the grid, thus, reducing the payment of grid tariffs and, fees. Thus, aggregating prosumers and/or consumers increases collective advantages and provide numerous benefits to the local distribution grid (Iazzolino et al., 2022).

As the cost of installing on-site renewables decreases, more homes and businesses will be able to afford the upfront cost of a system. At the same time, governments are reducing payments they used to make to prosumers who fed green energy into the grid. Parallel to this, energy systems are becoming more intelligent, making it simpler to account for ever-increasing amounts of energy and to transfer them between smaller actors in the energy market, all the way down to transactions between households (Brown et al., 2019). The current framework and the new regulation are indicating that energy community models will be extensively tested in different ways in the coming years. The underlying business model[1] and the consequent value created will be critical for the acceptance of RECs by energy markets, especially in light of a post-subside era.

[1] In this context, the term *business model* indicates a set of business strategies which can create, deliver, and capture value to generate economic benefit (F.G. Reis et al., 2021). These business strategies can combine

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Although energy communities are not primarily run for profit, they must ensure that their shareholders receive a return on their investment by gaining access to cheaper energy, selling surplus generation or participation shares, or self-consuming and thus reducing their reliance on the power grid (F.G. Reis et al., 2021). On top of it, Reis et al., (2021) highlighted that the value proposition of energy communities extends far beyond the economic dimension: the environmental contribution of renewable energy generation; the ability to choose energy generation technologies; and the social innovation created by shifting the role of consumers, who become customers, asset owners, and company shareholders; are all relevant value propositions of an energy community.

Up to now the most common business model for a prosumer are **feed-in-tariffs** (Brown et al., 2019). Figure 6 represents the basic business model of feed-in-tariffs. This is the mainstay until now for a business strategy that depends on subsidies (Brown et al., 2019). In feed-in-tariffs, one unit of renewable electricity is purchased at a set price. Typically, tariffs are guaranteed for a long time (e.g., 15–20 years) and all renewable electricity is required to be purchased by grid operators, regardless of the total demand for electricity (Jacobs & Sovacool, 2012). It is generally financed by a small surcharge on the electricity price for final consumers, i.e., additional costs are shared by all ratepayers. Other individual prosumer-driven business models found on literature are self-consumption, net-metering and leasing.

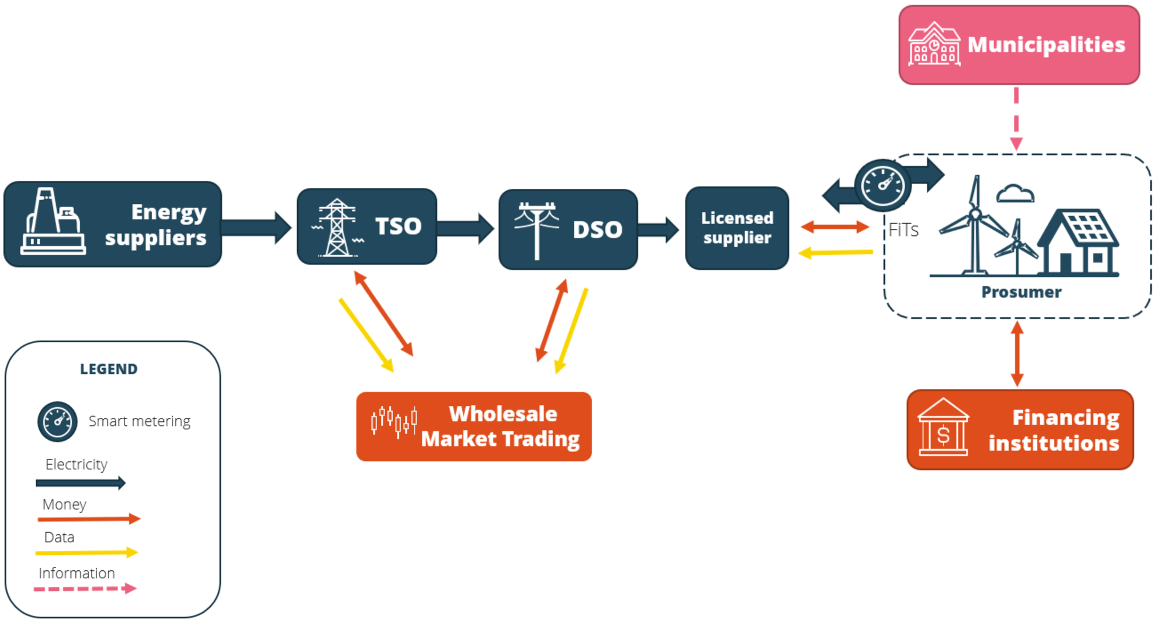

Figure 1: Scheme of a feed-in-tariff business model with value exchange and involved stakeholders (adapted from Botelho et al. (2021))

multiple instruments, and the economic benefits can be generated by different sources of revenue streams and cost reductions.

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An energy community becomes more complex as more individuals are aggregated, since it is designed to be a multi-agent system encompassing not only different types of services but also different types of participant groups fulfilling different and evolving roles, and a larger number of providers for each energy community service as well.

Figure 2 shows a community **prosumerism business model** in which prosumers join capacities to gain access to special financing conditions for asset acquisition, to participate in flexibility markets, to leverage collective energy efficiency initiatives, or to join local energy markets.

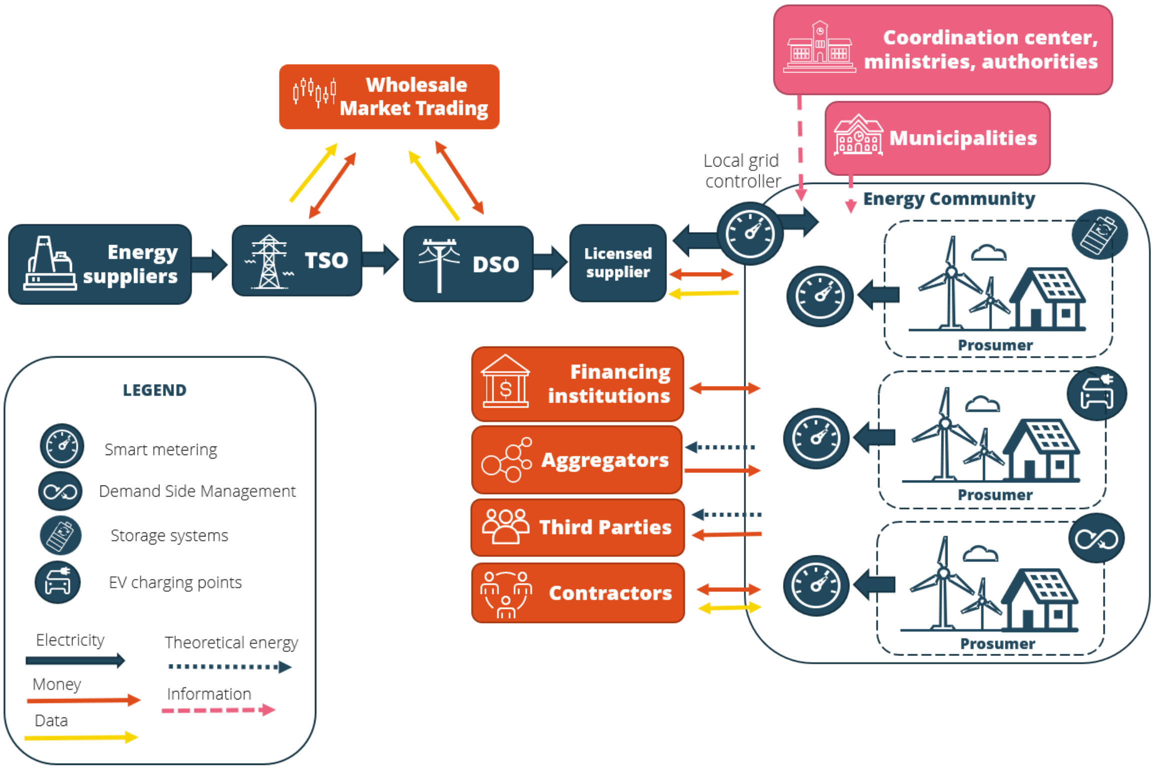

Figure 2: Scheme of a Community Prosumerism business model with value exchange and involved stakeholders (adapted from Botelho et al. (2021) and F.G. Reis et al. (2021))

In comparison with prosumers, grids with integrated energy communities offer a number of advantages and opportunities as summarized in Table 3.

Table 3: Comparing smart prosumers and energy communities in the electricity grid. Adapted from (Parag & Sovacool, 2016)

Dimension	Smart consumers	Energy communities
Resilience and self-healing	Consumers or their devices can automatically detect and respond to actual and emerging transmission and distribution problems; focus is on prevention	Communities could prevent and respond to grid problems as well as provide grid services, such as: voltage and reactive power control, and frequency control (FCR, aFRR, mFRR); focus on optimisation of collective self-consumption
Information and consumer involvement	Consumers are informed, involved and active	They are both consumers and owners of a share of the energy community, thus they are very well informed, involved and active
Quality of energy services	More modular and tailored to specific end uses, which can vary in quality	Highly flexible and self-consumption efficiency increase oriented
Diversification	Encourages large numbers of distributed generation deployed to complement decentralized storage options, such as electric vehicles (EVs), with more focus on access and interconnection to renewables and V2G systems	Will enable the implementation of numerous services in which all energy community participants can profit, e.g. aggregated energy trading, collective peak-shaving, and congestion management.
Competitive markets	More efficient wholesale market operations in place with integrated reliability coordinators and minimal transmission congestion and constraints	Creates its own internal energy trading market as well as services to be provided for internal and external consumers
Optimization and efficiency	Greatly expanded sensing and measurement of grid conditions; technologies deeply integrated with asset management processes and condition-based maintenance	Enhances its ability to aggregate and manage its own assets in a more efficient manner; Provides new opportunities for aggregating and managing its assets

Following Botelho et al. (2021), Brown et al. (2019), and Reis et al. (2021) Table 4 synthesises the main energy community Business Models archetypes.

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Table 4: energy community Business Models archetypes

Types	Description	Governance	Financial model	Key activities	Revenue streams
Cooperatives	Citizen-led initiative in which end-users fund their own energy generation systems and/or private grids.	Consumers and Prosumers	They can be profit or non-profit organizations and be involved in the management and operation of regional low-voltage distribution networks.	* Local generation and supply * Distribution system operation * Aggregation * Services provision * New members recruitment	* Sale of electricity to non-participant members * Sale of aggregated electricity surplus * Self-consuming * Distribution services
Private wire/ micro-grid	The aim is to share any distributed generation between prosumers in the private network area. They are typically being trialed on small island grids or new developments.	Consumers, Prosumers, and other investors	Cooperatives or local energy companies can benefit from owning their own grid and management of local energy production	* Local supply * Distribution system operation * Services provision * New members recruitment	* Sale of electricity to local members w/o tariff for shareholders * Sale of aggregated electricity surplus * Distribution services
Community prosumerism	Participants are prosumers, acting as decision-makers, investors, and customers seeking special financing conditions for asset acquisition, flexibility markets, collective energy efficiency initiatives, or local energy markets.	Prosumers	In addition to acquiring generation and storage systems, community members and energy suppliers enter into long-term power purchase agreements, which are responsible for buying surplus generation and supplying the remaining required power.	* Local generation and supply * Aggregation * New members recruitment	* Sale of own electricity surplus
Peer-to-peer trading	These models are theoretically based on the use of a third-party platform where prosumers can trade energy with each other with minimal involvement from suppliers	Consumers, Prosumers, and other investors	In this model prices can be negotiated directly with other prosumers, allowing them to select the provenance of their electricity.	* Local generation and supply * Aggregation * New members recruitment	* Sale of own electricity surplus
Community collective generation and self-consumption	Shared generation and storage systems are used in this model, which are installed on the roof of multi-tenancy buildings or near consumption sites, in order to enhance collective consumption.	Consumers, Prosumers, and other investors	The investment is shared by the dwelling owners (consumers, decision-makers and investors) and sophisticated net-metering and ICT-based infrastructures are required	* Local generation and supply * Aggregation * New members recruitment	* Sale of aggregated electricity surplus

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Local energy company	The aim is to work collaboratively to maximize their self-sufficiency and reducing the amount of power traded with external entities. Also, in this model trading conditions, as pricing, can be directly negotiated between market participants (prosumers and consumers).	Consumers and Prosumers	In these models, as a result of differences between retail and market tariffs, energy revenues are usually distributed among prosumers and consumers. Market participants consensually manage the trading platforms, while agreements are signed with energy retailers and the DSO to guarantee the supply and trading system reliability.	* Local generation and supply * Aggregation * New members recruitment	* Sale of aggregated electricity surplus
Third-party-sponsored communities	In this case utilities and technology companies provide technical advice and financial support in the form of grant funding, dedicated investment funds, or fully financing energy community projects	Investors	The investment and associated risks are made by the investors, who are compensated through long-term PPAs negotiated with clients. Users gain from renewable energy, which is often less expensive, while participating in regional energy-related initiatives.	* Local generation and supply * Aggregation * Services provision	* Sale of electricity to local members * Sale of aggregated electricity surplus * Other provided services
Flexibility aggregators	Communities looking to use aggregation to provide demand flexibility to the grid through collaborative Demand Side Management (DSM) programs. These models rely heavily on the consolidation of small-scale flexibility to generate meaningful volumes for system operators or wholesale markets.	Aggregator	Local community aggregators may be established, and a larger aggregator will group the flexibility they have gathered. Community aggregators and customers engage into bilateral contracts whereby customers agree to provide defined levels of flexibility by altering their energy usage patterns in exchange for lower energy costs. The aggregator makes all or most of the financial effort, and end-users are considered in decision-making moments through the specification of preferences and boundaries expressed in contractual clauses.	* Aggregation * Services provision	* Profit from the difference between stocking energy assets at the lowest possible prices and selling them at highest possible prices

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ESCO	External companies together with energy communities co-create and operate community ESCOs aimed at providing EE services (e.g., energy audits, building insulation, and so on) and/or renewable energy supply (electricity, heat or both)	ESCOs	By offering such EE services, ESCO ensures customers extra energy savings, which in turn protects ESCO remuneration because these companies are only compensated for the energy savings achieved.	* Local generation and supply * Energy efficiency * Aggregation * Services provision	* Energy savings shared between ESCO and customers in different ways
E-mobility flexibility and as a service	These models explore E-vehicles (electric cars, buses, motorbikes, etc.) as flexibility resources. Batteries are used as storage resources, exploiting V2G and G2V modes to profit from procuring energy during off-peak periods and providing flexibility services	Aggregator, Prosumer, Consumer, Investor, Cooperative, Public entities	To provide flexibility an aggregated smart charging scheme can be created to smooth out demand peaks with EVs' batteries to provide flexibility services – accessing the same revenues as the flexibility service business models. As a service, prosumers share the use of EVs, which are owned or operated by third party providers. As a cooperative Shareholders join forces to provide public transportation, car sharing, or carpooling services for the community.	* Local generation and supply * Aggregation * Services provision	* Sale of electricity to non-participant and participant members * Sale of aggregated electricity surplus * Profit from the difference between stocking energy assets at the lowest possible prices and selling them at highest possible prices * Other provided services

3/ Methodology

The methodology used to design different business models for the deployment of services by energy communities was developed to answer three main questions:

- What is the starting point?
- How to implement it?
- How does the result look like?

Each one of those questions represents a step of the methodology. Figure 3 shows the designed methodological framework including the inputs, steps, and outputs. To answer those questions a variety of data collection methods have been used, including a survey, interviews conducted during the site visits, reviews of deliverables and literature, and direct observation.

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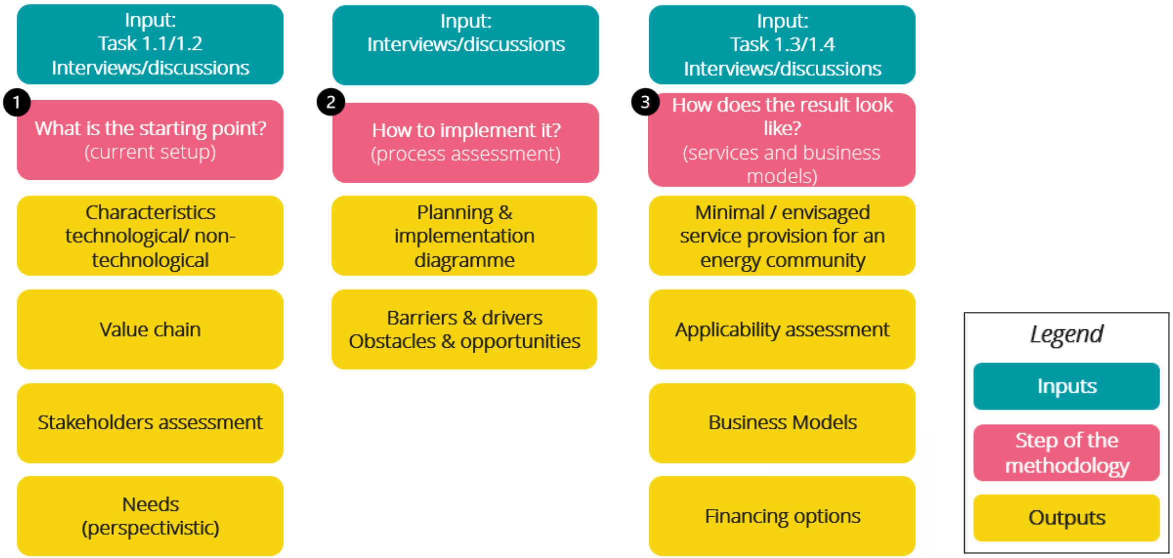

Figure 3: Methodological framework

Each method used in every step is described below:

STEP 1 – What is the starting point?

Characteristics technological/ non-technological

➔ **Review of previous deliverables (Task 1.1 and Task 1.2):** aggregation of main information about each Demo Site.

Current setup (value chain)

➔ **Literature review and survey:** the literature review provided the general framework of the value chain of an energy community, and the survey allowed to identify the locals value chain.

Stakeholder assessment

➔ A **stakeholder assessment** was developed to understand key aspects of the players and stakeholder dynamics in each energy community participant. By analysing those aspects one can achieve early alignment between all stakeholders and leverage from the knowledge and wisdom of these key players to help to guide the project to a successful outcome. The assessment was divided in four analyses:

- *Identify:* an identification of the stakeholders by level of influence was conducted through a literature review.
- *Evaluate:* an evaluation of the stakeholders by influence, responsibility, and decision-making role was made. The evaluation was made through the survey with the stakeholders (Appendix 10.5), in which questions were placed to assess the stakeholders' influence, responsibility, and decision-making role.
- *Group by priority:* An interest vs. impact matrix was used to group stakeholders according to their level of interest and impact. With an interest vs. impact matrix (Figure 5), stakeholders can be clearly categorized and managed accordingly to their level of prioritisation. Also, it can help

to identify relationships between stakeholders and anticipate potential enablers, partners, and conflicts. As Figure 5 shows, the Group 1 consists of stakeholders with high interest but low impact in the energy community. In Group 2, includes stakeholders with high interest and high impact. Group 3 comprises of stakeholders with low interest and low impact. And, Group 4 includes stakeholders with low interest but high impact.

- *Distinguish impacts into positive/negative:* the last analysis made were to distinguish the impacts into positive and negative. To do so, the survey made (Appendix 10.5) revealed which stakeholder can be positively or negatively affected by the energy community and which stakeholder can positively or negatively affect the community.

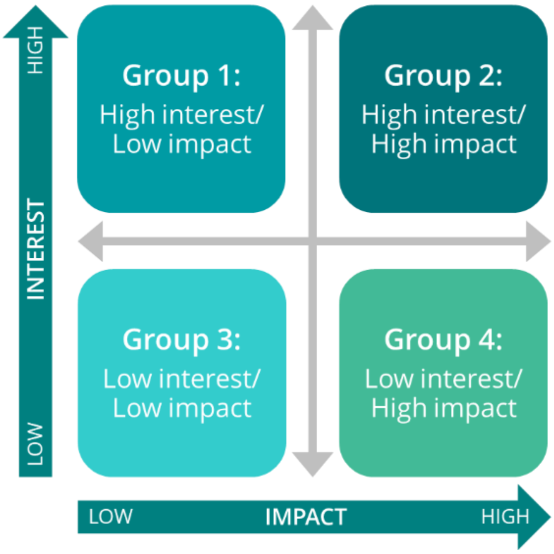

Figure 4: Interest x Impact Matrix

Stakeholder needs

➔ The **needs and desires of stakeholders** may contain vague, ambiguous statements that are difficult to translate into energy community activities. Thus, the objective of this step was to set clear and concise motivations and values statements from their own perceived statements.

The value proposition design framework developed by Osterwalder et. al. (2014) was used to assess the stakeholder needs and values and the stakeholder requirements, desired gains, and pain alleviation for the energy community. Overall, the value proposition is a framework designed to build a bridge between a product or service to the customer values and needs. The **value proposition design** is formed around two building blocks – customer profile and a company's value proposition. Using the value proposition design is useful when refining an existing service or when developing a new one, which is the case for the development of innovative business models for energy community. Thus, in this task the value proposition design was adapted to ensure that the energy community services were aligned with the stakeholders' values and needs. The value proposition framework for an energy community developed in this study involved two steps.

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1. **Defining the energy community needs profile:** in this first step, specific questions about motivations and values were included in the survey made during stakeholder's consultation meetings. Subsequently, the answers from the survey were translated into five main motivations and three main values of energy community stakeholders. Figure 1
2. **Listing the services:** for services defined in task 1.2 the job done for the energy community of each service, the gains for the energy community, and the pain alleviation have been identified, as shown in Figure 5.

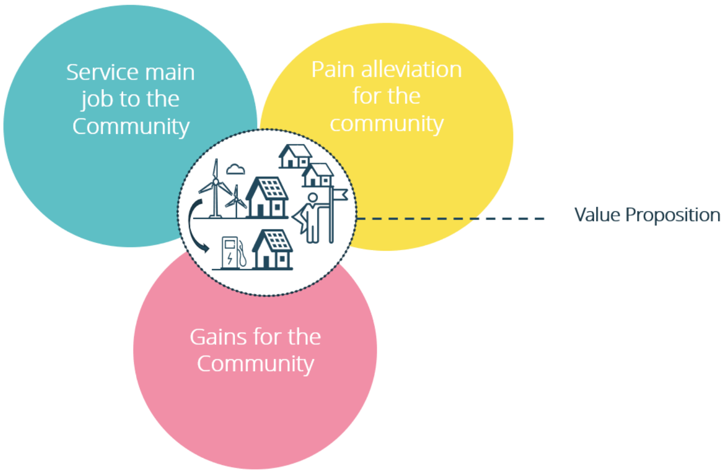

Figure 5: Illustration of the 3 aspects which encompass how services create value to energy communities

STEP 2 – How to implement it?

Planning & implementation diagram

➔ This step has the purpose of **identifying and evaluating the planning and implementation mechanisms** in the communities by using a multi-dimensional framework (technological, institutional, socioeconomic, environmental and organisational) developed by Maria Rosaria Di Nucci et al., 2010. Planning and implementation process (PIP): Describes the process of decision-making, planning, implementing, and operating demo site applications. Providing information specially concerning to organisational barriers.

➔ The evaluation was based on primary data and information derived from the analysis of previous tasks of WP1. Additional information was gathered through **site visits and interviews with different stakeholders** during the stakeholder consultation meting focusing on the identification of barriers and drivers.

STEP 3 – How does the result look like?

LocalRES services overview

➔ **Listing the services (qualitative aspects):** based on the results of task 1.2 a qualitative analysis of the services has been

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performed following the value proposition framework mentioned in step 2 of the methodology and illustrated in Figure 5.

➔ **Clustering of service packages by technology:** according to previous deliverables (Task 1.2 and Task 1.3) the services were aggregated based on the necessary technology to provide them.

Applicability assessment

➔ **Assessment of services:** Key service provision of the community has been identified followed by a review of these services.

Business Model

➔ **Business Model Canvas:** During the stakeholder consultation meeting a dynamic exercise was conducted, which included presenting a general business model Canvas (BMC) template for the particular community and its discussion. Subsequently, stakeholders were asked to evaluate what would fit for their community.

Financing options

➔ **Literature review and survey:** the literature review provided the general framework of the financial models and options, and the survey allowed identifying energy communities' preferable options. The initially planned investigation of financing options was not possible. The quantitative assessments resulting from CBA were not suitable for stakeholder consultations. Thus, this step only includes qualitative assessments.

The stakeholder consultation meetings were held at each pilot site as physical meetings. For these meetings, approximately twenty participants from each community were invited. The meeting consisted of an information session, guided survey with explanations and an extra session with the demo coordinator. An online survey was in this case not seen as essential, since the survey questions required explanation (esp. regarding the different financing options and business model options). The extra session with the demo coordinator focused on queries that required deeper understanding and expertise in innovation management. This included, among others, the design of the planning and implementation process diagrams and filling in the business model template.

4/ Evaluation of current setup and needs

4.1. Uses cases overview: characteristics technological/ non-technological

The first step of the developed methodology was to understand what was done previously in tasks 1.1, 1.2, and 1.3. As it is fundamental to understand the current status of each study case, a review of the main socioeconomic characteristics, energy generation capacity, regulatory framework, and 2030 goals follows.

4.1.1. Use cases overview: what we know up to now about Kökar

Kökar

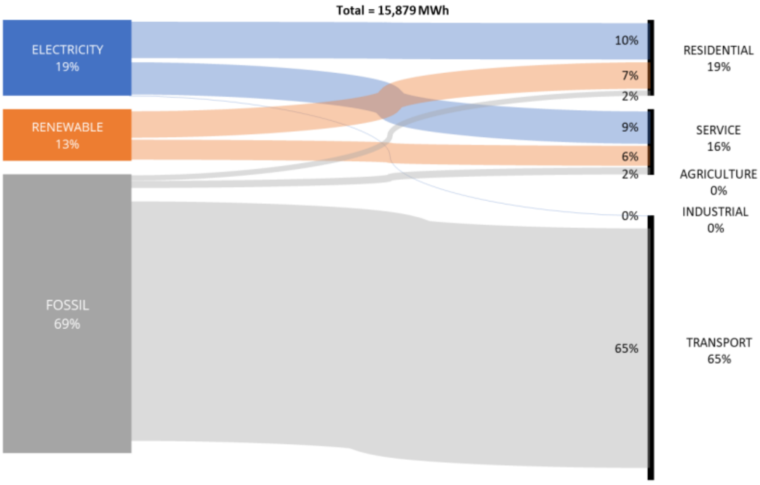
POPULATION
224 hab

ELECTRICITY PRICES
30.8 €/MWh

AREA*
63.6 km²

STAKEHOLDERS
9

ENERGY DEMAND BY SECTOR AND BY FUEL TYPE



KEY TAKEAWAYS

Barriers

- Only private grid allowed
- Very high grid fees (rural areas would need to build extensive parallel lines to avoid paying the fees
- If use of public grid: the DSO es not ready yet (no IT system operational, unclear compensation, no permitting procedure

Future opportunities

- Target market of housing companies with multiple buildings within a same property

Enablers and facilitators

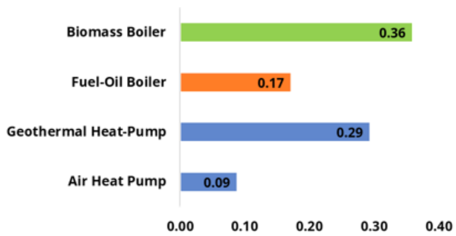
- Facilitating role of DSO
- Strong push from active citizens

GENERATION CAPACITY

0.05 MW

0.53 MW

HEATING TECHNOLOGIES CAPACITY (MW)



OBJECTIVES FOR 2030

- ✓ Creation of a REC
- ✓ Proper exploitation of DSM
- ✓ Contribute to reduce CO2 emissions by at least 60 % (compared to 2005)
- ✓ increase the share of renewable energy to at least 60%

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4.1.2. Use cases overview: what we know up to now about Ispaster

Ispaster

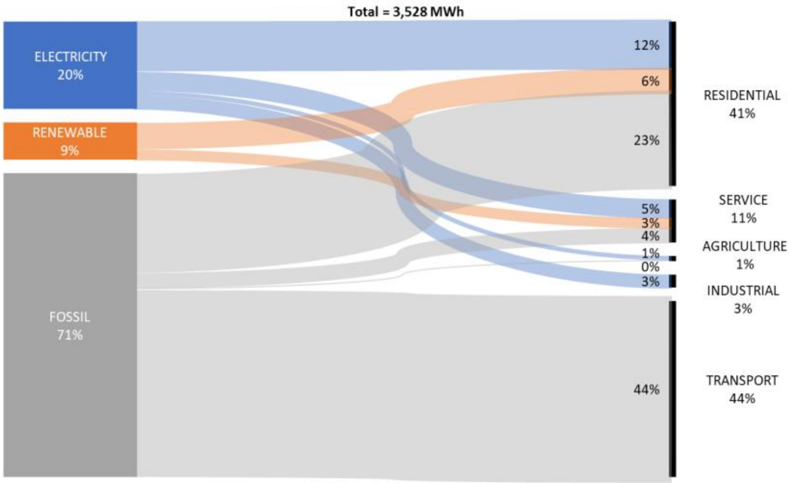
POPULATION
725 hab

ELECTRICITY PRICES
34.8 €/MWh

AREA*
22.6 km²

STAKEHOLDERS
4

ENERGY DEMAND BY SECTOR AND BY FUEL TYPE



KEY TAKEAWAYS

Barriers

- Uncomplete legislation, lack of confidence in regulatory stability
- Incumbent utilities
- Complicated administrative process
- Complexity in establishing ownership of assets, obligations & rights of members
- Complex social acceptance, lack of trust

Future opportunities

- A new framework will soon enter into force combined with the already available incentives for REC
- Some townhalls are offering taxes reduction to REC

Enablers and facilitators

- High cost of electricity
- Competitive electricity market
- Smart metering in place
- Financial incentives: ethical banks and crowdfunding
- Existing regulation on CSC with reduced grid fees

GENERATION CAPACITY

0.028 MW

ION

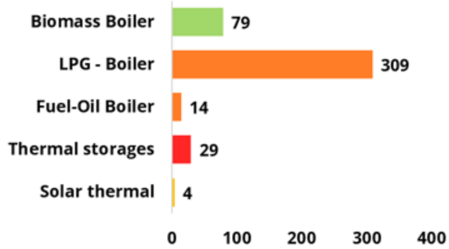
0.178 MWh

OBJECTIVES FOR 2030

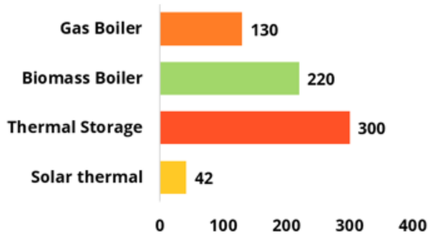
- ✓ Be an autonomous and isolated energy island based on 100% RES
- ✓ Increase the capacity of the microgrid to operate outside the community
- ✓ Defining new business models for ESCOs and different RES system operation. Though, a legalization procedure will be needed for the microgrid to allow selling the surplus energy in the market.
- ✓ Establish a solid REC in the area.

HEATING TECHNOLOGIES CAPACITY (kW, kWh Storage)

Single Buildings



District-heating



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4.1.3. Use cases overview: what we know up to now about Berchidda

Berchidda

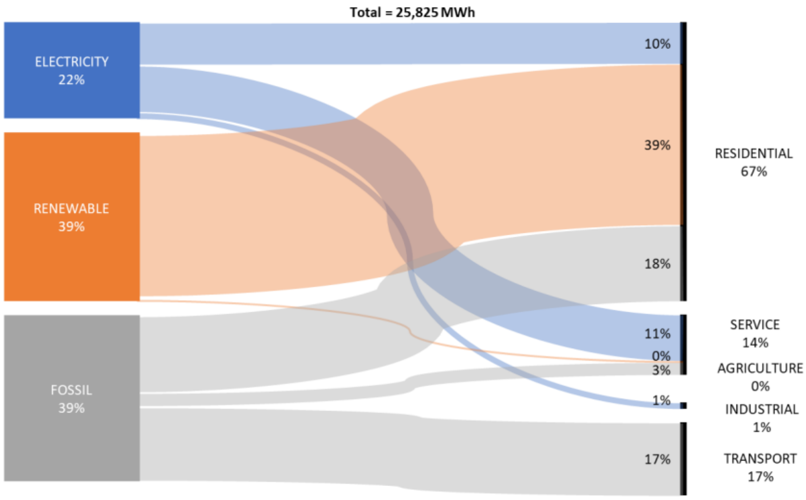
POPULATION
2668 hab

ELECTRICITY PRICES
50.7 €/MWh

AREA*
201 km²

STAKEHOLDERS
6

ENERGY DEMAND BY SECTOR AND BY FUEL TYPE



KEY TAKEAWAYS

Barriers

- Authorization procedure which is constantly evolving
- The legal entity of prosumer does not exist yet

Future opportunities

- More stable and clear authorization procedure

Enablers and facilitators

- Financial incentives (Ecobonus, Superbonus, etc.)
- Support from local authorities (one stop shops for building renovation and EE)

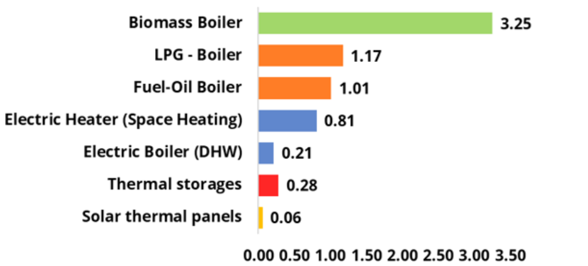
GENERATION CAPACITY

0.61 MW

OBJECTIVES FOR 2030

- ✓ Full distribution of PV panels (there's a wide deployment already)
- ✓ Power-to-heat
- ✓ Power- to- vehicle
- ✓ ICT infrastructure
- ✓ Management and monitoring of high-resolution data

HEATING TECHNOLOGIES CAPACITY (MW, MWh Storage)



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4.1.4. Use cases overview: what we know up to now about Ollersdorf

Ollersdorf

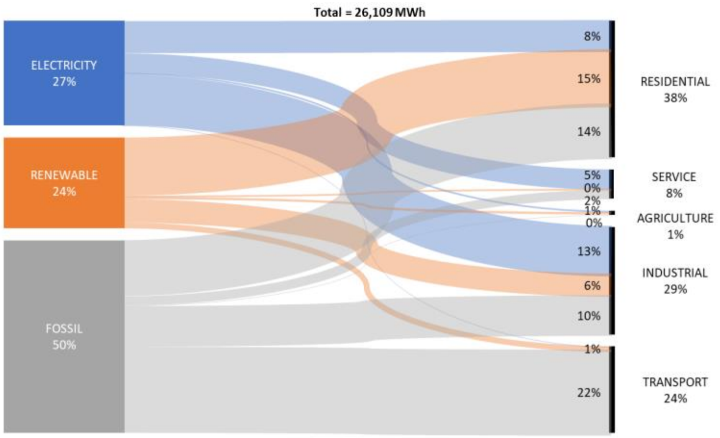
POPULATION
968 hab

ELECTRICITY PRICES
43.0 €/MWh

AREA*
8.9 km²

STAKEHOLDERS
4

ENERGY DEMAND BY SECTOR AND BY FUEL TYPE



KEY TAKEAWAYS

Barriers

- A few barriers in the regulatory framework remain to be solved
- Sharing coefficients that do not allow P2P trading
- Legislation rather tailored to the electricity sector

Future opportunities

- Additional guidance to set up communities expected late 2022
- Option of participating in multiple communities from 2024

Enablers and facilitators

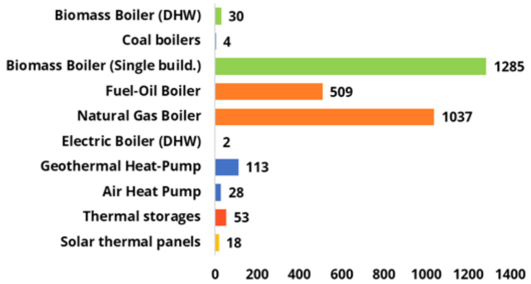
- Clear rules for interaction between grid operators and EC
- The low-voltage grid and medium-voltage grid can be used
- One Stop Shop "Koordinationsstelle"

GENERATION CAPACITY

0.32 MW

0.04 MWh

HEATING TECHNOLOGIES CAPACITY (kW, kWh Storage)



OBJECTIVES FOR 2030

- ✓ optimal generation mix to reduce the dependence from the main transmission line
- ✓ measures and strategies to update the local electric grid to allow these changes must be identified
- ✓ An existing automation framework will be further extended and used for simulation and validation of the power system, the ICT system, as well as control strategies and software components within the community

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4.1.5. Assessment of REC-driven services and of regulatory feasibility

Early in the project, several Renewable-Energy-Communities-driven services from the LocalRES project have been chosen for the four demo locations. This decision was made in accordance with regional regulations, local characteristics, physical resources, technology, and strategic goals. This group of services has been categorized into three tiers of analysis: thermal, electrical, and non-technical. The services chosen inside each demo site establish the functional and non-functional needs of the use cases. For each use case, stakeholders have been identified, along with the roles they play. All services may not be physically implemented within the project timeline, but the stakeholders at the demo site have highlighted them as being of significant interest.

After the pre-selection of services to be included in each UC a regulatory investigation was undertaken to access the feasibility of each pre-selected service. Based on this mapping, pertinent legal issues were looked into for each of the demos. The evaluations allowed the identification of regulatory gaps that already existed and to make the necessary adjustments to the use cases.

In task 1.5 investigated which of those services are already in place, which services will be optimized and/or expanded during the LocalRES project, and which services are planned for the future. Table *5* the summarizes REC-driven services and the regulatory assessment results.

Legend	
● (grey circle)	Ongoing service in the REC
✚ (grey plus)	Existing, but requires expansion and/or optimisation, implementation planned with LocalRES support
✖ (grey cross)	Planned to be installed with LocalRES support
➡ (grey arrow)	Planned to be installed in the near future (next 2 years)
(green)	RECs are allowed to provide the service, rules and processes are in place to enable them to do so
(yellow)	Service can be provided within the REC to its Members but cannot be offered to DSO
(red)	Service cannot be provided by the REC (to its members or to system operators)
NA	The regulatory/market feasibility of the service was not investigated, was not included into UC
(black)	No specific regulation provided, or market feasibility of the service was not investigated

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Table 5: Synthesis of selected services and regulatory framework for each Use Case

	SELECTED SERVICES	Kökär	Berchidda	Ispaster	Ollersdorf
Thermal	Operation of a DHN (District Heating Network) with RES	➡	NA	✚ (teal)	NA
	Sale of waste heat use to a DHN	NA	NA	NA	NA
	Help to balance a DH&CN (thermal demand response)	NA	➡	✚ (teal)	NA
	Heating/Cooling as a service	NA	NA	✚	NA
	Power to Heat and Heat to Power (P2H and H2P)	✖ (teal)	NA	✖ (teal)	➡ (teal)
	Building energy management & optimization	✖	➡	✚	➡
Electrical	Collective Peak shaving	✖	✖	✚	NA
	Collective self-consumption/ REC	✖	✖ (teal)	✚ (teal)	✖ (teal)
	Optimisation of electric flows within the REC	✖	✖ (teal)	●	➡ (teal)
	Voltage and reactive power control	NA	➡	✚	NA
	Frequency control (FCR, aFRR, mFRR)	NA	➡	✚	NA
	Demand response (implicit and explicit)	NA	✖	NA	NA
	V2G services	NA	➡ (teal)	NA	NA
	Blackout strategies/ Black start	NA	✖	✚ (yellow)	✖ (yellow)
	P2P energy trading	NA	➡ (teal)	NA	✖ (red)
	Aggregated (REC-level) energy trading	NA	✖ (teal)	NA	➡
	Public EV charging stations	✖ (teal)	✖ (teal)	✚ (teal)	● (teal)
	Energy storage/ Smart Storage Management System	✖ (teal)	✖ (teal)	✚ (teal)	➡
	Congestion management	NA	NA	NA	NA
	Anomalies detection at REC-level	NA	NA	NA	NA
Non-Technical	Capitalisation of monitored data	✖	✖	➡	✖
	Legal advice	✖	●	NA	✖
	Preliminary feasibility assessment	✖	●	✚	✖
	End-user engagement	✖	●	✚	✖
	Support on technical execution	✖	●	✚	✖
	Promotion of energy conscious behaviour	●	●	✚	✖
	Support vulnerable citizens reducing risks of energy poverty	NA	●	NA	✖

In summary, regulation compliance was generally upheld from the beginning of the use cases' design. The only barriers identified were (as of March 2022):

- P2P trading cannot take place in Austria because there is no process in place to notify the grid operator about any P2P agreements between participants.
- At the time being, the REC cannot provide grid services directly to grid operators but can provide grid services to REC members in order to improve the reliability of the local grid.

4.1.6. REC scenarios and future scenarios assessment

The identification of each demo site's local energy systems and consideration of their specific challenges enabled the definition of least-cost solutions for a faster energy transition and decarbonization up to 2030. This research is related to the main goal of RECs, considering a sector

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coupling approach and grid infrastructure requirements, as well as investigating the increase of self-sufficiency by local RES and maximization of system flexibility through energy storage. Table *6* summarizes the results for each demo site and shows the technologies that must be installed to achieve their objectives. It is important to note that these findings are related to one of three scenarios defined for each community.

Table 6: Future technologies capacities in each community for 2030

Legend	
(white)	Technology and installed capacity already available in the community
(green)	Technology is available and is planned for expansion
(blue)	New technology planned
(yellow)	Technology planned for expansion, but not as part of the reference scenario results*
(orange)	Technology planned to be phase-out

TECHNOLOGIES		Kökar	Berchidda	Ispaster	Ollersdorf
MW (MWh for storages)		2030	2030	2030	2030
Electricity Generation	Transmission line	1.50	1.50	0.11	5.00
	PV panels	0.07	2.11	0.41	7.10
	Wind turbines	0.80			
	Hydrogen production				
Heating-Single Buildings	Solar thermal panels		0.05	0.01	0.02
	Air Heat Pump	0.25	1.39	0.04	0.04
	Geothermal Heat-Pump	0.30			0.15
	Electric Boiler (DHW)		0.18		0.00
	Electric Heater (Space Heating)		0.39		
	Natural Gas Boiler				0.96
	Fuel-Oil Boiler		0.46	0.00	0.47
	Liquid Petroleum Gases - Boiler		0.53	0.06	
	Biomass Boiler	0.35	2.95	0.01	1.17
	Coal boiler				0.00
Heating - District Heating	Solar thermal panels			0.04	
	Biomass Boiler			0.26	
	Biomass CHP			0.06	
	Geothermal Heat-Pump			0.03	
	Gas Boiler				
Storage System	Electric batteries		0.40	0.41	0.12
	Thermal storages (Single Buildings)		0.26	0.02	0.05
	Thermal storages (DH)			0.18	
	Hydrogen storage (H_2 tank)				
Others	V2G (no. of vehicles)	55	77	65	14

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4.2. Value chain

Figure 6 schematically illustrates the main **exchange value** flows in an energy community: energy, data, money, and information, as well as involved stakeholders in a basic business model. The exchanged values between participants within an energy community are theoretical energy, heat, and money. The main exchange values between the energy community participants and external stakeholders can vary depending on their role within the energy community. Each one of those values exchanged can add financial value to the energy community. Thus, understanding these flows is essential to build a healthy business model. The next steps of the methodology were designed to understand **who the players are, what are their needs and aspirations for their community, as well as which services each energy community can/wants to develop**. After gathering this information, the identification of the most suitable Business Model for each energy community is possible.

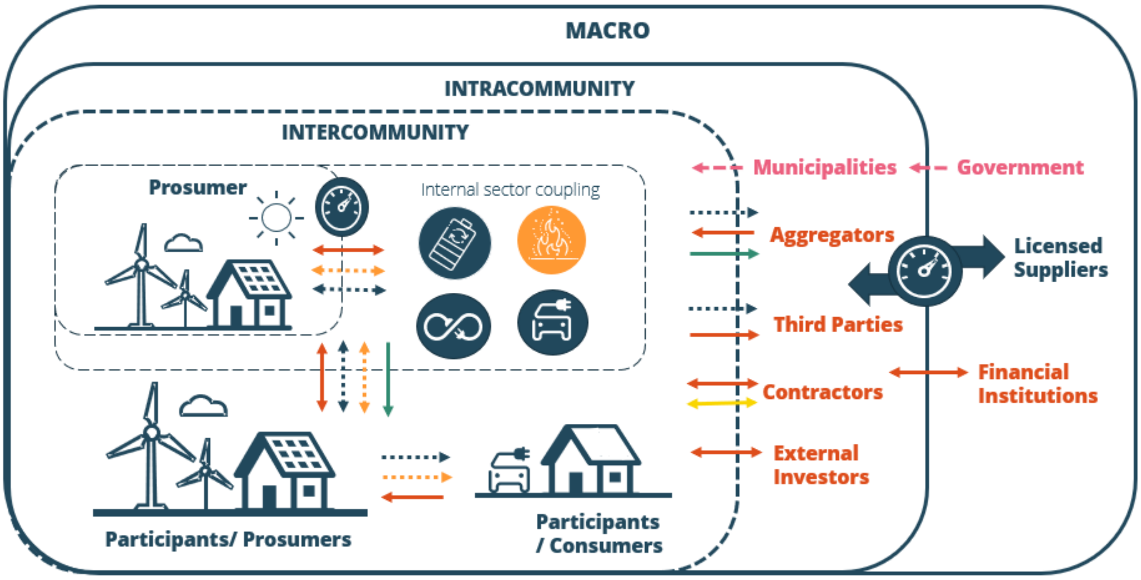
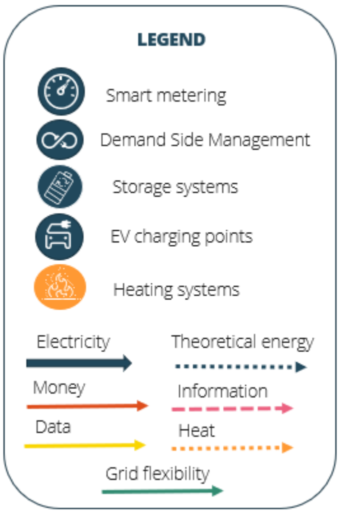


Figure 6: Scheme of main exchange values of an Energy Community



4.3. Stakeholders’ assessment

A key aspect of creating and implementing an energy community is making sure all stakeholders' needs are met by the concepts developed and are deemed relevant from a technical standpoint (indirectly and directly affected by the rollout of an energy community) (Heuninckx et al., 2022). In the same context, Baldassarre et al. (2017) highlight that: *Sustainable business model innovation entails developing value propositions that create value for multiple stakeholders at the same time, including customers, shareholders, suppliers and partners as well as the environment and society.* Ruggiero et al. (2014) raises the awareness that a project's development can be hindered or supported according to the perceptions of key stakeholders that the output of the project will benefit them. Stakeholders in this context refers to individuals or range of actors who either directly or indirectly use or influence the energy community system (Heuninckx et al., 2022; Ruggiero et al., 2014).

In order to better identify, understand and evaluate the stakeholders of each energy community a stakeholder assessment was developed. The assessment was divided into four analyses: (1) identification of stakeholders by the level of influence; (2) evaluate the stakeholders by influence, (3) responsibility, and decision-making role; (4) group the stakeholders according to their level of interest and impact; and, distinguish the impacts into positive and negative. The next subsections present the results of each one of these analyses made.

4.3.1. Identification of stakeholders by level of influence

Prior studies have already evaluated the main stakeholders and their influence/importance in an energy community (DigitalEnergy4All, 2022; Gährs & Knoefel, 2020; Heuninckx et al., 2022; Ruggiero et al., 2014). Heuninckx et al. (2022) enumerated six incumbent energy market stakeholders and ten potential additional energy community stakeholders. Gährs and Knoefel (2020) identified five stakeholder groups that can act as users, providers, initiators, or operators of energy community systems and services, or administrators within the legal framework. Ruggiero et al. (2014) divided stakeholders by their different level of influence and impact in an energy community: macro, intercommunity, and intracommunity. In which, influential stakeholders at the macro level included the government, energy suppliers, network operators, and commercial developers. The relevant stakeholders at the intercommunity level were nearby communities and intermediary organizations. Lastly, key stakeholders at the intracommunity level were identified as the local community at large, people living near an installation, local project champions, and businesses. Figure 7 summarizes the main energy community stakeholders within their level of influence and Table 7 lists the stakeholders found on the studied literature, their main roles and their level of influence in an energy community.

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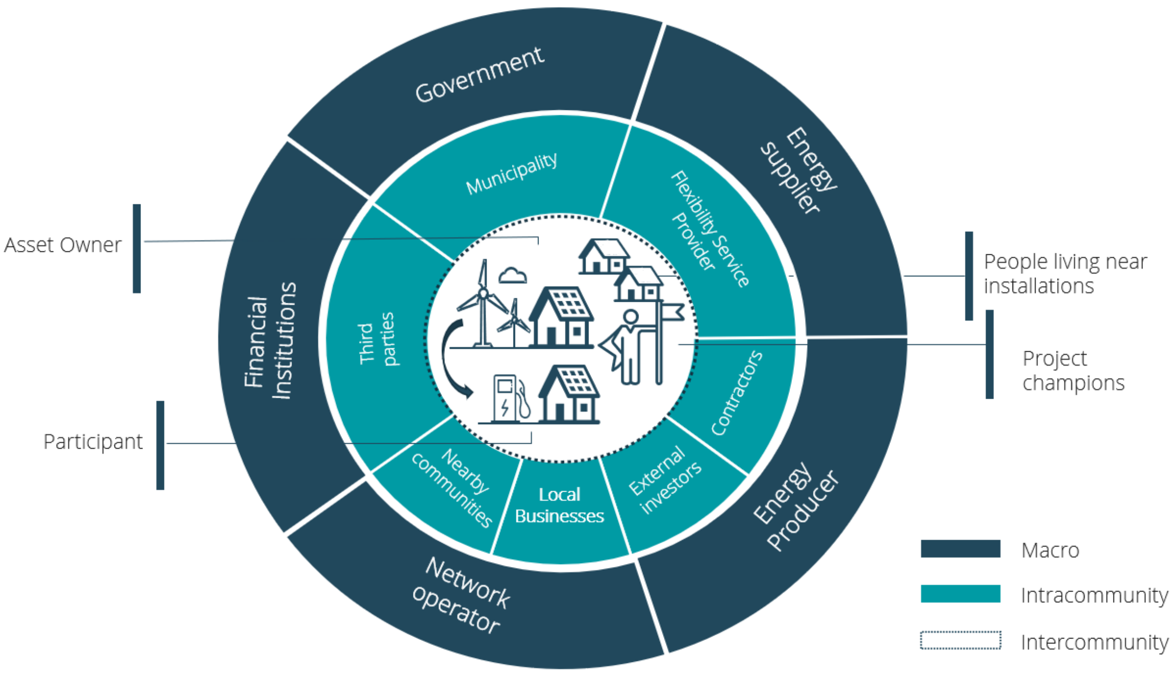

Figure 7: Key stakeholders and their level of influence. Adapted from (Ruggiero et al., 2014).

Table 7: Summary of stakeholders, their roles and level of influence in an energy community ((DigitalEnergy4All, 2022; Gährs & Knoefel, 2020; Heuninckx et al., 2022; Ruggiero et al., 2014)

Level of influence	Stakeholder	Role
Macro	Government	Public entity responsible for providing regulatory framework and decision-making at higher levels,
	TSO	Entity responsible for transmitting the electricity on high voltage levels.
	DSO	Entity responsible for distributing electricity on lower voltage level.
	Regulator	Actor that regulates the energy markets and guarantees energy networks
	Energy supplier	Actor responsible for residual load coverage and purchase surplus generation of energy community participants, as well as billing and contracting the grid operator with the consumer
	Energy producer	Entity responsible for energy production, traditionally based on centralized energy sources
	Insurance Party	Private entity providing insurance services to the energy community
	Legal Party	Private or public entity that supports the energy community with legal support
	Financing Institutions	Private entity or public body providing financial support schemes (money loans and grants for energy communities)

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Intracommunity	Municipalities	Assist in the implementation of the energy community concept and set the local regulation framework
	Flexibility Service Provider (FSP)/ Aggregators	There are two types of Flexibility Service Providers: aggregators that provide flexibility services or owners or the representative of large-scale or small-scale assets, connected to the electricity network, which provide energy services to TSOs or DSOs.
	Contractors/Engineering Office	Person, private or public entity that undertakes a contract to provide materials or services for energy communities (e.g., planning, operation, billing), and can participate in energy communities
	Intermediary organizations/ Third parties	Provide third-party services for energy communities (e.g., planning, operation, billing), and can participate in energy communities
	External investor	Private person, private or public entity which provide financial investments for local generation and/or services for the energy community
	Nearby communities	Can be cities, villages, neighbors who are nearby the energy community
Intercommunity	Local Businesses/ Associations	Local Businesses and/or Associations located in the energy community area. Normally not involved with energy subjects but can act as multipliers or with resistance to the energy community
	Energy Community	Shareholders of energy community (participants, aggregators, asset owner, etc.)
	Project Champions/ Initiator	Initiator of the energy community who can be a private person, private entity or social enterprise/NGO. Champignon can be called the member of a local community who had a prominent role in starting, endorsing or carrying out a project.
	Participant	energy community member who can be a private person or private or public entity and a consumer or prosumer
	Asset Owner	Person, private or public entity owning an energy producing or regulating unit that is part of the energy community system
	People living near installations	Households close to the energy system installations

Appendix 10/ includes tables with stakeholders of each energy community participant of LocalRES.

4.3.2. Evaluate stakeholders by role

Figure 8 summarizes the survey answers regarding which stakeholder is most influential, who is directly responsible for important decisions and who plays an important role in the decision-making process of the energy community (Appendix subitem 10.5.1). It is possible to observe differences in stakeholder weights among the energy communities. For example, the municipality has the highest influence, responsibility, and decision-making weight in Berchidda. At the same time, in Ispaster it is the asset owner and energy community participants which hold the highest importance on those aspects.

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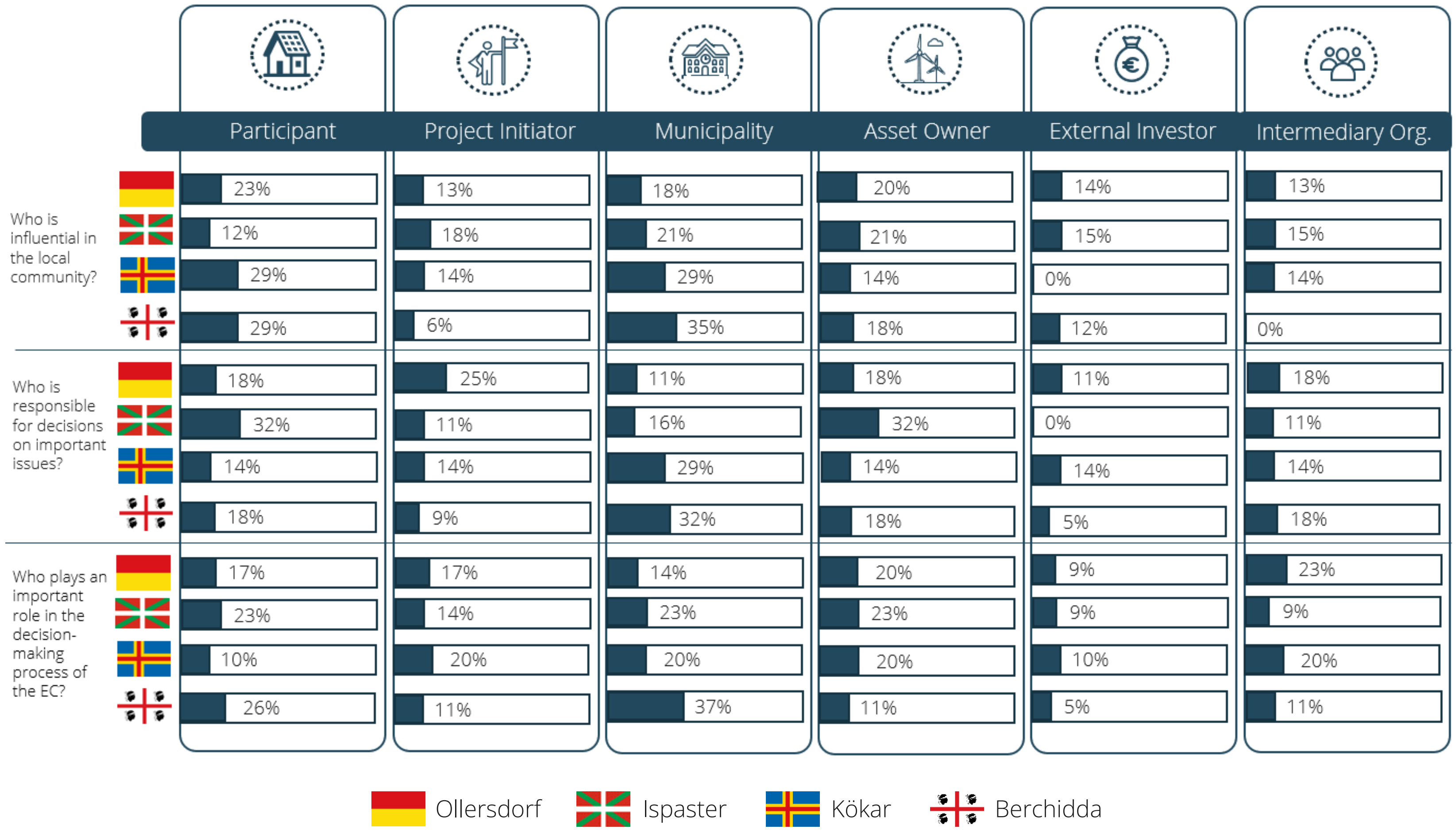

Figure 8: Summary of survey answers regarding stakeholder's r influence, responsibility, and decision-making role in each studied energy community.

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4.3.3. Group stakeholders by priority

As stakeholders are grouped, it provides an indication of how to manage them in accordance with their priority levels. The interest/impact-matrix method was used to group them during the stakeholder consultation meeting. Group 1 includes stakeholders with high interest but low impact, thus it is necessary to keep them involved, adequately inform these people, and talk to them to ensure that no major issues are arising. In Group 2 are the stakeholders with high interest and high impact. It is fundamental to manage them closely, fully engage them, and expand cooperation as they have the highest priority. In Group 3 are the stakeholders with low interest and low impact. It is the group with the least priority, thus is necessary to observe and monitor them. In Group 4 are stakeholders with low interest but with high impact., For this group it is important to put effort to keep them satisfied, as they hold a lot of power but no or low interest in the development of the energy community.

Figure 9 shows the interest/impact-matrix made during the stakeholder consultation meeting in Ollersdorf. The stakeholder group with highest priority includes: energy community participants, municipality, project initiator, intermediaries, and asset owner. The group that needs to keep satisfied includes: DSO, energy supplier, and the government. The group that is important to be kept involved includes: people living near the facility, contractor and any external investor.

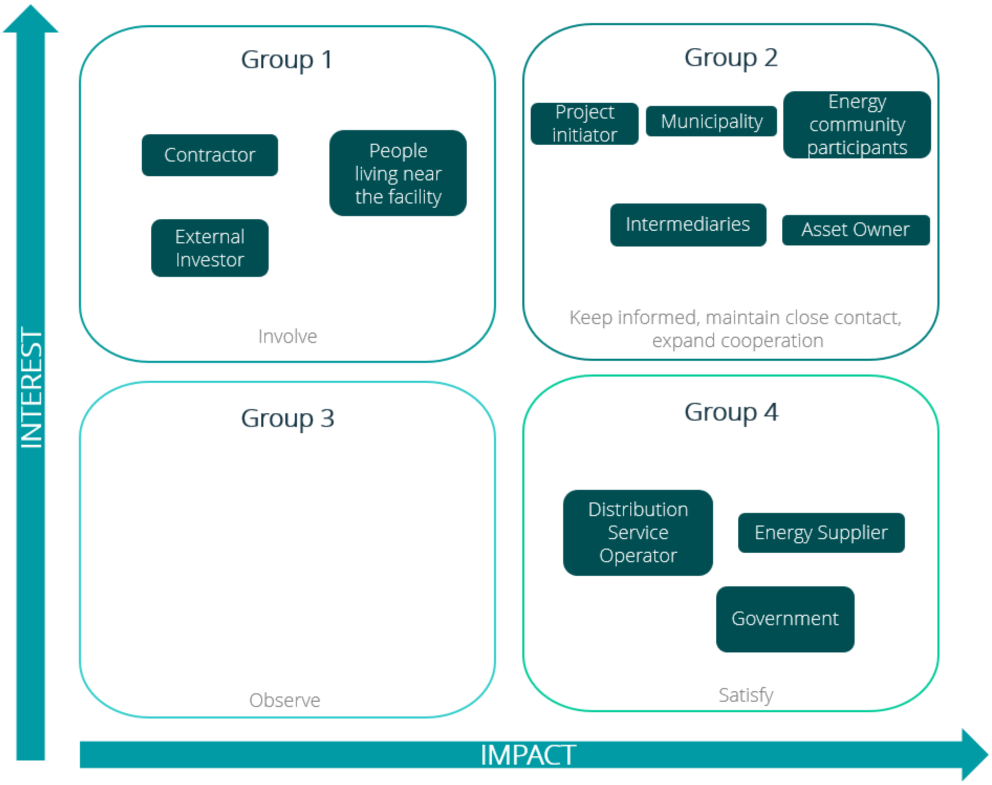

Figure 9: Stakeholders Impact x Interest Matrix of Ollersdorf

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Figure 10 shows the interest/impact-matrix designed during the stakeholder consultation meeting in Berchidda. The group of stakeholders with the highest priority are: municipality, DSO, people living near the facility. The project initiator was placed in between group 2 and 1.

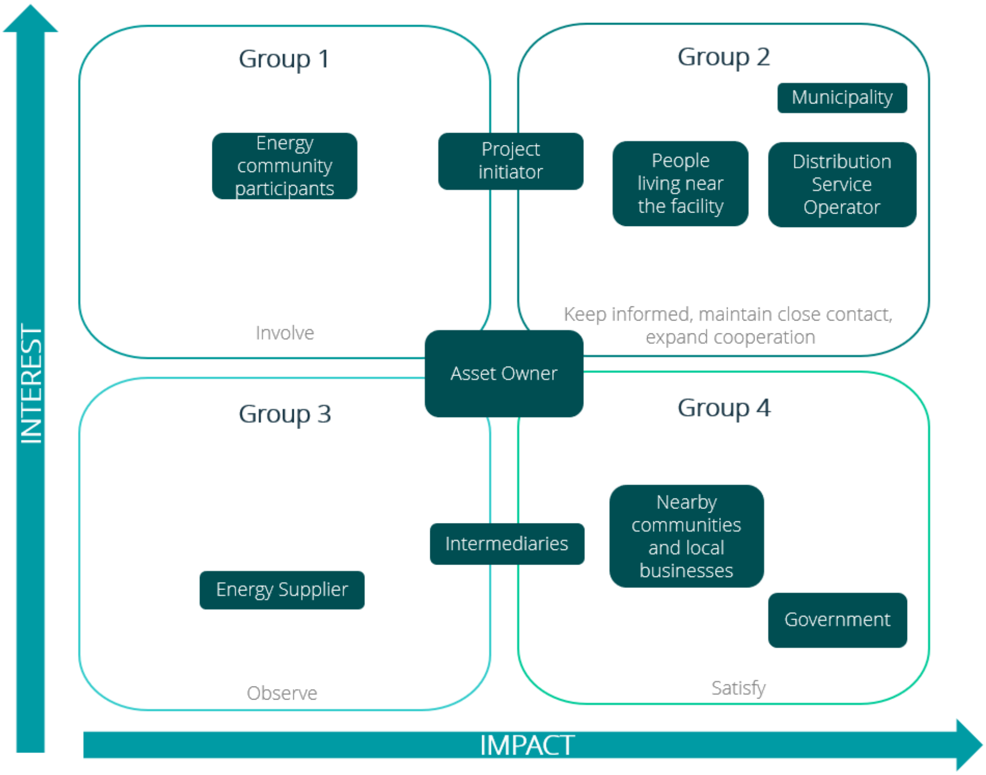

Figure 10: Stakeholders Impact x Interest Matrix of Berchidda

Figure 11 shows the interest/impact-matrix designed during the stakeholder consultation meeting in Ispaster. The group of stakeholders with highest priority includes here: municipality, energy community participants, asset owner, project initiator and intermediaries.

The interest/impact-matrix designed during the stakeholder consultation meeting in Kökar is showed in Figure 12. In this case, the group of stakeholders with the highest priority includes: municipality, energy community participants. The DSO and the asset owner were placed in between group 1 and 2.

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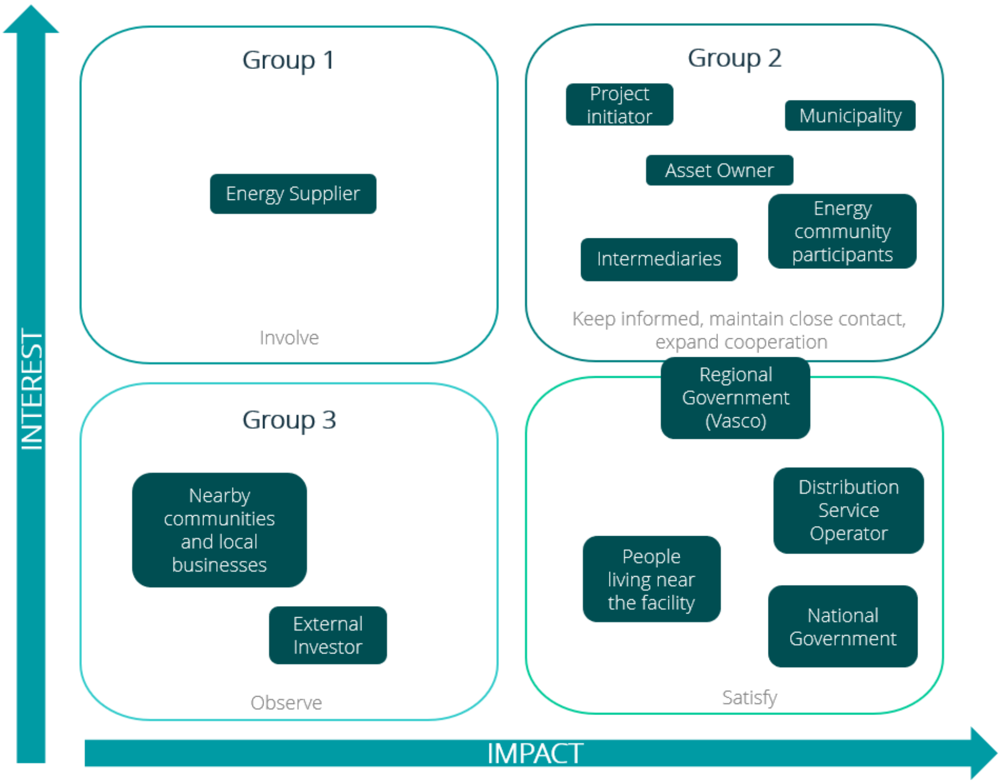

Figure 11: Stakeholders Impact x Interest Matrix of Ispaster

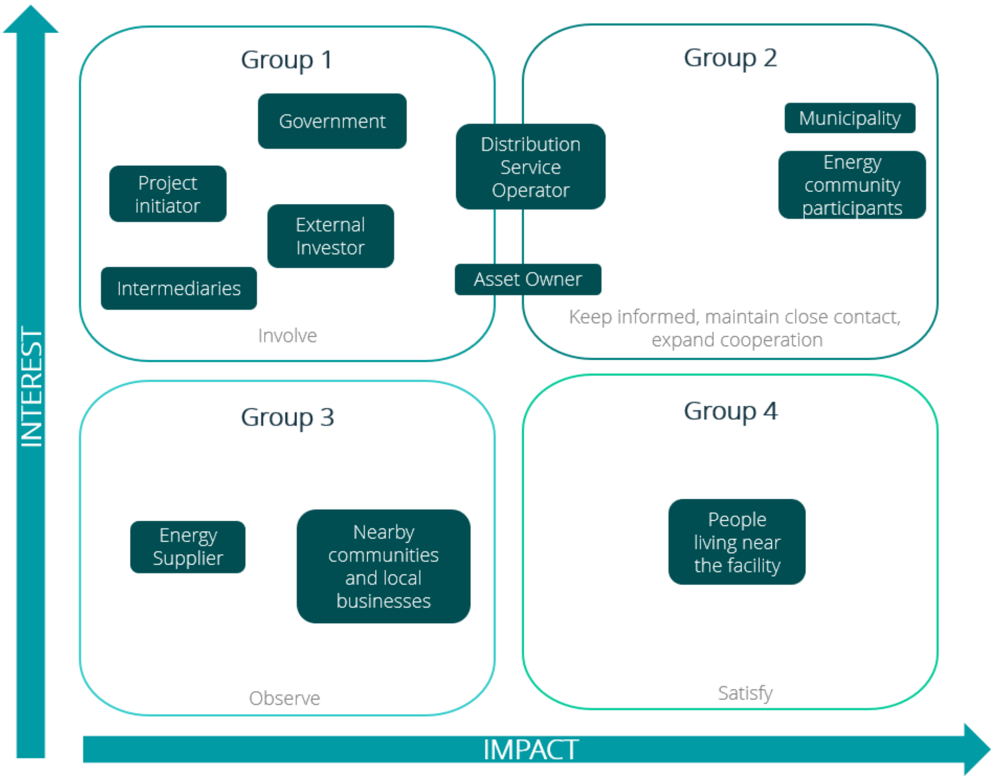

Figure 12: Stakeholders Impact x Interest Matrix of Kökar

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4.3.4. Distinguish stakeholders' impacts into positive/negative

A final step in the analysis was to distinguish the impacts of stakeholders on the energy community and vice versa. To identify those impacts during the stakeholder's consultation, specific questions were included in the survey, as can be seen in Appendix subitem 10.5.1.

Table 8 presents the survey results for Ollersdorf regarding the impact of stakeholders on the community. According to their answers the participants of the energy community will be the most positively affected and no one will be negatively affected by the energy community. The intermediary organisation/project initiator (EnergieKompass in this case) is the one which provides the support for the energy community development. Despite the municipality and the intermediary organisation/project initiator play a key role in disseminating the project, some answers suggested they could also obstruct the energy community development if they are not involved.

Table 8: The impact of stakeholders on the Ollersdorf community according to survey results

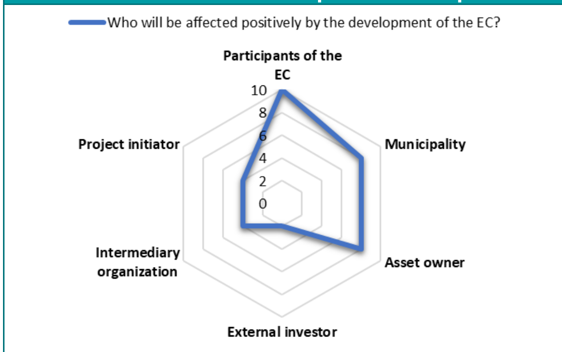
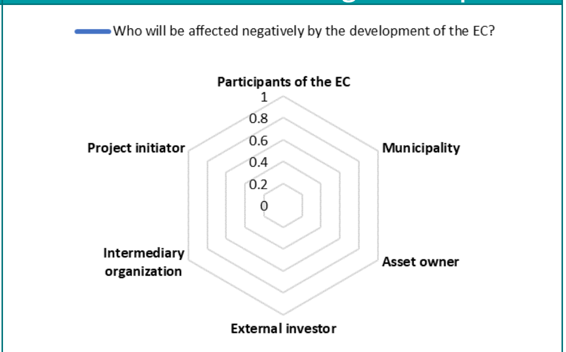
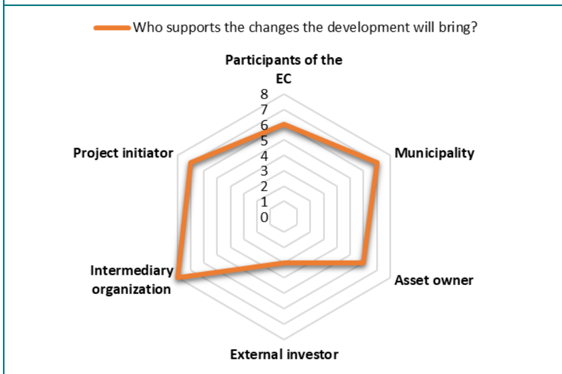
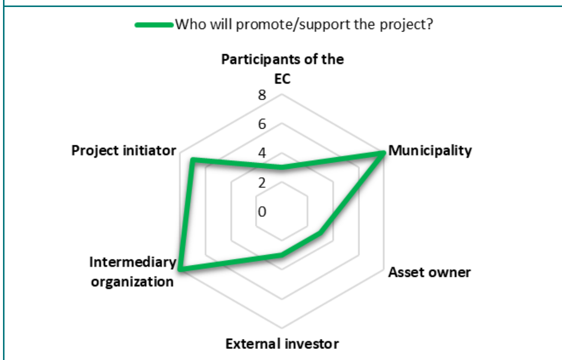
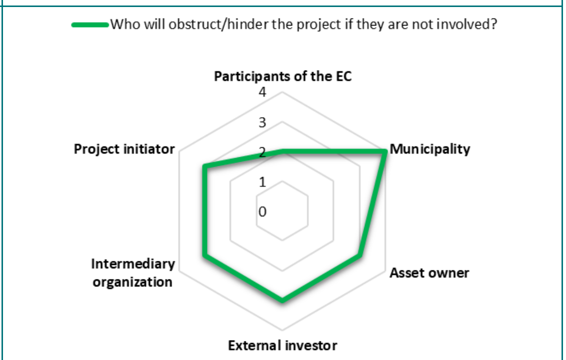
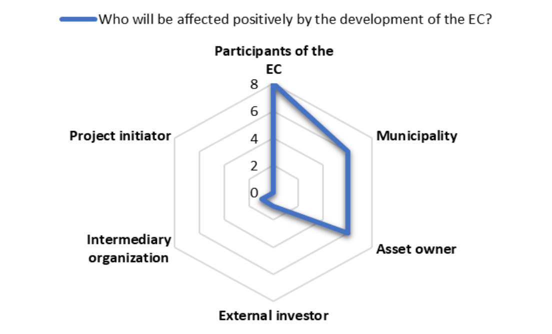
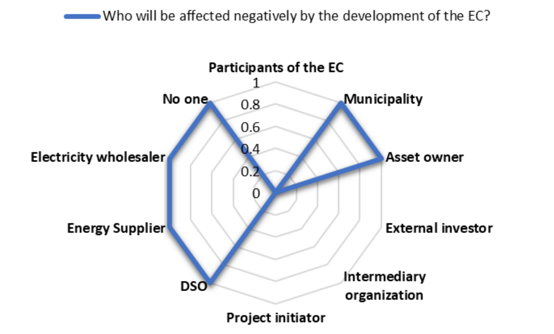
Stakeholders with a positive impact	Stakeholders with a negative impact
	
	
	

Table 9 presents the results for Berchidda regarding the impact of stakeholders on the community according to survey results. Participants of the energy community will benefit the most from the development of the energy community followed by the municipality and asset owners, according to their responses. The municipality is the one who most supports the changes. The project initiators, which in the case of Berchidda are the municipality and the intermediary organisation R2M, are the ones which are most indicated to promote the energy community development, together with energy community participants which were also mentioned. Regarding the negative aspects only a few indications were made. This includes the DSO which were mentioned to be negatively affected by the development of the energy community and to be opposed to the energy community development. Notice that opinion in the participants of the survey cannot be homogenous. For example, in case the Municipality 6 participants members thought that the development of energy communities will affect positively to the Municipality, however 1 thought the it could be negative.

Table 9: The impact of stakeholders on the Berchidda community according to survey results

<table>
<tr><th>Stakeholders with a positive impact</th><th>Stakeholders with a negative impact</th></tr>
<tr><td>
</td><td>
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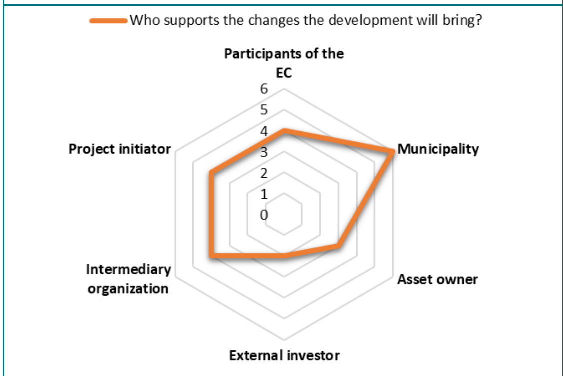
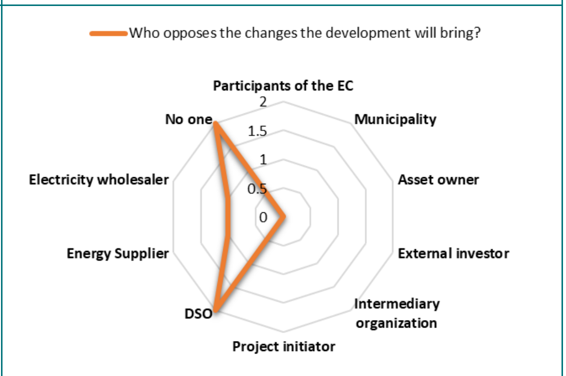
<tr><td>
</td><td>
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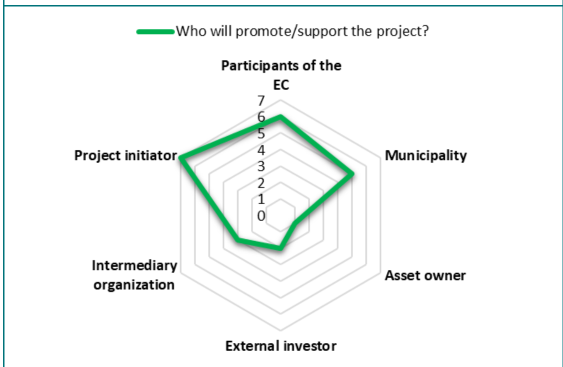
<tr><td>
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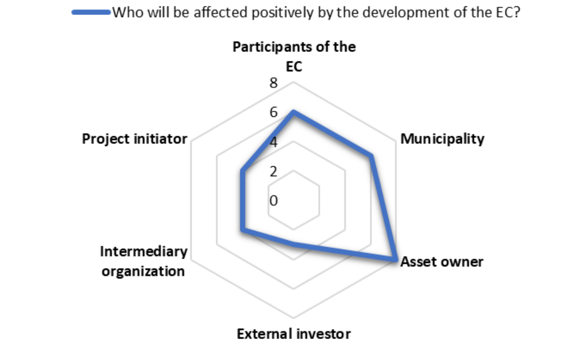
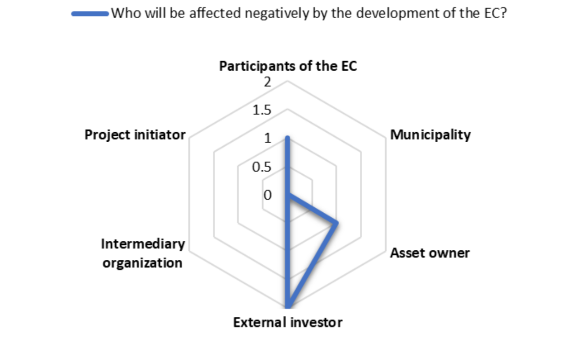
Table 10 presents the results for Ispaster regarding the impact of stakeholders on the community according to survey results. The municipality and the asset owners are the ones most mentioned to be positively affected, supports the changes, and promotes/supports the development of the energy community. External investor is the one most mentioned to be negatively impacted by the energy community as well as to oppose to the changes that energy community will bring. Municipality, asset owner, and intermediary organisation were equally mentioned to hinder the project if they are not involved. Worth mention that negative impacts received only two answers while the positive impact received up to eight answers.

Table 10: The impact of stakeholders on the Ispaster community according to survey results

<table>
<tr><th>Stakeholders with a positive impact</th><th>Stakeholders with a negative impact</th></tr>
<tr><td>
</td><td>
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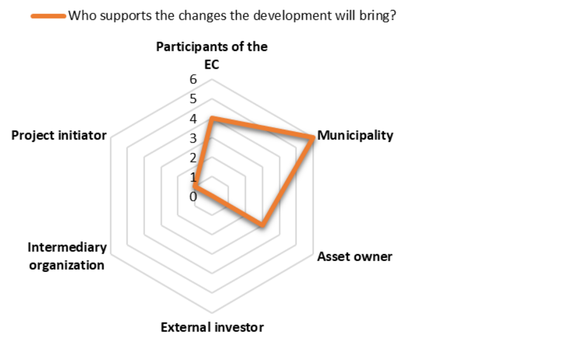
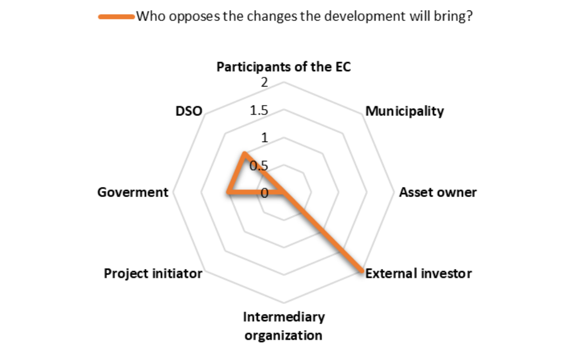
<tr><td>
</td><td>
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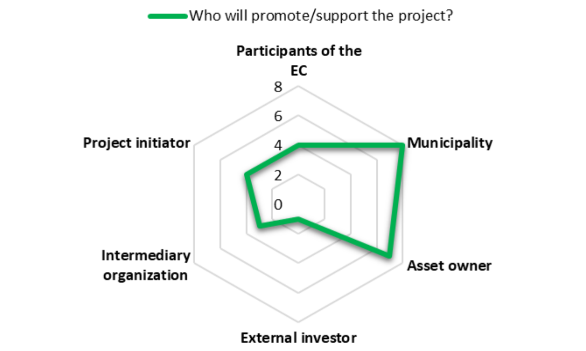
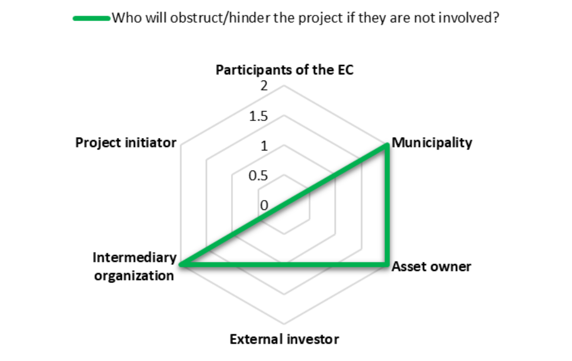
<tr><td>
</td><td>
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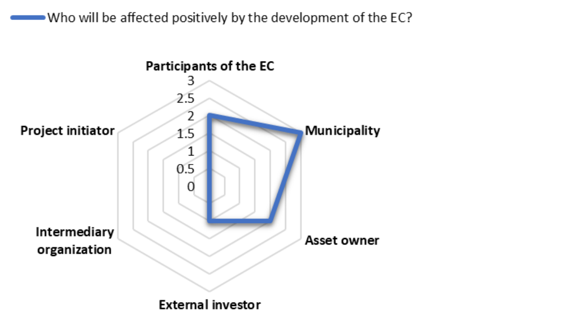
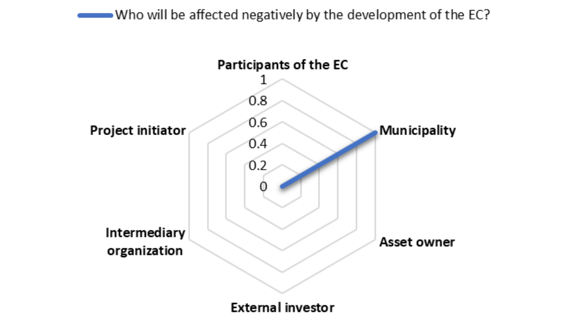
Table 11 presents the results for Kökar regarding the impact of stakeholders on the community according to survey results. The survey participants all agree that the municipality is the one that will be most positively affected by the energy community, but 1/3 also mentioned that it can be negatively affected. The development of the energy community is equally supported by the participants of the energy community, the municipality, and the intermediary organisation (Flexens). However, 1/3 indicated that people living near the installations, participants of the energy community, and the municipality can offer resistance to changes that the energy community will bring. 100% agree that Flexens are the one most indicated to promote the energy community. At the same time 2/3 agrees that the municipality can obstruct the energy community development if not included.

Table 11: The impact of stakeholders on the Kökar community according to survey results

<table>
<tr><th>Stakeholders with a positive impact</th><th>Stakeholders with a negative impact</th></tr>
<tr><td>
</td><td>
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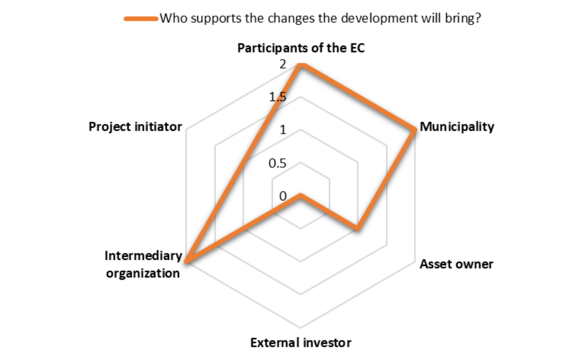
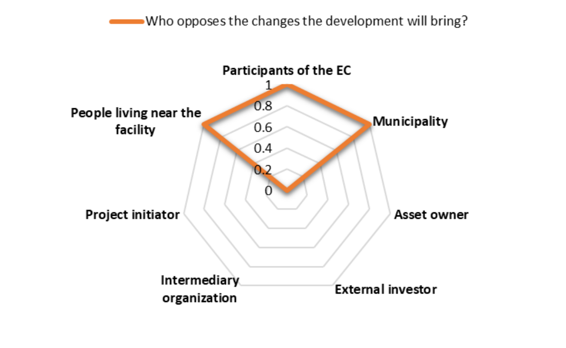
<tr><td>
</td><td>
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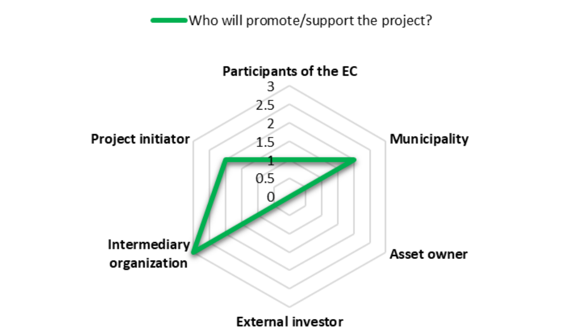
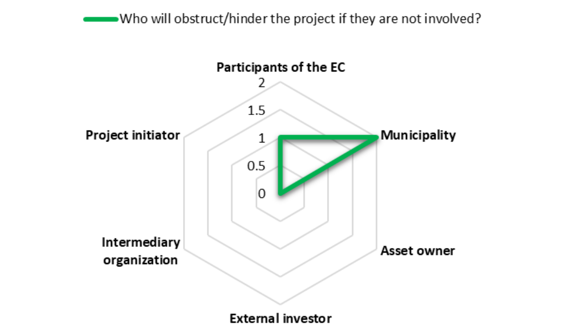
<tr><td>
</td><td>
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4.4. Needs and values

Motivations and desires of stakeholders are often ambiguous and difficult to translate into energy community actions. This step involves setting clear and concise needs and values statements based on their own perceptions. To evaluate these aspects, specific questions were included into the survey made during the stakeholder's consultation meeting (see also Appendix subitems 10.5.2 and 0). Full results of the survey answers are provided in 10.5.7.

Figure 13 summarizes the survey answers in five main motivations the energy community stakeholders stated. The environmental and energy savings were the most prominent in all demos.

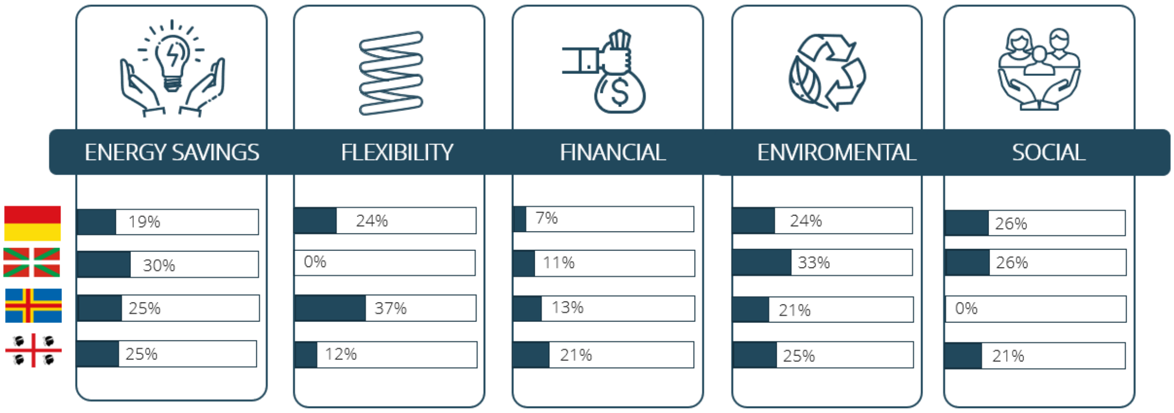

Figure 13: Five needs summarized from the survey results.

Figure 14 shows core values of each energy community, which are a fundamental aspect as they form the driving force behind the energy community and make them stick together. The economic value is the main driver for most of them. However, Ollersdorf's main value is their governance over their assets. Owning their assets and being in control of how to use them is their main priority.

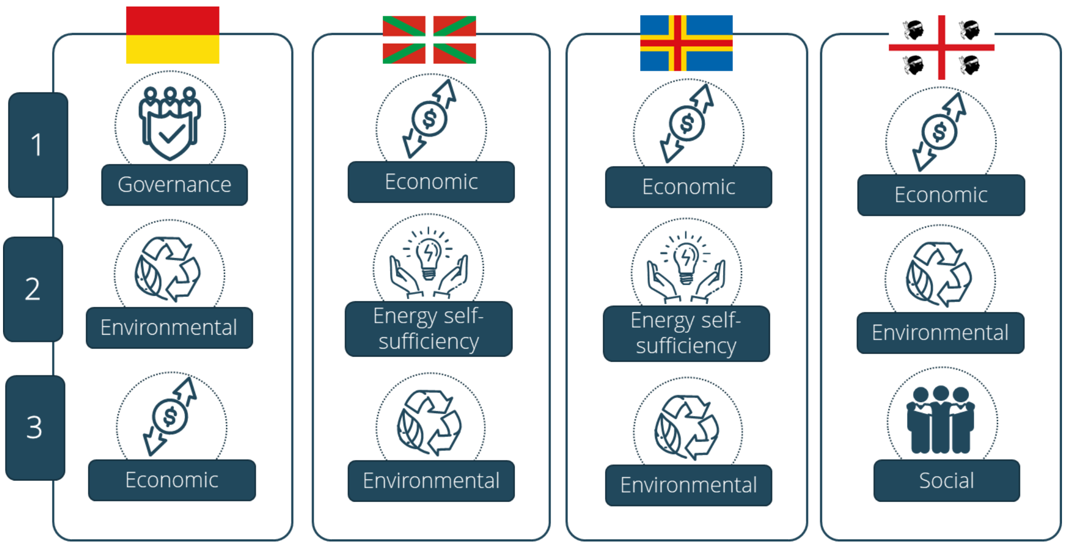

Figure 14: Three main values summarized from the survey results.

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A key observation is that financial aspect is one of the main motivation for the participants to start an energy community however not the only one, but rather a core value that holds them together.

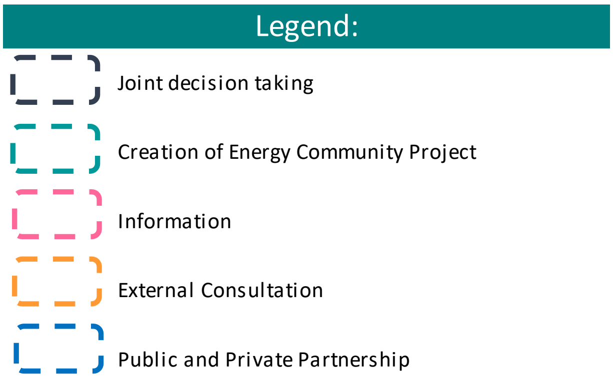
The second step of this analysis was the link between the services with the gains and pain alleviation of an energy community, which will be described in subchapter 6.1.1. The needs evaluation was also essential as a start point for the planning & implementation diagram of the energy community described in subchapter 5.1 below.

5/ Planning & implementation

5.1. Planning & implementation process

As Maria Rosaria Di Nucci et al. (2010) explained, planning & implementation process (PIP) diagrams provide a comprehensive view of how communities engage in the entire process. They outline the decision and design phases, as well as the implementation and operation phases, of the planning and implementation process. Throughout the PIP diagram, barriers and drivers appear at different stages, illustrating the integrative nature of the process. The diagrams also provide some background information about a community's administrative and policy background and highlight the key mechanisms supporting project planning and implementation. By comparing the diagrams for each community, common features became apparent that are crucial to success. Additionally, it illustrates aspects that can differ drastically between communities.

Figure 15, Figure 16, Figure 17, and Figure 18 show the PIP-diagrams developed for each demo site based on current development of the energy community and reviewed with each demo site expert during the stakeholder's consultation meeting.



MAIN ACTIVITIES			
Decision/Planning	**Design**	**Implementation**	**Operation**
EC creation: - definition of scope - definition of priorities	Coordination of EC activities and projects: - EC board	Coordination of operation development	
Supporting role: project co-financing and/or regulation information	Co-design of energy systems	Support with legal requirements and documents	Operation of energy systems
Project co-financing and information about regulation aspects	Technical Design	Coordination of construction (ensuring quality)	Monitoring construction
Predesign/ Feasibility studies (Guarantee of conection)	Creation of EC company	Construction works	Monitoring of energy systems
	Project coordination (ensure follows project plan)	Preliminary investments	Monitoring end-user information
	Support on Design phase (ensure follows project plan)	Financial healthy monitoring	Assets operation and Maintenace
	Development of Business Model and Aggregation plataform	Support on Implemetation phase (ensure follows project design)	
	Investment plan	Technical assessment / Provide guarantee of conection	

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	STAKEHOLDERS	NAME	PHASES: Decision/Planning	Design	Implementation	Operation
INTERCOMMUNITY	Energy community	Ollersdorf Community members	EC creation: - definition of scope - definition of priorities	Coordination of EC activities and projects: - EC board	Monitoring of EC implementation	Monitoring of EC operation / Energy savings
	Asset Owner	Energie Kompass and citizens investors		Financial options assessment	Financial healthy monitoring of EC projects implementaion	Financial healthy monitoring of assets operation
	External Investor	Energie Kompass		Financial proposal plan and design	Preliminary investments	
	Project Initiator	Municipality and Energie Kompass	Predesign/ Feasibility studies (Guarantee of conection)	Project coordination (ensure follows project plan) and Co-design of energy systems	Coordination of operation development	
INTRACOMMUNITY	Municipality	Ollersdorf im Burgland	Project co-financing and/or information about regulation aspects	Support on Design phase		
	FSP/ Aggregators	Energie Kompass		Development of Business Model and Aggregation plataform	Support on Implemetation phase (ensure follows project design)	Monitoring end-user information
	Third parties	Energie Kompass		Technical Design: Solar Power Plant Model	Coordination of construction (ensuring quality)	Assets operation and Maintenace
		Lab act4.energy		Technical Design of optimizition of self-consumption	Support with legal requirements and documents for Solar Power Plant Model	
		University of Passau		Technical Design: Black-out system		
		AIT		Design and development of the local optimization algorithm	Support on Implemetation phase (ensure follows project design)	
MACRO	Financing Institutions					
	DSO	Burglandenergie			Technical assessment / Provide guarantee of conection	
	Licensed Supplier	Netz Burgeland				

Figure 15: Planning & implementation in Ollersdorf

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	STAKEHOLDERS	NAME	PHASES: Decision/Planning	Design	Implementation	Operation
INTERCOMMUNITY	Energy community	Householders	EC creation: - definition of scope - definition of priorities	Coordination of EC activities and projects: - EC board	Monitoring of EC implementation	Monitoring of EC operation / Energy savings
	Asset Owner	Berchidda municipality		Financial options assessment of EC services	Financial healthy monitoring of EC services implementation	Financial healthy monitoring of assets operation
	Project Initiator	Berchidda municipality/ Gridability	Predesign/ Feasibility studies (Guarantee of conection)	Project coordination (ensure follows project plan) and Co-design of energy systems	Coordination of operation development	
INTRACOMMUNITY	Municipality	Berchidda municipality	Project co-financing and/or information about regulation aspects	Support on Design phase		
	FSP/ Aggregators	Gridability		Coordination of datahub and development of Prosumer app	Coordination of Prosumer app and datahub implementation	Monitoring of Prosumer app and datahub operation
	Third parties	Centrica		Development of the multi-energy virtual power plant (MEVPP)	Coordination of MEVPP implementation	Monitoring of MEVPP operation
		Energy4com		Support on legal advice and prefeasbility studies		
		Gridability		Design of Smart Energy Storage Mangement (SESM) and optimisation of electric flows	Coordination of SESM optimisation of electric flows implementation	Monitoring of SESM optimisation of electric flows operation
		R2M		Design of V2G services and public EV charging points	Coordination of V2G and EV charging services implementation	Monitorig of V2G and EV charging services operation
		AEC		Support on energy system sizing and legal entity		
	Contractors	R2M			Responsible for instalation of EV charging stations and heat-pumps	who will operate?
MACRO	Financing Institutions					
	DSO	Berchidda municipality			Technical assessment / Provide guarantee of conection	
	Licensed Supplier	Axpo			Support on aggregation contract for manage storage and monetization of aggregated suplus of energy	

Figure 16: Planning & implementation in Berchidda

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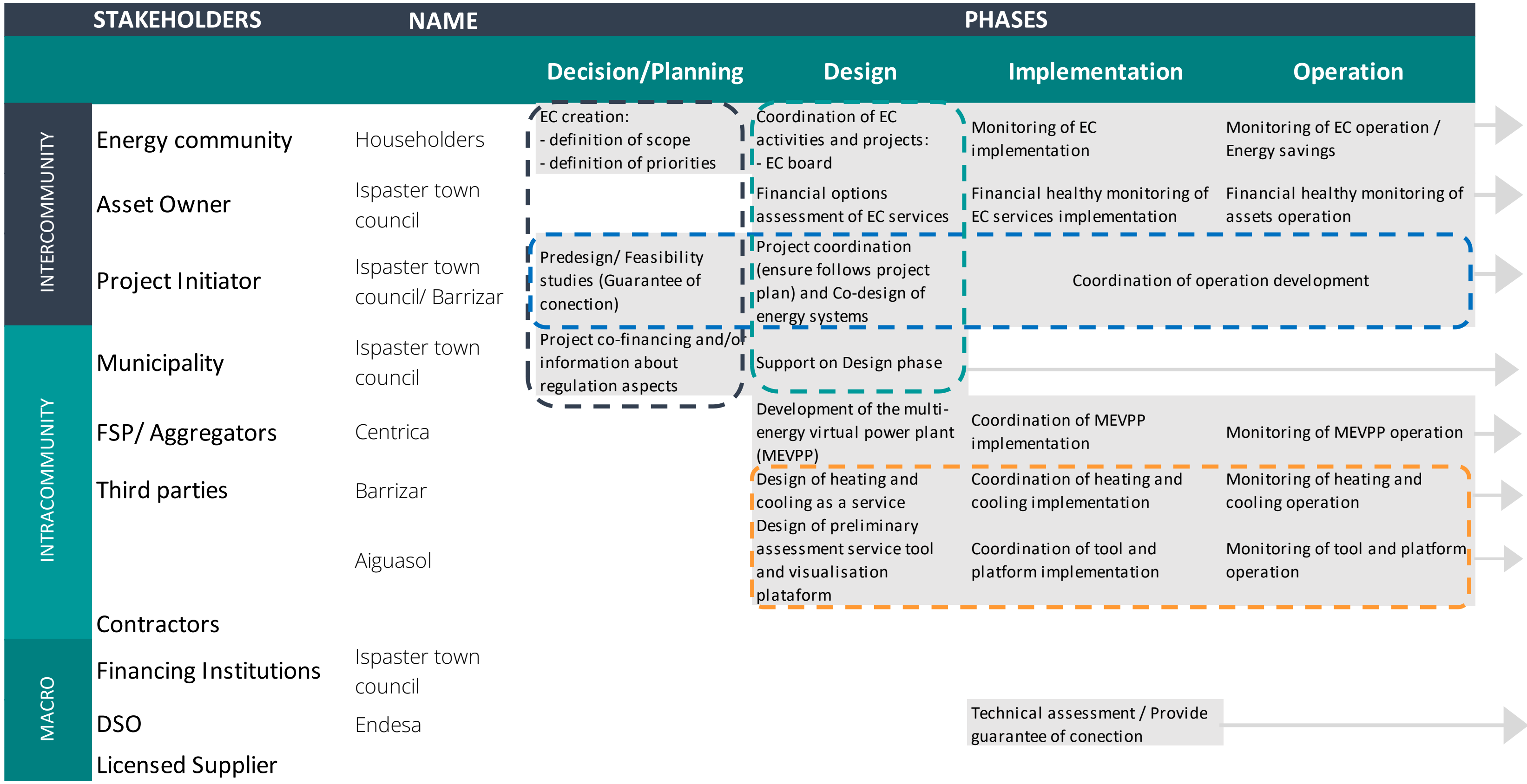

Figure 17: Planning & implementation in Ispaster

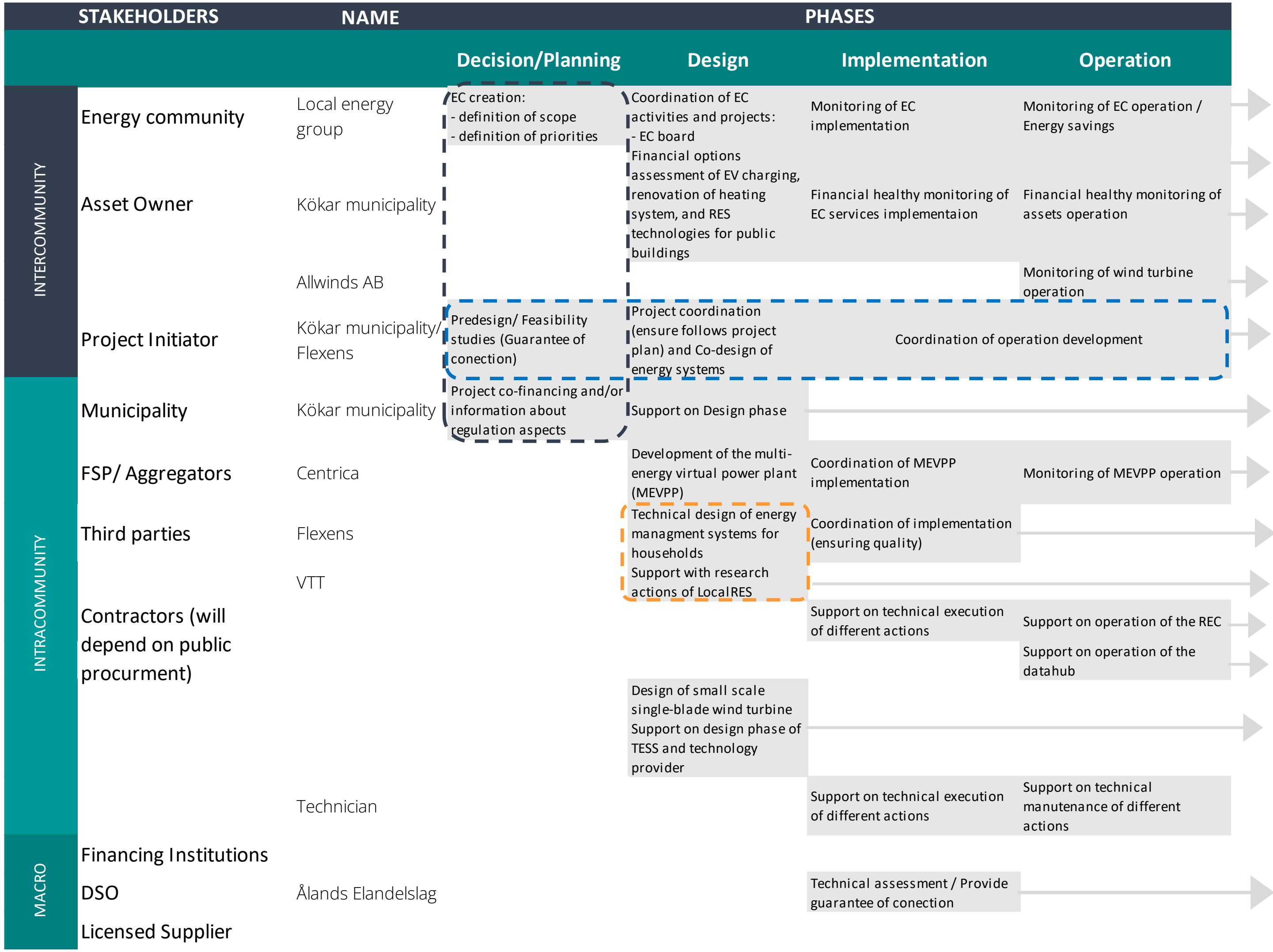

Figure 18: Planning & implementation in Kökar

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In all energy communities the municipalities provided the initial push to engage in projects related to energy savings, e.g. energy-efficient buildings, photovoltaic panels installation at public buildings, and district heating systems. To be able to do that they needed to contract external energy experts. From this public private partnership, the four energy communities started. They are called the project initiators, which encompass the stakeholders responsible for the formation of the energy community. Throughout all phases of a project from decision to operation the municipalities were engaged, identifying key stakeholders from the public and private sphere with whom they need to cooperate, including other public agencies and departments, private developers, utilities, housing associations, research groups, construction companies, etc.

As Maria Rosaria Di Nucci et al. (2010) already pointed out, having public entities playing a leading role has a number of advantages: financial, administrative or legislative changes affecting the original plan can usually be managed better because resulting project delays may not be as financially harmful as this might be the case for private firms. As well as acting in the public interest in terms of energy efficiency and renewable energy sources, they must also act in the public interest in terms of quality-of-life factors affecting communities. Moreover, they can attract large groups of stakeholders interested in participating in ambitious projects.

Energy experts acting as third parties also play a central role in the energy community. Due to their extensive expertise in the energy field and extensive local and regional networks of stakeholders, energy experts often serve as consultants to local authorities. Energy experts also assist in specifying energy standards and are in most cases involved in all phases of energy community development to make sure of the service quality. They also often coordinate with local authorities and funding organizations at the EU and national levels to ensure that funds and subsidies are received to support energy community initiatives. In its turn, funding organisations/agencies often provide a portion of the funds necessary to support energy community initiatives. Thus, a proper mix of stakeholders involving both municipality and third parties and their active involvement has been an important partnership in the formation of the energy communities. As the municipality provided the trust, private parties (third parties) provide the expertise in energy-related activities.

Universities and contractors consist of a vast body of experts such as architects, engineers, monitoring experts etc. Their primary role is to provide expertise in the fields required for designing, planning, and implementing energy community services. Unlike some other stakeholders, they may not be involved throughout the entire process but rather during certain phases of the project. However, that continuous involvement on their part improves the advancement of technology.

The DSO plays an important role in providing the licenses for the energy community technologies to operate. In each energy community they had a different impact. In Kökar the DSO is a cooperative well interested in understanding the energy community goals and needs and in building a partnership with the municipality and the third parties to enable the energy community development. The DSO in Berchidda is owned by the municipality, which provides all the facilities for the integration of new technologies as it is in their own interest. In Ollersdorf and in Ispaster the DSOs are regional utility companies with low to no interest in the energy community development, thus offering no support for the integration of new energy community activities/services.

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It is imperative that the energy community participants (householders and citizens) are proactively involved throughout all phases of the project. They have essential roles as end-users, energy producers, and energy community active participants. As their engagement and participation can be crucial to the successful development of the energy community, it is important to keep them engaged, motivated, and committed throughout the energy community activities development. In Ollersdorf, e.g., they have regular meetings with the energy community participants. In Berchidda they have sensibilization events to keep the energy community participants informed, increase the acceptance, and engage new residents.

5.2. Challenges & opportunities

Due to the need to work with existing infrastructure the main challenge will be access to data. Municipalities only have access to data for facilities that they own. Some municipalities who are in countries with feed-in tariffs will have access to data, but it is likely that they will not know anything about other infrastructure such as storage or smart meters. Generally, the large majority of municipalities will not have access to key data and there are always tensions around accessing data from regulators or from private operators. For example, in Austria, the distribution of shared energy is done by the DSO ex post, not allowing for real-time management based on smart meter data (Frieden et al., 2021). Smart meters may allow energy communities to access real-time data in the future, but data reader devices must be paid for by the communities, and the interfaces are still being developed (Frieden et al., 2021). There are some cities like Lisbon who via their solar map (Solis, n.d.) are also encouraging citizens to self-declare their PV installations. There is another campaign that has just started in the Balkans that is encouraging citizens to produce posters to share information around the PV that they are putting on their private houses (Balkan Solar Roofs, n.d.).

Currently the LocalRES pilot sites work with local private companies. A key challenge will be around trust and the relationships between these private companies and the relationships they have with the homeowners. As mentioned above access to data and clear communication to households will once again be key to the success or failure of this business model. Another potential challenge is how the social inclusion and fuel poverty aspects are dealt with. Post-Covid and the Ukrainian crisis are challenging and municipalities are lacking capacity to properly take care of their responsibilities. Here municipalities can play a key role in providing grants or assistance to poorer households as enablers and facilitators.

Furthermore, managing electricity flows poses a technical challenge for developing new services within the energy community, such as peer-to-peer trading, collective self-consumption, and optimizing electricity flows. The electricity flows of an energy community must be supplied by the same electrical substation for accounting and balancing purposes. Thus, the physical location of some of the energy community participants may offer a barrier to join these energy community services. Figure 19 summarizes specific challenges related to each of the LocalRES communities.

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Cities are increasingly looking for production and consumption to be closer together due to the increasing pressure on the current networks etc.– which is already in your advantages. As many municipalities are currently installing or have previously installed PVs with storage and smart meters, a key opportunity for them will be to be an active member of the community if they have facilities close to private houses. As private houses are often producing excess energy during times when it is not needed i.e., daytime in summer – this could fit in very well with public facilities that require energy during the day and vice versa. This could also allow the energy community to set up business models whereby increased resilience will attract other actors to join i.e., social housing, small businesses. Another key opportunity for the energy communities is to disseminate information and knowledge through the community residents.

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	Legal	Regulatory	Technical	Economical	Social
Ollersdorf	none	One of the most desired service is P2P trading although is not regimented by Austrian law.	• As the DSO is not collaborating it takes more effort for the accomplish some technical task. • Access to EC data from the DSO.	none	none
Ispaster	There is not a legal formation of an EC. This is slowing the LocalRES development as it is not clear yet who is part of the community. Thus, is not clear who is taking the decisions.	Uncomplete legislation, and lack of confidence in the regulatory stability	DSO has a burocratic an complicated process for grid integration. Which demotivates some residents in joining the EC.	Without funding there is low likelihood for investments in other RE-assets than the most commercial such as PV.	Stakeholders related that there are some residents who wants to join the EC, but they´re pursuing the process as too slow. Which is taking more effort from the project initiators to keep them motivated
Kökar	A local resident is legally questioning the project, which is causing serious delay in the LocaRES development. The process still being reviewed by authorities.	none	Most of CO2 emissions come from the transport sector, which is more difficult to be included in the decarbonization plan of the EC.	Without funding there is low likelihood for investments in other RE-assets than the most commercial such as PV.	Residents tend to be skeptical towards external projects.
Berchidda	Lack of knowledge about the proper application of the Italian legal framework	Not clear how the regulatory framework will works under local conditions.	The incorporation of technologies that need high space (e.g., heat pumps) are difficult to be installed due to the topology of the houses.	Stakeholders avoided the idea of external investors for the EC development. Also, without funding there is low likelihood for investments in other RE-assets than the most commercial such as PV.	Difficulty to engage citizens with new technologies to set REC e.g., heat pumps or demand side management devices

Figure 19: Main challenges of LocalRES energy communities

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6/ Services and Business Models

This chapter presents a qualitative analysis of all energy community services followed by the business model propositions in the form of a business model canvas (BMC) for all LocalRES demos.

6.1. LocalRES services overview

6.1.1. Listing the services: qualitative aspects

Energy community services and activities are analyzed qualitatively in light of stakeholders' values and needs. Thus, for each service their contributions to the pain alleviation and for the desirable gains for an energy community have been analyzed. The three pain alleviation aspects are shown in Figure 20, and 5 desirable gains in Figure 21.

Figure 20: Three Pain alleviation aspects analysed for the energy community services.

Figure 21: Five desirable gains analysed for the energy community services.

Table 12 shows the list of services linked with their main contribution, pain alleviation and gains for the energy community following step 2 of the value proposition framework developed in this study.

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Table 12: List of the services with their main contribution, pain alleviation and gains for the energy community

Categ.	SELECTED SERVICES	VALUE CREATION FOR THE ENERGY COMMUNITY: MAIN CONTRIBUTION FOR THE ENERGY COMMUNITY	PAIN ALLEVIATION FOR THE ENERGY COMMUNITY: MEM[1]	MARK[2]	RES[3]	GAINS FOR THE ENERGY COMMUNITY: ES[4]	FLEX[5]	FIN[6]	ENV[7]	SOC[8]
Thermal	Operation of a DH (District Heating) network with RES	Maximize the RES thermal share in the DHN system	■	■					■	
Thermal	Help to balance a DH&C network (thermal demand response)	Adapt the production or consumption profile of users (individual or aggregated) from the DHCN as a response from the network operator to ensure the operation under nominal conditions	■	■	■	■		■		
Thermal	Heating/Cooling as a service (H/CaaS)	- Provide heating or cooling to costumers at the highest efficiency - Ensure thermal comfort	■						■	
Thermal	Power to Heat and Heat to Power (P2H and H2P)	Optimization of the technical performance of a system or the REC	■	■	■	■			■	
Thermal	Building energy management & optimization	Optimise the use of energy systems and appliances in a building while maintaining the comfort and covering the energy needs	■			■	■	■	■	
Electrical	Collective Peak shaving	Avoid peak loads, either at system or grid levels (or both), while the energy needs are covered	■	■			■	■		
Electrical	Collective self-consumption/ REC	Ensure the REC energy needs are covered by self-consuming electricity production of local energy production	■			■	■	■	■	
Electrical	Optimisation of electric flows within the REC	- Minimize energy-systems costs - Maximize self-consumption to make sure that REC electricity generation is used locally - Maximize RES integration and production - Avoid grid congestion		■		■	■	■	■	
Electrical	Demand response (implicit and explicit)	- Balance energy consumption - Increase of grid flexibility and stability - End-user economic savings		■			■		■	
Electrical	V2G services	- Offer flexibility to the grid (within a REC or not) - In isolated systems or systems aiming at being autonomous, maximize the energy independence		■			■	■		
Electrical	Blackout strategies/ Black start	Ensure power supply for the community in case of a blackout scenario	■		■		■			
Electrical	P2P energy trading	- Ease access to renewable energy within the energy community - Promote the use of renewable energy for local consumption	■					■		

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	Aggregated (REC-level) energy trading	- Participating in energy markets as an aggregated agent - Benefiting of the aggregated structure in the participation in energy markets								
	Public EV charging stations	- Promote the use of EVs - Facilitate the access to charging infrastructure								
	Energy storage/ Smart Storage Management System	- Maximize the self-consumption and integration of variable distributed energy resources - Participation in emergency service events or peak shaving - Economic incentives and profits								
	Anomalies detection at REC-level	Detect, minimize and prevent anomalies within the energy systems of a REC (thermal or electric)								
Non-technical	Capitalisation of monitored data	Obtain added value (monetary or not) from monitoring data								
	Preliminary feasibility assessment	- Discard unattractive ideas and choose the best among different alternatives - Provide valuable information to REC members to allow them make informed decisions								
	End-user engagement	Engage end users to actively participate in the activities associated to the REC								
	Support vulnerable citizens reducing risks of energy poverty	Reduce energy poverty within the REC, or nearby the REC								

1	ES	Energy Savings
2	FLEX	Flexibility
3	FIN	Financial revenues
4	ENV	Environmental benefits such as reduction of CO2 emissions
5	MEM	Services which provide mainly benefits for energy community members/ participants
6	MARK	Services which has a market value for external stakeholders
7	RES	Services which increase the resilience of the energy community energy system
8	SOC	Services which contribute to social aspects of the Community

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6.1.2. Clustering of service packages by technology

Figure 22 illustrates the aggregation of services in groups by the technology needed to implement these services in the energy community. This clustering supports the understanding of the link between the services and technology. By evaluating the energy community's current technologies, it is possible to check which services are possible to be implemented. In the other way around as well, which technologies need to be installed to have some of the desired services available.

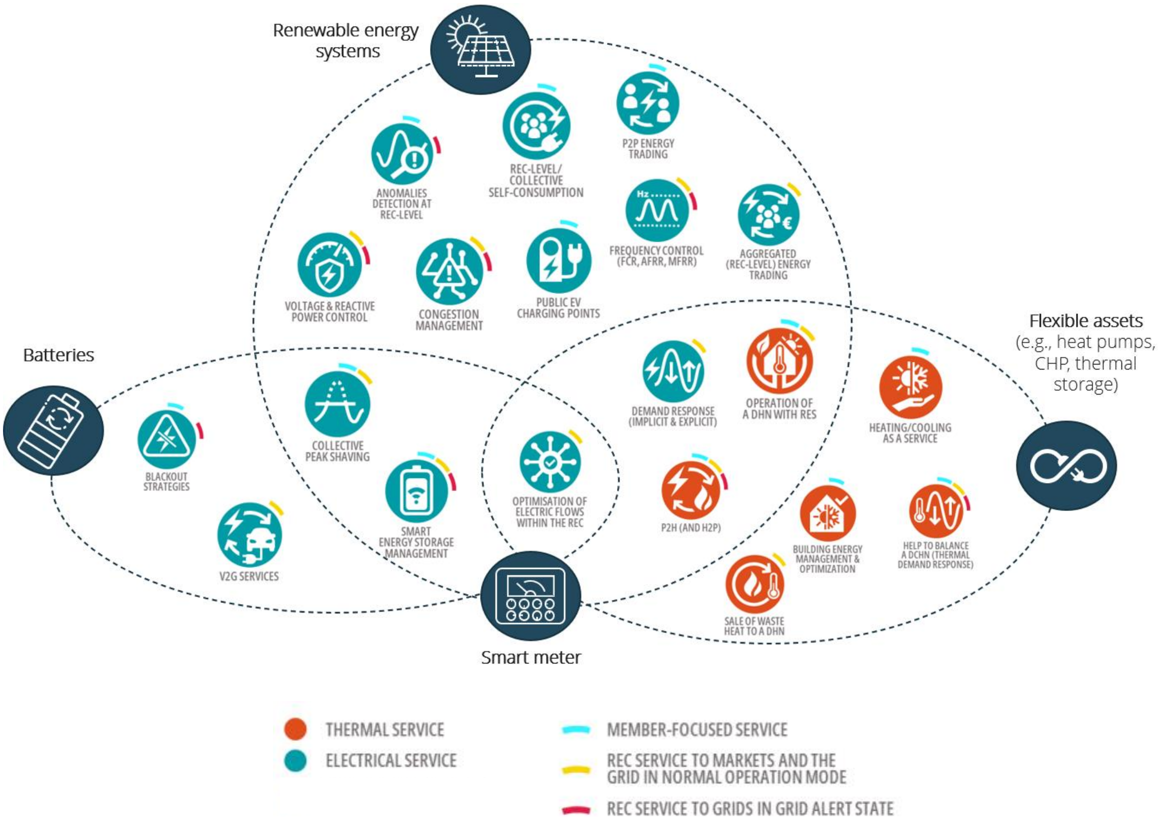

Figure 22: Clustering of service packages by technology

Figure 23 shows for each energy community the services grouped by technology. The services come from Table *5*.

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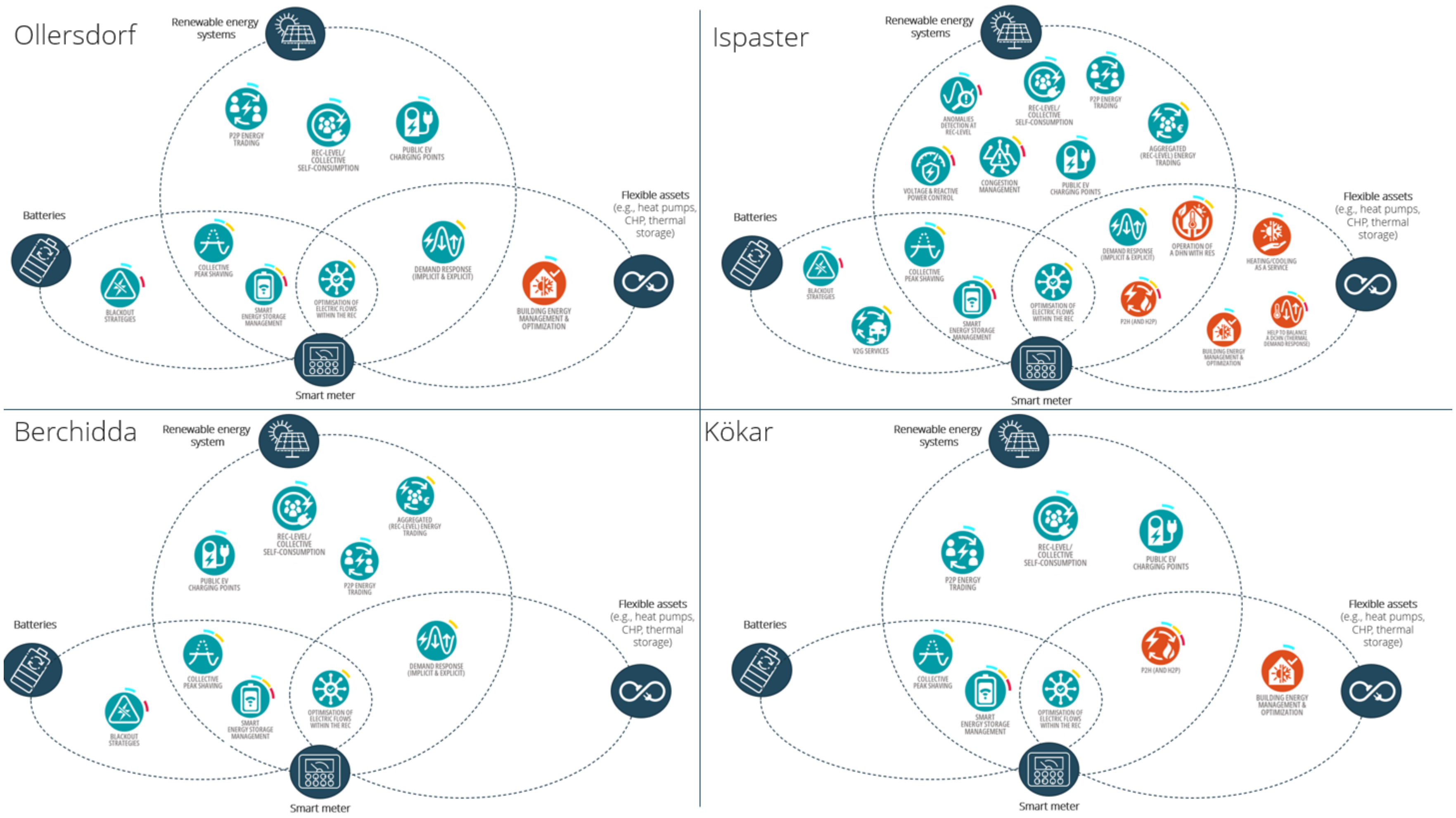

Figure 23: Clustering of service packages by technology of each one of the LocalRES energy communities

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6.1.3. Key service provision

The list of relevant services for the four pilot communities is comprehensive and shows the final stage of the implementation in the future. The implementation and provision of the services is a long-term process and requires different aspects that need to be fulfilled / possible for the service to be offered. Some of these services require a particular infrastructure to be in place or offerings from external partners that are not being provided at the time being. Exemplary for this limitation are services that can be provided to a DSO, while the DSO does not request them or is not allowed to do so, but this will most likely change in the future. Another example is the P2P-trading. Although a service that is envisaged by the community of Ollersdorf to be implemented and in place, this service is not possible within the current Austrian regulation (for more information see deliverable D1.1).

For this reason and because the service provision by the communities must be seen as a mid-term to long-term process, the communities identified services that are key and that will be provided to members in short term. These are part of the initial implementation phase that is also being covered by the duration of LocalRES. During discussions of Task 1.4 with communities' representatives and within local community workshops in Task 1.5, key services resp. a minimal service portfolio has been defined for each of the communities and are listed in Table 13.

Table 13: Overview of key services

	Thermal		Electrical				
Kökar	BUILDING ENERGY MANAGEMENT & OPTIMIZATION	P2H (AND H2P)			BLACKOUT STRATEGIES	DEMAND RESPONSE (IMPLICIT & EXPLICIT)	
Berchidda	BUILDING ENERGY MANAGEMENT & OPTIMIZATION	P2H (AND H2P)		PUBLIC EV CHARGING POINTS			
Ispaster	BUILDING ENERGY MANAGEMENT & OPTIMIZATION	P2H (AND H2P)	REC-LEVEL/ COLLECTIVE SELF-CONSUMPTION	PUBLIC EV CHARGING POINTS			
Ollersdorf		P2H (AND H2P)	REC-LEVEL/ COLLECTIVE SELF-CONSUMPTION		BLACKOUT STRATEGIES		OPTIMISATION OF ELECTRIC FLOWS WITHIN THE REC

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6.2. Applicability assessment

The following chapters explain which key services will be applied in the communities.

6.2.1. Building energy management and optimization

One of the most comprehensive solutions provided by the communities as a key service is the energy management and optimization of the buildings. The provided functionality to the stakeholders is primarily the decrease of the energy consumption and avoidance of energy wasting. The resulting main benefit to the stakeholders is increased energy efficiency and energy savings. The service is of key importance for the renewable energy communities as, following the energy efficiency first principle, energy efficiency is seen as the main resource of the European Union[2] and in the planning and implementation process of energy communities the energy demand needs to be reduced first before measures for local energy generation are being planned and implemented.

The service and its implementation are complex and go far beyond the information system which forms the core of the service. Also, based on the local potentials and conditions as well as on the scope of implementation, the extent, and assets necessary to provide such solution differ significantly. The implementation in other communities will require the involvement of energy planners or building services engineers to receive a tailored-made solution. In the LocalRES communities this service is being implemented as a comprehensive system including energy generation, storage, controlling systems and building automation. Obviously, energy efficiency measures in communities will require actions going far beyond the scope of an energy community (e.g. insulation and replacement of building construction elements during refurbishment).

The allocation of monetary benefits to this service is hardly possible since its performance and functionalities are embedded in the operation of the whole system. Non-monetary benefits are mainly environmental, by reducing the amount of fossil fuels needed for space heating and domestic hot water (DHW) preparation, and social by ensuring or increasing the comfort of the tenants. The application of the service will vary significantly in other communities. In any case, considering this service in the approach of future energy communities is strongly recommended.

6.2.2. Power-to-heat

The application of this solution is in most cases combined with the previous service of building energy management and optimization as a part of the bundle of thermal-energy-related solutions. The main target in this case is the replacement of fossil fuel-based heating appliances with appliances that are able to be supplied by renewable energy sources. The planning and design of these measures needs to be done in a comprehensive way by assessing possible sources that can be utilized for space heating and DHW preparation. In case, power-to-heat is identified as suitable solution, further integration and combination with other measures in the energy community is

[2] For further information about the energy efficiency first principle see EC website https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-first-principle_en

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recommended. This enhances the functionality specter that the solution can provide, e.g. in combination with demand-side management, building or community energy management.

The application of this solution in other communities will require, as in the case of the building energy management service, the involvement of energy planner or building services engineer. An assessment for the best solution of thermal energy provision to local buildings should be performed ahead of the design and implementation in any case.

6.2.3. Optimization of electric flows

This service will provide stability to the distribution grid. These services can be provided to the DSO in the future. The main prerequisite for the provision of this service is the availability of an offer from the DSO side, which is not the case at the time being. The infrastructure consists of an IT equipment: hardware (sensors, server) and of a software solution. In case there are financial incentives available from the DSO, this could enable a new revenue stream for the community.

As long as no public incentives exist or are not possible, other means of renumeration can be used, including: tokens, free EV-charging, discounts in local businesses and use for collective measures.

6.2.4. Collective self-consumption

The main aim of this service is to reduce the delivery of electricity or heat from external sources outside the community. The main asset necessary for this solution is the IT infrastructure, that in the case of the municipality of Ollersdorf is also being developed for the optimization of the electric flows (see the following chapter). The collective self-consumption service is one that has to be provided by each energy community in order to be effective. To have a system in place, that is being owned and performed by the community and not by an external stakeholder (i.e. DSO), is seen as the next step in the development and operation of energy communities. In Ollersdorf, a software solution has been developed and is being tested in the project. For more information about this service, please refer to its description in deliverable D1.2.

6.2.5. Demand response

Demand response is an additional service that allows increasing the share of locally-generated energy to be locally consumed, and should thus lead to the minimization of the demand from external sources. Obviously, it will need an (inter-)action from the prosumers' side. The willingness might in this case differ significantly. This is one of the pre-requisites for such a system to be applied. The infrastructure will not differ significantly from the one necessary for the optimization of energy flows or self-consumption.

6.2.6. Public EV-charging

Two communities (Berchidda and Ispaster) will provide public EV charging as a key service. The service provides infrastructure in the community that will be necessary sooner or later anyway, and also helps to promote EVs within the municipality. The measure is in some cases being combined

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with the procurement of EVs for the municipality. The infrastructure is then used by the municipality itself but is also free for use for the inhabitants of the municipality generating revenues for the community by sales of electricity to third parties. The implementation of the service is nowadays not a complex issue anymore since a variety of offers exist on the market already.

The service will provide basic structures and starting infrastructure for the use of EVs in the community and needs to be seen as a first step in the process of EV rollout that is likely to grow much more in the future. The capital costs consist primarily of the charging infrastructure. Full integration and functionality within the community energy system is provided by inclusion of the system into other services such as the optimization of electric flows within the community, energy management and optimization or demand response systems.

6.2.7. Flexibility Reservation for blackout recovery strategies

For the service of blackout strategies, certain technical requirements, which translate to investment and running costs correspondingly, need to be fulfilled. Technical details of reservation optimization will be covered in D3.6, whereas the cost problematic is sketched in the following. It should also be noted, that in the current legal situation, it is impossible to operate a power grid island without the permission of the grid operator.

In order to technically black start a power grid island, grid-forming resources, such as spinning diesel generators or –in the case of highly renewable systems– grid-forming converters are required to operate the power grid in an islanded mode during a wide area blackout. Those devices require initial investments as commonly installed PV inverters do not provide grid-forming capabilities. Their size depends on many factors and thus the calculation of costs is highly case-dependent.

To reduce the initial investment costs for community battery storage systems to supply energy during blackouts, user flexibility in the grid region could be reserved to support the grid-forming resources over longer timespans (15min - 24h/48h). This is especially the case for grid-forming converters, which are usually coupled with varying wind or solar energy sources or are operated with an energy-limited battery storage system. As shown in Figure 24, smart converters have a fast reaction time to stabilize voltage and frequency, whereas user flexibility has a much higher capacity in terms of power and energy. As the reservation of flexibility (i.e., given state of charge setpoints at specific times), does not necessarily align with the goal of other services, such as trading energy on national-scale markets, this reservation is coupled to certain reservation costs (or missed revenues).

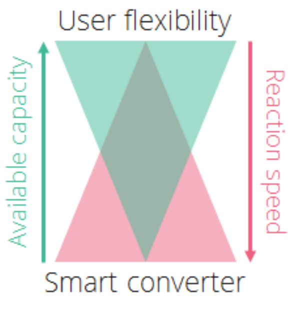

Figure 24: User flexibility vs. Grid-forming smart converter

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Beside battery storages systems, another type of user flexibility is load curtailment, meaning that certain loads will be disconnected in case of islanding operation or undersupply. In order to optimize the overall energy situation in islanded mode, those load curtailments are also bound to costs, i.e., the price a user would pay to ensure that even in blackout situation, its load is still served by community level generation and flexibility.

Generation costs for renewable generation such as PV system are neglected in the case of a blackout as they would not be able to sell their energy without grid-connection. For the rare and comparable short case of islanding operation, their energy is used as good as possible as only local energy source. However, the costs for filling batteries state of charge level during grid connected state to be capable of withstanding blackouts are considered and is thus part of the running costs of flexibility reservation.

In the flexibility reservation optimization, the trade-off between cost for energy storages (=missed revenue) and filling up these energy storages is contrasted with the costs a user is willing to pay for not curtailing its load. A short survey, conducted in Ollersdorf, revealed the willingness to pay for not facing a blackout. 43% of the participants are not concerned about blackouts or consider them to be part of the duties of the grid operators and thus do not want to pay more for their electricity to establish a blackout strategy as described in this project. Another 43% would pay up to 10% more and the remaining 14% even up to 20% on top of the electricity price.

6.2.8. Providing services by MEVPP

From the LocalRES developments within the activities in WP3, Centrica is responsible to develop an innovative multi-energy virtual power plant (MEVPP). The focus of this MEVPP is to define strategies and optimal dispatch that energy communities can trade energy in different markets and provide various services. These services can be categorized into three groups: local, DSO and ancillary services. Local services provided by the MEVPP is referring to local energy and flexibility services provided for community, such as collective peak shaving and collective self-consumption. While DSO services is focusing on providing flexibility to local DSO and/or external grid/DSO. Voltage control and congestion management are the services within DSO category. Moreover, MEVPP can provide the opportunity to energy communities to provide services to TSO and participate in energy markets, such as frequency control. To this end, the services provided by MEVPP do not only bring benefits to energy communities, but also it can be beneficial to system operators (DSO and TSO).

6.3. Business Model

The energy community will need to establish a legal form to facilitate the equal ownership rights of participants. A legal form is a way to formalize the energy community initiative. Although, many citizen-led initiatives do not necessarily require a legal form, such as collective purchasing, crowdfunding and collective self-consumption, a legal form is required when developing production, supply, or infrastructure projects (Compile, 2022). Also, the legal form can provide several benefits: legal protection, investments facilitation and access to financing, access to market

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participation, and governance facilitation (Compile, 2022). According to the European energy community definitions (REC/CEC), each member state can choose their legal form. The most common legal forms according to Compile (2022) are:

- **Free association, Clubs, not for profit entities:** these forms usually have a light administrative and management procedures. But they often do not allow to make profit from own activities.
- **Limited Liability Companies:** are usually simple collective contracts with a high degree of flexibility and adaptation to the current energy community activities. The flexibility can on the other side become a risk regarding democratic governance practices as the roles and responsibilities are usually not equal.
- **Foundation and Trusts:** most foundations fall somewhere between non-profits and for-profits, and usually serve a purpose other than economic gain.
- **Cooperatives:** although the cooperative legal form is flexible and provides an equal share of governance, it can bear a lot of administrative effort.

There are different business model archetypes that encompass the current available legal frameworks (as Table 4 summarized). The most important aspect to consider when choosing the most suitable business model archetype is that the chosen model will automatically have an impact on the ownership of the energy community.

In the survey stakeholders were asked which type of business model they would consider more suitable for their energy community (subitem 10.5.3). Results showed that cooperatives are the most desirable business model archetype within the LocalRES communities followed by local energy company, and community collective generation. Ollersdorf and Berchidda already have a cooperative legally formed in which the new energy community participants will be able to join. Ispaster and Kökar still did not have a business archetype legally set up. The stakeholders' answerers indicate that in Ispaster they would equally prefer to form a cooperative or a local energy company. In Kökar, they would rather have a cooperative and as a second option a local energy company or a community collective generation. Overall, there are not many differences between the preferences for any model. This means the decision on which type of the form can be made dependent on other aspects, such as organizational effort, financing possibilities, risk sharing, etc.

Archetypes form the foundation of an energy community formation, while a BMC is the detailed description of how an organization's activities are built. The BMC outlines nine segments which form the building blocks for the business model in a concise way. During the stakeholder consultation meeting the stakeholders were asked to design a Canvas for their energy community. Figure 25, Figure 26, Figure 27, and Figure 28 presents Canvas for each one of them.

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Key partners

- Community members
- Municipalities and public entities
- Service providers
- Technology manufacturers
- Technical know-how providers (engineers, lawyers, accountants, etc.)
- External investors
- DSO and other network operator

Key Activities

- Community investment
- Local generation and supply
- Aggregation
- Services provision
- System operation
- New members recruitment

Key Resources

- Members
- Physical conditions
- Available funding
- Regulatory framework
- Public incentives
- Project champion (initiator)

Value Propositions

- Self-governance
- Environmental value
- Economic value
- Social value
- Energy self-sufficiency
- Distribution of costs and responsibilities

Customer Relationship

- Personal and direct contact

Channels

- Face-to-face meetings
- REC plataform

Customer Segments

- Households
- Small and medium-sized enterprises (SMEs)
- Public entities

Cost Structure

- Technical and economic feasibility studies
- Planning and licensing costs
- Capital costs for building and installing assets
- Public grid usage costs
- Reinvestment costs to maintain, improve and increase the existing infrastructure
- Procurement/Purchasing costs
- Outsourcing costs

Revenue Streams

- Sale of community members' shares
- Sale of energy to other consumers
- Sale of generation surplus
- Sale of aggregated demand flexibility
- Subsides or long-term contracts between the government and renewable energy producers

Figure 25: Ollersdorf Business Model Canvas. Adapted from: (F.G. Reis et al., 2021).

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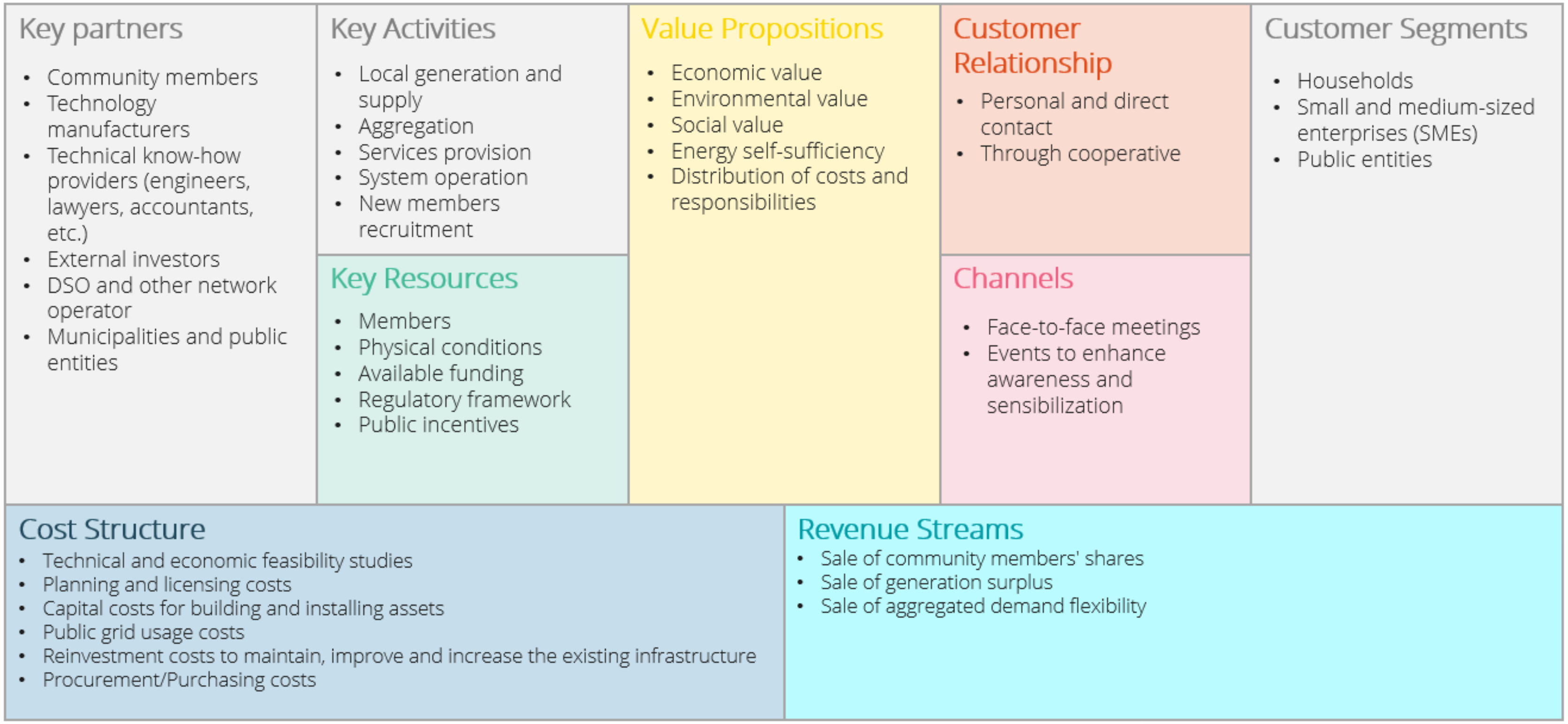

Figure 26: Berchidda Business Model Canvas. Adapted from: (F.G. Reis et al., 2021).

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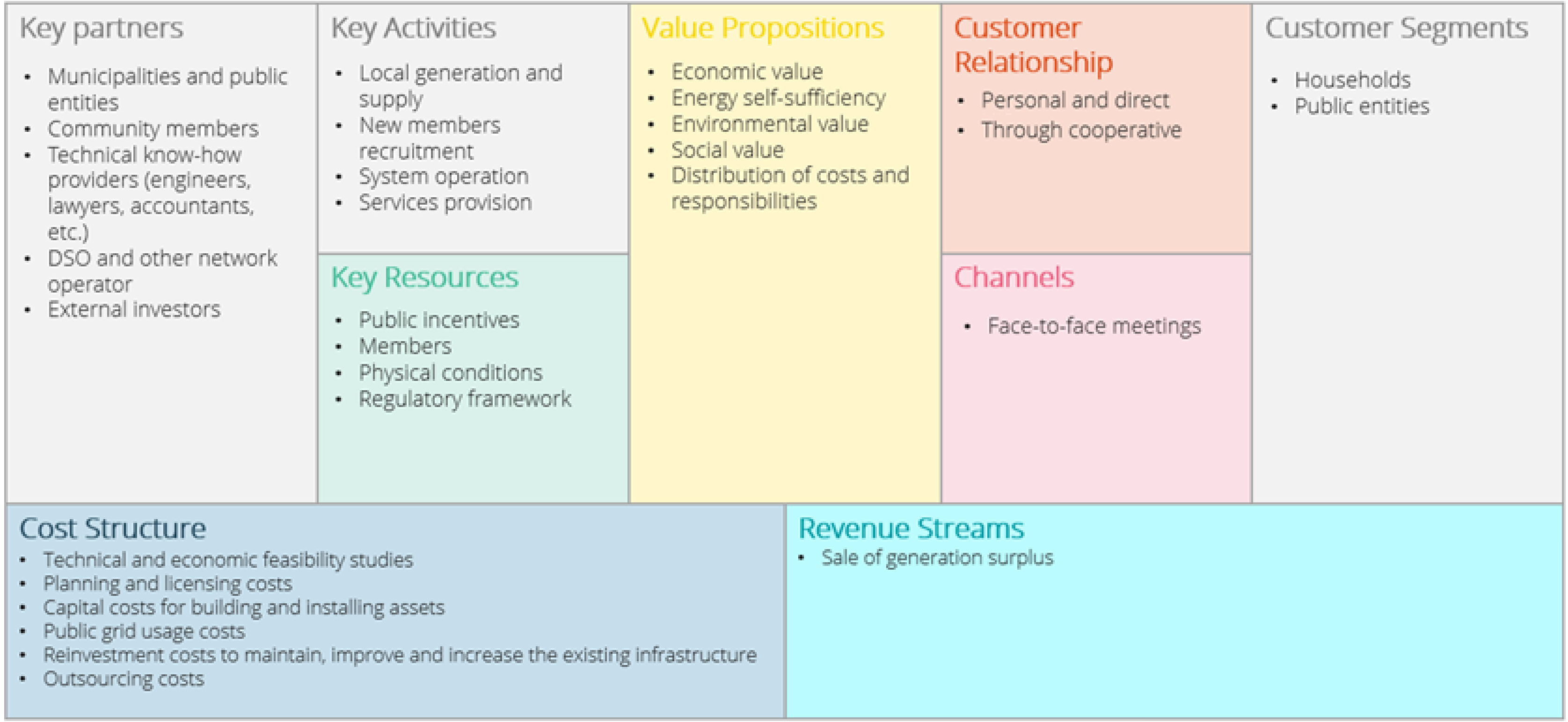

Figure 27: Ispaster Business Model Canvas, Adapted from: (F.G. Reis et al., 2021).

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Key partners

- Municipalities and public entities
- Community members
- Technology manufacturers
- Technical know-how providers (engineers, lawyers, accountants, etc.)
- External investors
- DSO and other network operator

Key Activities

- Local generation and supply
- Aggregation
- Services provision
- System operation
- New members recruitment

Key Resources

- Members
- Physical conditions
- Available funding
- Regulatory framework
- Public incentives

Value Propositions

- Economic value
- Environmental value
- Energy self-sufficiency
- Social value
- Distribution of costs and responsibilities

Customer Relationship

- Personal and direct contact

Channels

- Face-to-face meetings

Customer Segments

- Households
- Small and medium-sized enterprises (SMEs)
- Public entities

Cost Structure

- Technical and economic feasibility studies
- Planning and licensing costs
- Capital costs for building and installing assets
- Public grid usage costs
- Reinvestment costs to maintain, improve and increase the existing infrastructure
- Procurement/Purchasing costs
- Outsourcing costs

Revenue Streams

- Sale of generation surplus
- Subsides between the government and renewable energy producers
- Sale of aggregated demand flexibility (in the future)
- Sale of energy to other consumers (in the future)

Figure 28: Kökar Business Model Canvas. Adapted from: (F.G. Reis et al., 2021).

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6.3.1. Key partners, activities and resources

The communities have similar key partners, activities and resources. The main difference between them is their level of importance. Ollersdorf and Berchidda, for instance, place greater emphasis on their community members than on the municipal government. Most likely this is because they already have an energy community in place and are in the process of gathering more members. While the energy community in Ispaster and Kökar is not yet a fully formed entity, the municipality is still playing a key role in its development. The main key activity between all of them is local energy production and consumption. While other activities might be present, they are not as representative as the energy generation. The only exception is Ollersdorf which mentions the community investment as the main activity. This might be the result of the higher development grade of the community. In this way, it can be seen that the members' participation importance increases as energy community development goes on. Such activities require key resources, including: 1) members who wish to participate and investors willing to finance them; 2) a physical location for installing generation and storage equipment, as well as infrastructure (net meters, distribution networks, heat pumps, etc.); 3) the regulatory framework, which defines the role of local DSOs, aggregators, and potential energy community participants; 4) the long-term financial resources to support the implementation of the project throughout its lifetime; and 5) demand flexible loads to exploit demand-side-management (F.G. Reis et al., 2021).

6.3.2. Value proposition

In general, the main value proposition of energy community is the opportunity for end users to participate in the electricity generation process as well as increase local generation and self-consumption. Most end users have limited investment funds and their participation may be hindered by an economic barrier. Therefore, the energy community participants place major value on economic value since it is their primary concern. This is also the reason, why the municipality involvement places some security as they could assume the risk of a failure investment. A more detailed analysis of the values was already presented in the subchapter 4.4.

6.3.3. Channels, Customer relationships and Customer segments

In LocalRES energy communities direct and close relationships are the main channels of communication. In Berchidda events to raise the sensibility of the residents regarding the importance of the energy community have been mentioned. In Ollersdorf, participants are planning to have indirect communication through the aggregation app that is currently being developed, and a common space where all the data related to the energy community will be fully available for all the residents is being built up. Both communities stressed the importance of raising awareness and providing information about the energy community. Thus, information and knowledge are key factors for increasing the participation of end-users in the energy community. Overall, the customer segments are the different groups of people or organizations the energy community aims to reach and serve. This includes users who might not generate revenues, but who are necessary for the

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business model to work. A more detailed analysis of the stakeholders and which priority and role they have were already discussed in subchapter 4.3.3.

6.3.4. Cost structure and Revenue streams

Costs arise from the creation and delivery of value, the maintenance of customer relationships, and the generation of revenue. When defining key resources, key activities, and key partnerships, these costs can be better calculated. Overall, an energy community business model includes fixed (e.g., technology and land acquisition) and variable costs (e.g., monthly operation costs). Payments for public transportation and electricity distribution and/or transmission must also be included in use-of-system fees.

Energy communities generate revenue primarily through the sale of energy, energy savings, and e-mobility services. Government subsidies and incentives to promote renewable energy projects may also be compromised. Shares of ownership, surplus energy sold to other community members, external retailers, reserve and ancillary services sold to system operators must also be considered revenue sources (F.G. Reis et al., 2021).

6.4. Financing options

The financial securing of the energy community activities is the main concern for the stakeholders. Specially because most of the citizens are not willing to invest their own money on collective purchases, but they would rather provide their rooftop and/or own space to produce renewable energy for the community. This is not the case for alternative heating systems and electric cars, since these have been identified as investments the energy community participants are willing to do. Thus, collective activities with higher investments have the probability of having more success if the municipality is in charge and willing to take all the financial risks.

There are many different financial models and financial options for energy communities. Figure 29 provides an overview of the most common financial options that energy communities may consider while financing their activities and projects. Not all financing models might be available to all energy communities. Other options available for energy communities to raise financial assets are:

- **Green bonds:** as a regular other bond, a green bond is a fixed-income financial instrument for raising capital from investors through the debt capital market. The label "green bond" distinguishes it from regular bonds, which promise to use funds raised for financing or refinancing "green" assets, projects, or business endeavors.
- **Energy service companies (ESCOs):** In this scheme through a local energy supply contract an ESCO supplies energy (usually electricity or heat) and is paid for the quantity of energy supplied over the term of the contract. In exchange for payment from the energy savings, energy performance contracts guarantee savings for a set period (LECo, 2019). For example, in Finland an ESCO-contract was formed for eight cities, consisting of schools and other large municipal buildings. The total cost was approximately € 480,000, with an estimated annual savings of about € 74,000. Overall, It has been found that the ESCO model

is reliable, cost-effective, and energy-efficient for renovating properties according to the municipality (LECo, 2019).

- **Tax incentives:** Local, regional, and national tax relief can be used to set incentives. Investments in energy efficiency or renewables can also result in tax exemptions, such as income tax reductions, for private individuals or businesses. Yet, tax systems around Europe have not yet embraced these options. The existing policy and financial networks tend to favor large schemes (LECo, 2019).
- **Feed-in tariffs:** it is a feed-in tariff support to produce electricity based on renewable energy. Most common form of revenue pursued by individuals and energy communities.

The last two options are being listed for the sake of completeness, in a post-subsidy era, theses financing instruments are likely to phase out.

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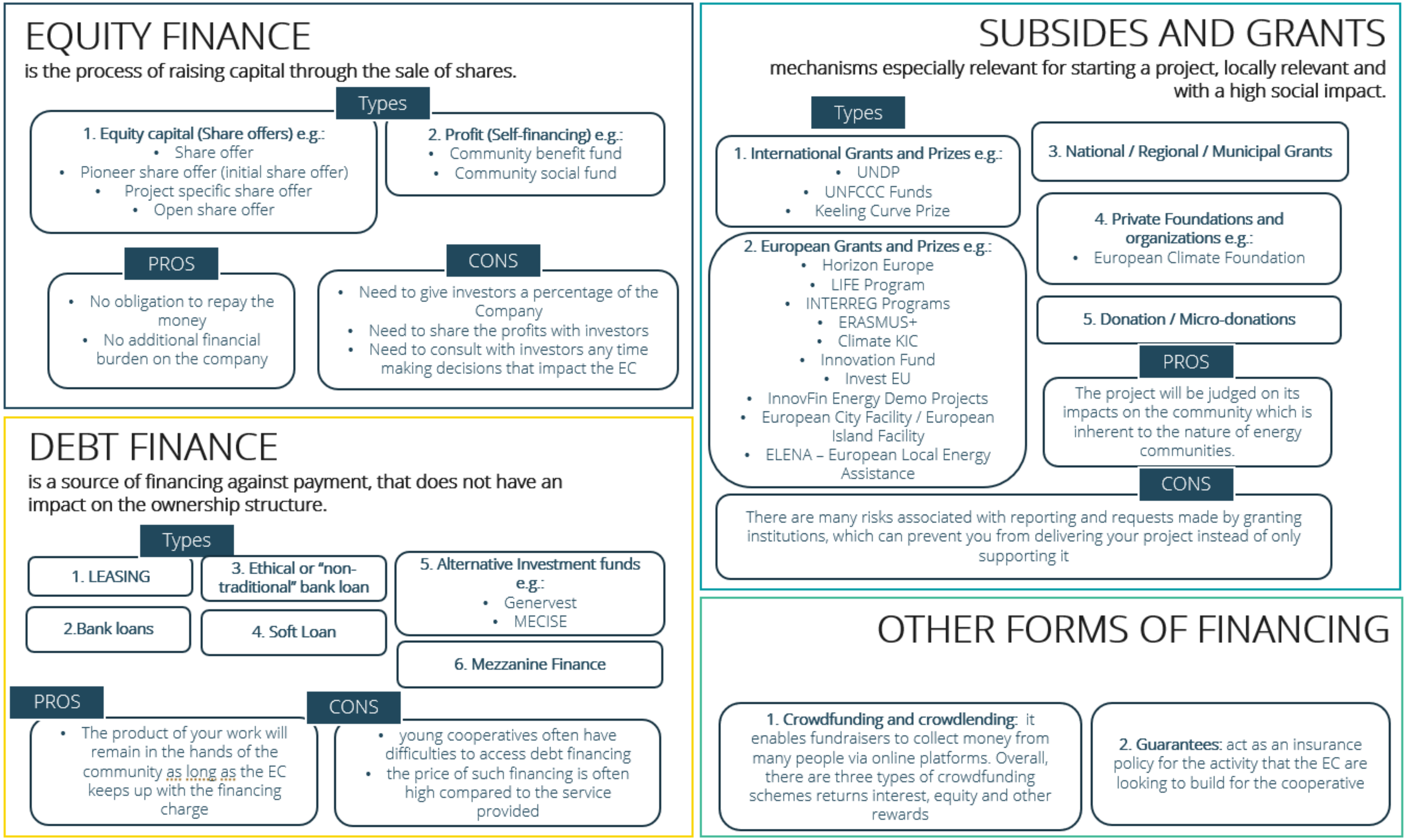

Figure 29: Summary of finance models. Adapted from: (Compile, 2022).

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Up to now energy communities have been relying mainly on subsides and grants in order to finance themselves. However, this might not be case in the near future. As some subsides are already being reviewed by some countries, especially in Europe. As the EU COMMISSION (2022) recently reported the deployment of renewable power generation should be increasingly market-based due to the decreasing trend in costs of renewable technologies, but so far the majority of projects have been supported by public support. For example, France decided to re-evaluate the feed-in tariffs for PPAs signed prior to the 2011 amendments, claiming that they were overly profitable (DLA Piper, 2022). Despite that energy communities have been given preferential treatment by tendering authorities in Germany, Ireland, and France (EU COMMISSION, 2022). It is crucial for the financial health of the energy communities to plan for the long-term and be prepared for other forms of financing themselves. It is also an opportunity for banks, alternative funds, and private foundations to elaborate new financing models to support energy communities in this transition to market-based prices.

To identify the best financial options for the LocalRES energy communities the stakeholders have been asked which are the preferable revenue streams and financial options they would like to have in their community in a scenario without subsides and grants. Figure 30 presents the preferable forms of revenue stream stakeholders would like to have in their community. In order of preference are self-consuming electricity, sale of aggregated electricity surplus, electricity distribution services, and profit from shared energy savings systems owned by the energy community or external partner. Figure 36 shows all the results related to the revenue streams in the energy community.

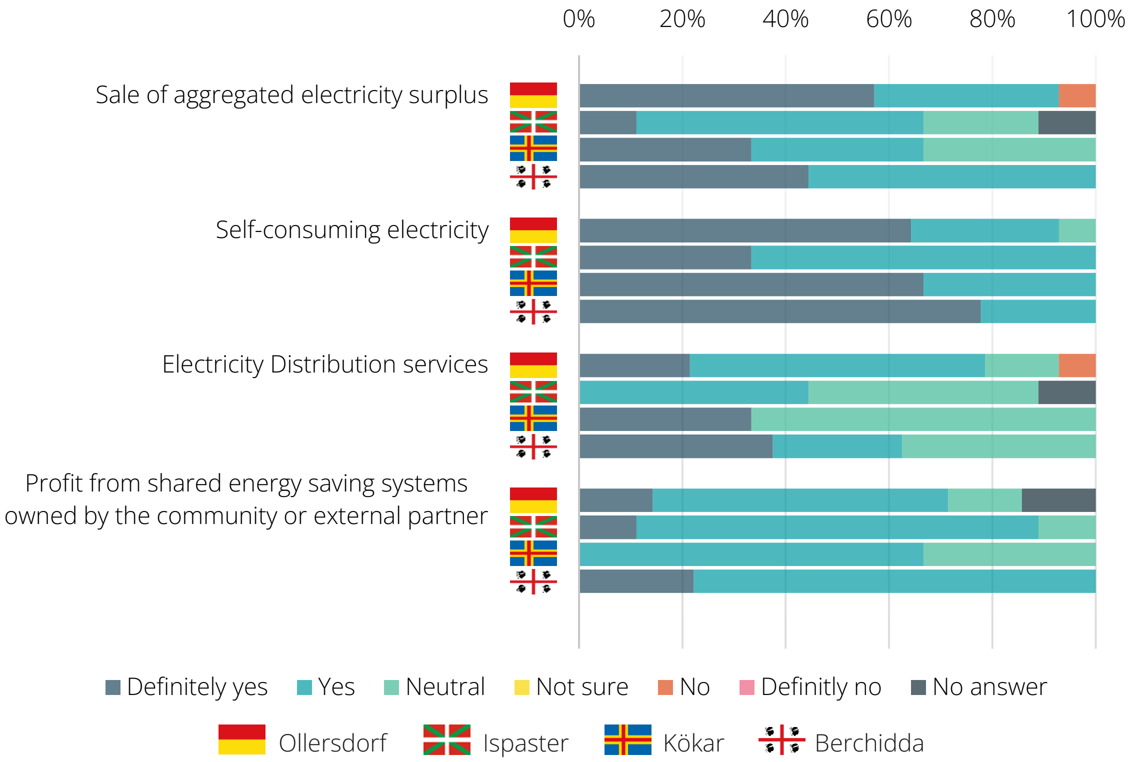

Figure 30: Preferable forms of revenue stream stakeholders would like to have in their community

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Figure 31 presents the preferable financial sources they would consider in a scenario without grants from government, in order of preference are loans from financial institutions, individual investments, crowdfunding, and investment from third parties. Figure 38 illustrates which type of financial sources the stakeholders would consider more suitable for their energy community.

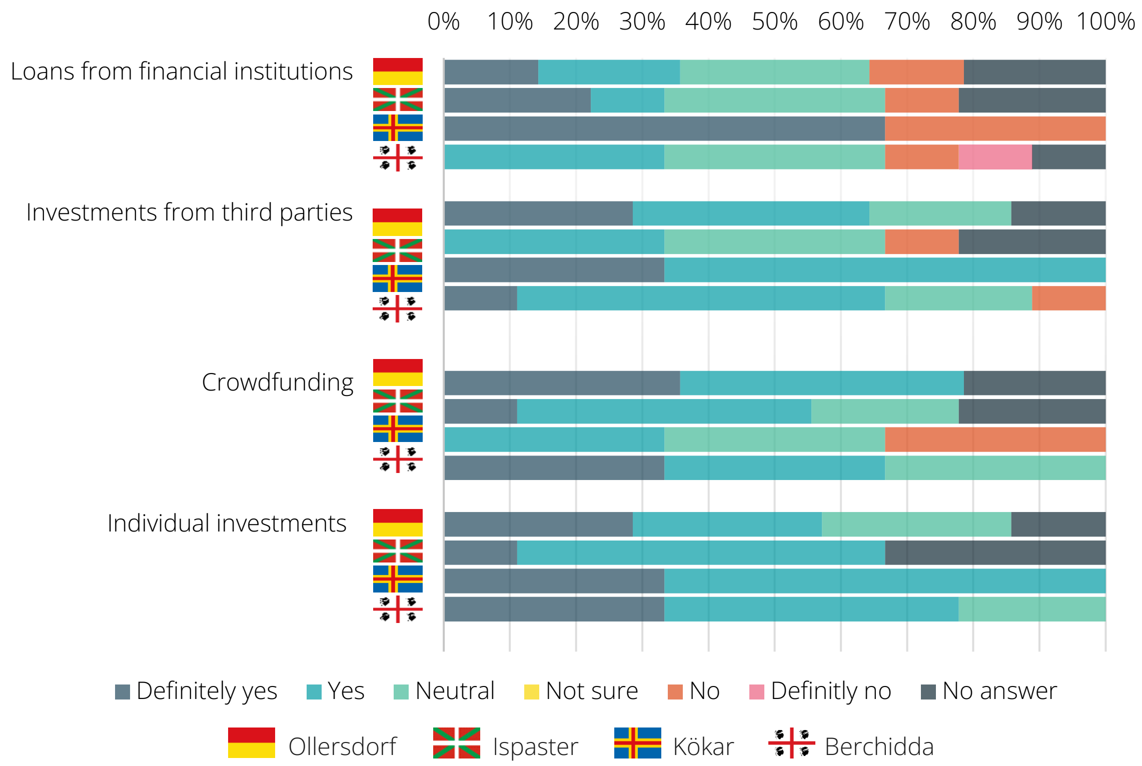

Figure 31: Preferable financial sources the stakeholders would consider more suitable for their energy community in a scenario without subsides and grants

Being asked what their capacity to financially contribute to the energy community development the stakeholders have, the answers were similar across all communities. Figure 32 summarizes the answers in a cloud of words. The most common forms of contribution mentioned were provision of land and roof area for the installation of renewable energy, followed by volunteer work, and individual contributions. Some specificities are interesting to highlight in each energy community. In Ollersdorf the individual contributions and money were mentioned more often than in other communities. In Ispaster it was mentioned more than once that this is a very delicate topic. In Berchidda, the roof area was the preferable option for contribution. In Kökar most of stakeholders mentioned that the financial participation is limited to the installation of PVs.

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Figure 32: Cloud of words summarizing answers of the stakeholders regarding the energy community capacity of financially contribute to the energy community

7/ Highlights

- Self-consumption leads to the creation of new services with the consequent creation of new business models. These services can be categorized into three groups: local, DSO and ancillary services.
- Self-governance is a key driver for end-users to join an energy community.
- Municipalities have an important role of providing trust and as risk taker.
- Knowledge and information dissemination are the best tools for the integration of new energy community members.
- Finding the community main values are an important guide for which type of services are more suitable to be implemented in the energy community.
- Three pillars for a successful beginning of an energy community are: trust, clear values, and opportunity (e.g., existing infrastructure).
- When a legal framework already exists, it facilitates the integration of new participants.

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8/ Recommendations

An analysis about the stakeholders and types of business model frameworks for energy communities has been carried out. Business models for four selected case studies were developed: Berchidda, Ispaster, Kökar, and Ollersdorf. The Business model were designed using a Business Model Canvas. The input data included the survey results obtained during a Stakeholders Consultation Meeting. At this point, recommendations for the communities from the assessments are provided:

- An energy community approach not only changes the way energy value chains are understood and the delivery and provision of energy are structured. It is also a possibility for municipalities to engage with citizens and involve them to actively participate in the energy transition and shape the local energy system to be fit for the future.
- The assessment revealed that environmental and energy savings were the most prominent motivation between all communities.
- A key observation is that financial aspect is not the main motivation for the participants to start an energy community, but rather a core value that hold them together.
- Municipal administrations are a big enabler for the implementation of energy communities. They ensure that citizens trust new structures and organizations and are able to widen the scope of the community. Therefore, they should play a key role in the development and operation of energy communities.
- Each community needs a driving force; an organization or person that is behind the implementation and pushes the development forward. In each of the LocalRES pilot sites, an initiator was present. It is the party with high influence and impact on the formation of the community.
- Energy expertise should be ensured in the formation and operation of the energy community. Usually this is being provided by an energy planner, energy agency or, in the case of larger municipalities by the department of the municipality responsible for public services and infrastructure.
- DSO plays an important role in providing the licenses for the energy community technologies to operate. In each energy community they had a different impact. In Kökar and Berchidda these stakeholders acted as enablers and supported the implementation actively. In Ollersdorf and Ispaster this was not the case which can lead to certain obstacles. As far as the DSO is open and supportive, it should be involved. But this is not the case in every community.
- The service provision of an energy community can be quite extensive. For the beginning, certain services should be identified as key and targeted as first for implementation. This avoids the community to fail because the effort cannot be managed. Also, some services are not possible at the moment, e.g. because the regulation does not allow it. Such services can be foreseen and put into the development plan of the community and be implemented as soon as the regulation is novelized.
- There are several organizational and financing forms for an energy community. All of them have pros and contras and should be seen as options that can be investigated considering the needs of the stakeholders and local conditions.

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9/ References

Baldassarre, B., Calabretta, G., Bocken, N. M. P., & Jaskiewicz, T. (2017). Bridging sustainable business model innovation and user-driven innovation: A process for sustainable value proposition design. *Journal of Cleaner Production*, *147*, 175–186. https://doi.org/10.1016/j.jclepro.2017.01.081

Balkan Solar Roofs. (n.d.). *Gallery*. BSR. Retrieved November 22, 2022, from https://www.balkan-solar-roofs.eu/gallery

Botelho, D. F., Dias, B. H., de Oliveira, L. W., Soares, T. A., Rezende, I., & Sousa, T. (2021). Innovative business models as drivers for prosumers integration—Enablers and barriers. *Renewable and Sustainable Energy Reviews*, *144*, 111057. https://doi.org/10.1016/j.rser.2021.111057

Brown, D., Hall, S., & Davis, M. E. (2019). Prosumers in the post subsidy era: An exploration of new prosumer business models in the UK. *Energy Policy*, *135*, 110984. https://doi.org/10.1016/j.enpol.2019.110984

Compile. (2022). *Financing Guide*. https://www.rescoop.eu/uploads/rescoop/downloads/D4.1.2_Financing_Guide.pdf

DigitalEnergy4All. (2022). *DigitalEnergy4All with Digital Citizen Energy Communities | FFG*. https://www.ffg.at/laura-bassi-4.0-digitalisierung-und-chancengerechtigkeit-digitalenergy4all

DLA Piper. (2022). *Reduction of French solar tariffs – how can investors protect their rights | Actualités | DLA Piper Global Law Firm*. DLA Piper. https://www.dlapiper.com/fr/france/insights/publications/2022/03/reduction-of-french-solar-tariffs-how-can-investors-protect-their-rights/

EU COMMISSION. (2022). *REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL: on the performance of support for electricity from renewable sources granted by means of tendering procedures in the Union*. https://energy.ec.europa.eu/system/files/2022-11/COM_2022_638_1_EN_ACT_part1_v2.pdf

F.G. Reis, I., Gonçalves, I., A.R. Lopes, M., & Henggeler Antunes, C. (2021). Business models for energy communities: A review of key issues and trends. *Renewable and Sustainable Energy Reviews*, *144*, 111013. https://doi.org/10.1016/j.rser.2021.111013

Frieden, D., Tuerk, A., Antunes, A. R., Athanasios, V., Chronis, A.-G., d'Herbemont, S., Kirac, M., Marouço, R., Neumann, C., Pastor Catalayud, E., Primo, N., & Gubina, A. F. (2021). Are We on the Right Track? Collective Self-Consumption and Energy Communities in the European Union. *Sustainability*, *13*(22), Article 22. https://doi.org/10.3390/su132212494

Gährs, S., & Knoefel, J. (2020). Stakeholder demands and regulatory framework for community energy storage with a focus on Germany. *Energy Policy*, *144*, 111678. https://doi.org/10.1016/j.enpol.2020.111678

This project has received funding from the European Union's Horizon 2020 Programme under the Grant Agreement no. 957819

Heuninckx, S., Boveldt, G. te, Macharis, C., & Coosemans, T. (2022). Stakeholder objectives for joining an energy community: Flemish case studies. *Energy Policy*, *162*, 112808. https://doi.org/10.1016/j.enpol.2022.112808

Iazzolino, G., Sorrentino, N., Menniti, D., Pinnarelli, A., De Carolis, M., & Mendicino, L. (2022). Energy communities and key features emerged from business models review. *Energy Policy*, *165*, 112929. https://doi.org/10.1016/j.enpol.2022.112929

Jacobs, D., & Sovacool, B. K. (2012). 1.06—Feed-In Tariffs and Other Support Mechanisms for Solar PV Promotion. In A. Sayigh (Ed.), *Comprehensive Renewable Energy* (pp. 73–109). Elsevier. https://doi.org/10.1016/B978-0-08-087872-0.00104-9

LECo. (2019). *LECO: Finance Options for Local Energy Communities*. Northern Periphery and Artic Programme. https://localenergycommunities.net/finance-options-for-local-energy-communities/

Maria Rosaria Di Nucci, Olivier Pol, Ute Gigler, & Christina Spitzbart. (2010). *CONCERTO: planning and implementation process assessment report* (ISBN 978-3-9503080-0-6).

Parag, Y., & Sovacool, B. K. (2016). Electricity market design for the prosumer era. *Nature Energy*, *1*(4), 16032. https://doi.org/10.1038/nenergy.2016.32

Renewable energy directive. (n.d.). Retrieved July 28, 2022, from https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

Ruggiero, S., Onkila, T., & Kuittinen, V. (2014). Realizing the social acceptance of community renewable energy: A process-outcome analysis of stakeholder influence. *Energy Research & Social Science*, *4*, 53–63. https://doi.org/10.1016/j.erss.2014.09.001

Solis. (n.d.). Mapa Solar de Lisboa I Consulte o potencial Solar da Cidade de Lisboa. *Solis Lisboa*. Retrieved November 22, 2022, from https://www.solis-lisboa.pt/mapa-solar-de-li/

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10/Appendix

10.1. Stakeholders' identification of Ollersdorf

Level	Ollersdorf stakeholders	Entity	Description
Macro	TSO	Austrian Power Grid AG	Is part of the European Transmission System Operators and responsible for the bulk transmission of electric power on the main high voltage electric networks.
	DSO	Netz Burgeland	Is owned by Energie Burgenland AG. It is responsible, among other things, for the construction, operation and maintenance of electricity and gas lines.
	Licensed energy supplier	Burglandenergie	The Austrian electricity market has been fully liberalized since 2001 and is subject to the rules of free competition. In Ollersdorf, the citizens can choose between 4 energy suppliers.
Intracommunity	Municipalities	Ollersdorf im Burgland municipality	The mayor for more than 15 years is Bernd Strobl which has an active role in the energy community formation. The municipality owns PV panels, batteries and a smart charging station. Also, it is the municipality in charge of the management and interaction with local stakeholders.
	Intermediary organizations/ Third parties	Energie Kompass GmbH	Is a service provider company with focus on the intelligent use of renewable energies founded by Ing. Andreas Schneemann. Energy Kompass is the main information provider about the municipality and the energy community.
		Lab act4.energy	Is an innovation laboratory funded by the Austrian Research Promotion Agency (FFG) under the "City of the Future" program with a focus on photovoltaic self-consumption optimization and energy. Andreas Schneemann (Energy Kompass owner) is also an initiator of this initiative in which Michael Niederkofler is the head. This initiative is supporting Energie Kompass to increase the number of installed photovoltaic systems and the associated awareness of the topic among the population, municipal institutions and companies in the region. OPtimizition self-consumption.

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		University of Passau	Technology partner of the demo site in charge of the design and development of the black-out strategies' integration in the MEVPP.
		AIT	It is the biggest research institute in Austria. It is the leader and responsible of the demo site and in charge of the design and development of the local optimization algorithm. .
Intercommunity	Project champions/ Initiator	Municipality and Energy Kompass	In this case the initiators are the Municipality lead by the mayor and in partnership with Eng. Andreas Schneemann which is also the owner of Energy Kompass and initiator of Innovation Lab act4.energy.
	Energy Community	Participants	There are 34 participants up to now.
	Asset Owner	Energie Kompass and citizens investors	Energie Kompass with the support of the municipality developed a Solar Power Plant Model in which Interested citizens, entrepreneurs, organizations or Clubs make their roof area(s) available for the installation of PV panels. In this model the surplus energy sold to the grid is used to pay the PV system. Thus, the more photovoltaic electricity is used, the sooner ownership is transferred. Capital repatriation occurs on the one hand through savings in grid electricity purchases as well as excess electricity remuneration (=> almost no capital outlay required by the interested party). The model was created in such a way that the future system owner can add a power storage device, hot water preparation components, and an e-charging infrastructure at any time. Prospects upset finance the capital required for the participation model. The attractive return and the annual proportional return of capital result in corresponding economic benefits for investors. In this model approx. 40 households of Ollersdorf, as well as the town hall, kindergarden and primary school are participanting up to now.
	Local Business		There are 2 local businesses participating in the REC, but they have no influence beyond their status as REC members.

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10.2. Stakeholders' identification of Ispaster

Level	Ispaster stakeholders	Entity	Description
Macro	Goverment	Regional public sector	Provides support and funding for the energy community.
	DSO	Endesa	There are 5 DSO in Spain in charge of supplying different regions. In Ispaster the responsible DSO is Endesa. Buildings connected to the DSO grid only: school, bar and restaurant; buildings connected to the electrical micro-grid only: kindergarten & canteen, gym & retirement home & play center, and the boiler room of supplying the DH network; buildings connected both to the DSO grid and to the micro-grid for the actual supply: pelota court, city hall, cultural center.
	Energy supplier	Various	The householders have the option of chosen between the licensed suppliers in liberated market or in the regulated market. In the regulated marketer, the utilities sell all the energy with the regulated tariff and the Social Bonus; both set by the Government. These marketers cannot offer other services, or discounts of any kind. In the liberated market small customers (powers under 10 kW) can benefit from the so-called "Voluntary Price for Small Consumers" (PVPC). They do not have a fixed price but vary each month depending on the behavior of the market.
Intracommunity	Municipalities	Ispaster town council	It's the local government with a double role as the asset owner of the microgrid and of the district heating system.
	Intermediary organizations/ Third parties	Barrizar	Is an ESCO with 5 participants in charge of the operation and management at technical and financial level of the energy community and its services. They have the leadership over the energy community and provide thermal and electrical energy to Ispaster town council. They are also the demo site leader and responsible for providing information, and overall support in LocalRES activities.
		Aiguasol	Provides support on technical execution and the preliminary feasibility assessment service
	Contractors/ Engineering Office	Barrizar	It is an energy service cooperative (see above)

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Intercommunity	Energy community	Householders	There is not a formal community established, but the municipality is making great efforts in the promotion of energy-related activities and initiatives.
	Asset Owner	Ispaster town council	It's a public body which has the ownership of the microgrid and of the district heating network. The district heating network is fueled by electricity generated by local sources and provides thermal energy for heating and DHW.
	Local Business	NA	NA
	Project champions/ Initiator	Ispaster town council	The municipality has started the energy community by addressing the municipal building and facilities, being selected since 2015 as a pilot village in Biscay by the Basque Government. Also, Ispaster municipality signed the Program for the Further Implementation of Agenda 21 in 2008 and the Covenant of Mayors in 2016.

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10.3. Stakeholders' identification of Berchidda

Level	Berchidda stakeholders	Entity	Description
Macro	DSO	Berchidda municipality (Azienda Elettrica Comunale - AEC)	Berchidda Municipality is the owner of the local grid and AEC is a department of the Municipality. AEC is in charge of the grid managment, provide local know-how including support to the energy system sizing and legal documentation that may be required.
	Energy supplier	Axpo	Local energy provider and ESCO. Provide support in deployment activities, and other services.
Intracommunity	Municipalities	Berchidda municipality	Double role of the Municipality in Berchidda (municipality + DSO)
	Intermediary organizations/ Third parties	GridAbility	Smart Grids and Citizens Energy Communities are the goals of Gridability as it assists the territories in their Energy Transition. In this demos site it is in charge of providing information for the services to be integrated in the MEVPP and responsible for the overall physical implementation. Also, in charge of the installation of batteries, smart meters, and responsible for the installation of the smart management platform that will connect all the energy community. As well as responsible for the provision of the prosumer platform in the scope of "Berchidda Energy 4.0" local plan (developed by Prosume Energy, who is one of their associated partners). Stakeholder in charge of the citizen engagement.
		Energy4com	It is a private non-profit company connected to GridAbility, that is supporting the community of Berchidda to set up the legal entity.
		AEC	Grid manager (DSO-TSO) that will offer local know-how including support to the energy system sizing and legal documentation that may be required.
		R2M	It is the demo site leader
	Contractors/ Engineering Office	R2M	In charge of the installation of the heat pumps and the community EV charging points.
	Flexibility Service Provider/ Aggregator	Axpo	They are helping to create the smart contracting, also to manage the storage capacity and the surplus of energy that would be monetized somehow. Double role (energy supplier + aggregator).

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Intercommunity	Energy community	Householders	There is not a formal community established, but the municipality is making great efforts in the promotion of energy-related activities and initiatives.
	Asset Owner	Households and Municpality	There are 87 PV plants in which 82 are owned by individual citizen and 5 belongs to the Municipality as well as the distributed network system
	Local Business/ Associations	Diverse	Local associations such as: Tourist Association Pro loco; Time in Jazz Cultural Association; Pietro Casu Heirs Association; Vermentino Brotherhood; can engage as multipliers to reach and motivate further energy community participants.
	Project champions/ Initiator	Berchidda municipality/ Energy4com	Energy4com with the support of R2M energy and Gridability guided by the municipality of Berchidda.

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10.4. Stakeholders' identification of Kökar

Level	Kökar stakeholders	Entity	Description
Macro	TSO	Kraftnät Åland (KNÅ)	Is the only transmission grid operator (TSO) of the Åland islands and its grid is part of Nord Pool's bidding zone SE3. KNÅ has the obligation to both ensure power supply for the inhabitants of the islands and the stability in the whole system from the in- and outside group and owned by the local government.
	DSO	Ålands Elandelslag (ÅEA)	It is a cooperative in which every customer holds an equal share in the company.
	Licensed supplier		The householders can choose between 3 licensed suppliers.
Intracommunity	Municipalities	Kökar municipality	Despite its small size it is a fully developed municipal service that covers all areas: primary school, day care, health care, library, and care home. They are in charge of the installation of the new assets and energy management systems.
	Intermediary organizations/ Third parties	Flexens Oy Ab	It is a project development company with sustainability focus which support Kökar in its energy transition. Flexens is owned 50% by CLIC Innovation and 50% by the following Åland Parties (local demo partners including the Government of Åland, testbed operators and energy companies). CLIC Innovation is a consortium of Finnish research institutes and companies specialized in energy systems, bioeconomy and circular economy. Flexens is the coordinator of the demo site and responsible for the household energy management system. It is the main infomartion providor and contact of the municipality and of the energy community.
		VTT	It is in charge of the research actions of the project.
	Contractors/ Engineering Office	Kökar service	It is a local company in charge of the power and data networks. They have cooling machine certification and are in charge of maintenance and heat installation. They ensure that the technical equipment is up to date and are responsible for the REC's proper operation. They are the owners of the one-of-a-kind e-car that is currently on the island.

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		Consilia Solutions AB	Entity which operate the datahub that collect all the consumption data measured in the smart meters.
		Single Wing Energy Oy	It is developing Small Scale Single-blade wind turbine (TRL6) to be installed ni the Kökar school.
		Polar Night Energy	The technology provider for the novel TESS for Kökar's school.
		One Technician	Person in charge of the works in the local school and elderly home.
Intercommunity	Energy community	Local energy group	The energy community is formed by the municipality and 20 private householders.
	Asset Owner	Electricity Producer Allwinds AB	Owner and operator of the only wind turbine installed in Kökar.
	Local Business	Kökar Business Association	Brings together island business owners for discussions regarding sea transport and joint marketing. Their business model depends heavily on Kökar's attractiveness, both for getting customers and for attracting employees.
		Företagsam Skärgård	An association formed by the six archipelago municipalities in Åland: Brändö, Föglö, Kumlinge, Kökar, Sottunga and Vårdö. This organization promotes immigration, business establishment and education, as well as advice and support for businesses.
		Ålands Natur och Miljö	A non-profit, non-governmental organization promoting sustainable development on the Åland islands. It has more than 100o members and has influence policymakers and the society overall.
	Project champions/ Initiator	Kökar municipality / Flexens	The municipality with the support of Flexens.

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10.5. Stakeholder Consultation Meeting survey

10.5.1. Assessing stakeholders influence and interests (positive or negative)

Question 1: Which of the stakeholders would you consider in those situations? (Choose more than one if necessary)								
		Participants of the EC	Municipality	Asset owner	External investor	Intermediary organization (e.g. Flexens)	Project initiator (Project champignon)	Other (please specify)
1	What is your role in the Energy Community?	○	○	○	○	○	○	
2	Who is influential in the local community?	○	○	○	○	○	○	
3	Who is directly responsible for decisions on issues important to the project?	○	○	○	○	○	○	
4	Who will be affected positively by the development of the EC?	○	○	○	○	○	○	
5	Who will be affected negatively by the development of the EC?	○	○	○	○	○	○	
6	Who supports the changes the development will bring?	○	○	○	○	○	○	
7	Who opposes the changes the development will bring?	○	○	○	○	○	○	
8	Who plays an important role in the decision-making process of the EC?	○	○	○	○	○	○	
9	Who will obstruct/hinder the project if they are not involved	○	○	○	○	○	○	
10	Who will promote/support the project?	○	○	○	○	○	○	
11	Who has not been involved up to now but should have been?	○	○	○	○	○	○	

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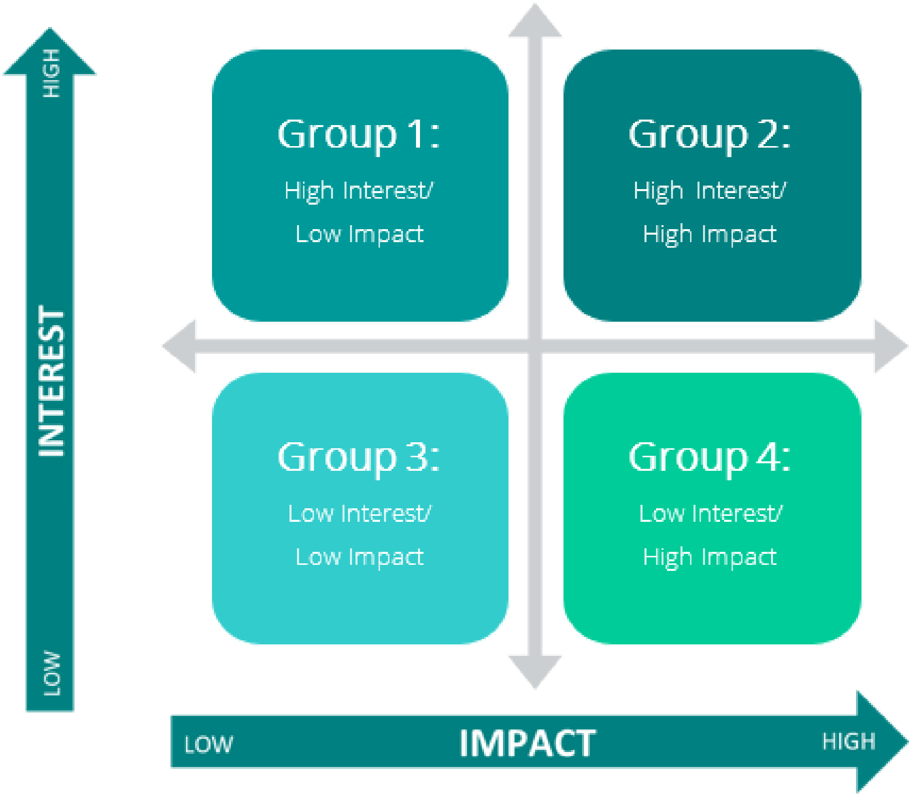
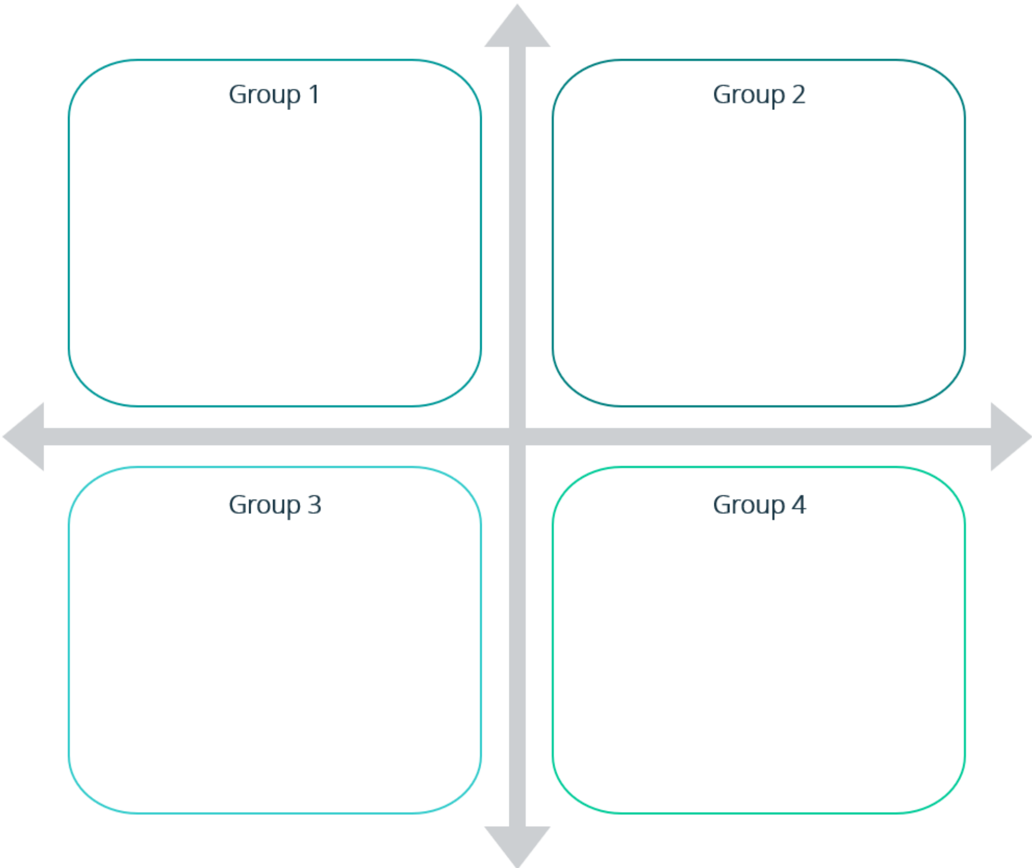
Question 2: Assign the stakeholders in the Interest/Impact Matrix? (Choose more than one if necessary)
Consider the following questions when determining where stakeholders fall on the Interest/Impa analysis quadrant. 1. Are they likely to impact the success or failure of your project? 2. What is their relationship with the community? 3. Who impacts and by whom is impacted?



Note
Influence is defined as a person's level of involvement, while impact is a stakeholder's capacity to effect the desired change. This could happen either during project planning or implementation. A stakeholder with the power to set deadlines and, consequently, the project timeline, for instance, would be categorized as having a strong impact.

Stakeholder's list:

- Energy community participants
- City Council/Municipality
- Asset owner(s)
- People living near the facility
- Nearby communities and local businesses
- Authorized energy supplier/Energy producer
- External investor
- Intermediaries
- Project developers
- Government
- Distribution Service Operator (DSO)



10.5.2. Identifying preferable investment options

Question 1: Which of the following motivates you to be part of an Energy Community?								
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not sure	Other (please
1	Climate emergency – reduce carbon emissions	◯	◯	◯	◯	◯	◯	
2	Save money on energy bills	◯	◯	◯	◯	◯	◯	
3	Make a return on investment	◯	◯	◯	◯	◯	◯	
4	Generate income for the community	◯	◯	◯	◯	◯	◯	
5	Strengthen the local community	◯	◯	◯	◯	◯	◯	
6	Increase the security of the supply	◯	◯	◯	◯	◯	◯	
7	Support local economic development	◯	◯	◯	◯	◯	◯	
8	Serve as example for other communities	◯	◯	◯	◯	◯	◯	
9	All of these	◯	◯	◯	◯	◯	◯	
10	Other (please specify)	◯	◯	◯	◯	◯	◯	

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Question 2: How much you agree with the following statements?								
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not sure	Other (please
1	I'm willing to change my energy consumption behavior to save money	◯	◯	◯	◯	◯	◯	
2	I´m willing to invest in renewable energy in my home	◯	◯	◯	◯	◯	◯	
3	I´m willing to spend more to have renewable energy supplied to my home from an energy supply company	◯	◯	◯	◯	◯	◯	
4	I would like to see renewable energy produced for local use in my community	◯	◯	◯	◯	◯	◯	
5	I would like to invest on renewable energy produced for local use in my community	◯	◯	◯	◯	◯	◯	
6	I would like to see energy use reduced in existing buildings in my community	◯	◯	◯	◯	◯	◯	
7	I would prefer to see renewable energy produced somewhere other than in my community	◯	◯	◯	◯	◯	◯	
8	I´m willling to change my heating system in the near future	◯	◯	◯	◯	◯	◯	
9	I´m planning to have an electric or hybrid car in the near future	◯	◯	◯	◯	◯	◯	
10	I think black-out strategies are important and should be considered in my community	◯	◯	◯	◯	◯	◯	
11	I would like to invest in renewable energy but don't have my own space	◯	◯	◯	◯	◯	◯	
12	I would like to support renewable energy but can't provide upfront capital investment	◯	◯	◯	◯	◯	◯	

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Question 3: Which type of revenue streams would you like to have in your community?								
		Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
1	Sale of electricity to non-participant members	◯	◯	◯	◯	◯	◯	
2	Sale of aggregated electricity surplus	◯	◯	◯	◯	◯	◯	
3	Self-consuming electricity	◯	◯	◯	◯	◯	◯	
4	Electricity Distribution services	◯	◯	◯	◯	◯	◯	
5	Sale of individual electricity to local members (P2P)	◯	◯	◯	◯	◯	◯	
6	Profit from the difference between stocking energy assets at the lowest possible prices	◯	◯	◯	◯	◯	◯	
7	Profit from shared energy saving systems owned by the community or external partner	◯	◯	◯	◯	◯	◯	
8	E-mobility services (e.g. car sharing)	◯	◯	◯	◯	◯	◯	
9	E-mobility flexibility	◯	◯	◯	◯	◯	◯	
10	Other (please specify)	◯	◯	◯	◯	◯	◯	

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Question 4: Which type of Business would you consider more suitable for your energy community?										
	Type	Description	Financial model	Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
1	Cooperatives	It is a citizen-led initiative in which end-users fund their own energy generation systems and/or private grids.	They can be profit or non-profit organizations and be involved in the management and operation of regional low-voltage distribution networks.	○	○	○	○	○	○	
2	Private wire/micro-grid	The aim is to share any distributed generation between prosumers in the private network area. They are typically being trialed on small island grids or new developments.	Cooperatives or local energy companies can benefit from owning their own grid and management of local energy production.	○	○	○	○	○	○	
3	Community prosumerism	Participants are prosumers, acting as decision-makers, investors, and customers seeking special financing conditions for asset acquisition, flexibility markets, collective energy efficiency initiatives, or local energy markets.	In addition to acquiring generation and storage systems, community members and energy suppliers enter into long-term power purchase agreements. In which power suppliers are responsible for buying surplus generation and supplying the remaining required power and community members can also buy and sell all their electricity within the community boundaries.	○	○	○	○	○	○	
4	Peer-to-peer trading	These models are theoretically based on the use of a third-party platform where prosumers can trade energy with each other with minimal involvement from suppliers	In this model prices can be negotiated directly with other prosumers, allowing them to select the provenance of their electricity.	○	○	○	○	○	○	
5	Local energy company	The aim is to work collaboratively to maximize their self-sufficiency and reduce the amount of power traded with external entities. Also, in this model trading conditions, such as pricing, can be directly negotiated between market participants (prosumers and consumers).	In these models, as a result of differences between retail and market tariffs, energy revenues are usually distributed among prosumers and consumers. Market participants consensually manage the trading platforms, while agreements are signed with energy retailers and the Distribution System Operator (DSO) to guarantee the supply and trading system reliability.	○	○	○	○	○	○	

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Question 4: Which type of Business would you consider more suitable for your energy community?										
	Type	Description	Financial model	Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
6	Community collective generation	Shared generation and storage systems are used in this model, which is installed on the roof of multi-tenancy buildings or near consumption sites, in order to enhance collective consumption.	The investment is shared by the dwelling owners (consumers, decision-makers, and investors), and net-metering and Information-and-Communication-Technologies (ICT) based infrastructures are required.	◯	◯	◯	◯	◯	◯	
7	Third-party-sponsored communities	In this case, utilities and technology companies provide technical advice and financial support in the form of grant funding, dedicated investment funds, or fully financing energy community projects	The investment and associated risks are made by the investors, who are compensated through long-term PPAs negotiated with clients. Users gain from renewable energy, which is often less expensive, while participating in regional energy-related initiatives.	◯	◯	◯	◯	◯	◯	
8	Flexibility aggregators	Communities looking to use aggregation to provide demand flexibility to the grid through collaborative Demand-Side-Management (DSM) programs. These models rely heavily on the consolidation of small-scale flexibility to generate meaningful volumes for system operators or wholesale markets.	Local community aggregators may be established, and a larger aggregator will group the flexibility they have gathered. Community aggregators and customers engage into bilateral contracts whereby customers agree to provide defined levels of flexibility by altering their energy usage patterns in exchange for lower energy costs. The aggregator makes all or most of the financial effort, and end-users are considered in decision-making moments through the specification of preferences and boundaries in contractual clauses.	◯	◯	◯	◯	◯	◯	
9	ESCO - Energy Service Company	External companies together with energy communities co-create and operate community ESCOs aimed at providing EE services (e.g., energy audits, building insulation, and so on) and/or renewable energy supply (electricity, heat, or both)	By offering such Eenergy Efficiency services, ESCO ensures customers extra energy savings, which in turn protects ESCO remuneration because these companies are only compensated for the energy savings achieved.	◯	◯	◯	◯	◯	◯	
10	E-mobility flexibility and as a service	These models explore E-vehicles (electric cars, buses, motorbikes, etc.) as flexible resources. Batteries are used as storage resources, exploiting Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) modes to profit from procuring energy during off-peak periods and providing flexibility services	To provide flexibility an aggregated smart charging scheme can be created to smooth out demand peaks with Electric Vehicles' batteries to provide flexibility services – accessing the same revenues as the flexibility service business models. As a service, prosumers share the use of EVs, which are owned or operated by third party providers. As a cooperative Shareholders join forces to provide public transportation, car sharing, or carpooling services for the community.	◯	◯	◯	◯	◯	◯	

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10.5.3. Identification of preferable financial options

Question 1: What is the community's capacity to financially contribute to the Energy Community development?

A community may make contributions in cash or in kind (e.g. voluntary labor, use of land, materials, donated services)

Open answer

Question 2: What external sources of financing are available to the community?

This can take the form, for example, of government grants and loans, loans from financial institutions, and third-party investments in certain locations (such as financial plans for the benefit of communities, special programs that allow for women's participation, and partnerships with industry entities). private).

Open answer

Question 3: In a scenario with no government grants and loans, what external sources of financing would you consider more suitable for the community?

		Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
1	Loans from financial institutions	○	○	○	○	○	○	
2	Investments from third parties	○	○	○	○	○	○	
3	Investments from third parties with capital repatriation	○	○	○	○	○	○	
4	Crowdfunding	○	○	○	○	○	○	
5	Individual investments (e.g. for the establishment of a community company/ cooperative)	○	○	○	○	○	○	
6	Funding opportunities (e.g. Green Bonds)	○	○	○	○	○	○	

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10.5.4. Identifying local values

Question 1: Who is the initiator of the project?
It is an initiative from outside or from within the community? Are existing community organisations involved in setting up the project/community energy entity? Is it an entirely new organisation?

Open answer

Question 2: What is the desired level of ownership? What legal structures are available for setting up the initiative?
The extent of local energy autonomy that a community desire will affect the ownership type the community chooses. A community's legal framework will be determined by the local laws in that area.

Open answer

Question 3: What are the community´s core values and practices?
When adopting best practices from other community energy projects developed in various social, economic, environmental, and institutional contexts, a strong awareness of core values and practices is especially important.

Open answer

Question 4: What should the community look for in potential partners?
Partnerships will be more successful if partners understand a community´s preferred decision-making approach and its core values and practices.

Open answer

Question 5: How will benefits be distributed to community members? Are costs and benefits equitably distributed?
Revenues from a community project, for example, can be distributed to community members based on ownership percentage, directed to vulnerable people, or allocated to community projects benefiting all local residents. Benefits such as creating local job opportunities and providing education and technical training to women and youth, in particular, may be considered.

Open answer

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10.5.5. Flexibility services

Question 1: Which of the following statements motivates you to adopt flexibility measures in your home?

Flexibility refers to the ability to shift energy demand profiles to meet local needs, for example: adjust the temperature of your heating system during peak-load hours

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not sure	Other (please specify)
1	Climate emergency – reduce carbon emissions	◯	◯	◯	◯	◯	◯	
2	Save money on energy bills	◯	◯	◯	◯	◯	◯	
3	Receive discounts on local business	◯	◯	◯	◯	◯	◯	
4	Strengthen the local community	◯	◯	◯	◯	◯	◯	
5	Be part of the development of a new technology	◯	◯	◯	◯	◯	◯	
6	Support local business development	◯	◯	◯	◯	◯	◯	
7	Serve as an example for other households	◯	◯	◯	◯	◯	◯	
8	Other (please specify)	◯	◯	◯	◯	◯	◯	

Question 2. Which kind of flexibility options would you consider?

	Type	Description	Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
1	Standby	Optimization of self-consumption. No flexibility required/provided	◯	◯	◯	◯	◯	◯	
2	Net Price Low	Increase in electricity procurement, reduction in electricity delivery	◯	◯	◯	◯	◯	◯	
3	Net Price High	Reduction in electricity purchases, increase in electricity supply	◯	◯	◯	◯	◯	◯	

Question 3. How would you prefer to collect your flexibility earnings?									
	Type	Description	Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
1	Tokens	Community token which can be exchanged between local business partners	◯	◯	◯	◯	◯	◯	
2	EV charging	Exchange for electricity to charge Electric Vehicle	◯	◯	◯	◯	◯	◯	
3	Local Business Discounts	Exchange for discounts in local business partners	◯	◯	◯	◯	◯	◯	
4	Community aggregation	Community earnings are collected together and earnings are used for collective actions	◯	◯	◯	◯	◯	◯	

Question 4: How much heating comfort are you willing to compromise to reduce your energy demand?								
		Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
1	Less than 5°C of my space heating system	◯	◯	◯	◯	◯	◯	
2	Between 5°C and 10°C of my space heating system	◯	◯	◯	◯	◯	◯	
3	More than 10°C of my space heating system	◯	◯	◯	◯	◯	◯	
4	Less than 3°C of my water heating system	◯	◯	◯	◯	◯	◯	
5	Between 3°C and 6°C of my water heating system	◯	◯	◯	◯	◯	◯	
6	More than 6°C of my water heating system	◯	◯	◯	◯	◯	◯	

Question 5: What configuration of the flexibility aggregation platform would you prefer?								
		Definitely yes	Yes	Neutral	No	Definitly no	Not sure	Other (please specify)
1	Advice me when I should adjust my appliances	◯	◯	◯	◯	◯	◯	
2	Automatically adjust my appliances according to my own preferences	◯	◯	◯	◯	◯	◯	
3	Automatically make adjustments to my appliances based on efficiency and/or cost savings.	◯	◯	◯	◯	◯	◯	

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Question 6: Would you give access to your smart metering system to be part of an integrated platform? Considering that all security measures are taken care of to keep your data safe.
☐ yes, in full (so-called opt-in, transmission of the 15-minute values)
☐ Basically yes, but I don't know enough about it
☐ no, I don´t want to share my data

10.5.6. General Information

1. How long have you lived in (name of the community)?

2. What is your occupation?

3. How many people are there from each age group in your household?

Under 16	16 – 24	25 – 44	45 – 64	65 -74	75 or over
☐	☐	☐	☐	☐	☐

4. What kind of building do you live in?

☐ Flat or Apartment
☐ Semi-detached house
☐ Detached house
☐ Terrace house/ Townhouse

5. Is your house:

☐ Rented
☐ Owner-occupied
Other – please specify: ____

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6. Do you, or any of your households, hope to continue living in (name of the community) ir

- ☐ No – would prefer to move away
- ☐ Yes – for the next 5 years
- ☐ Yes – for the next 10 years or more

7. Where do you get information about renewable energy and efficiency?

- ☐ Radio
- ☐ Television
- ☐ Social Media
- ☐ Training courses/Workshops
- ☐ Newspaper
- ☐ Magazine
- ☐ Word of mouth
- ☐ Schools
- ☐ National website
- ☐ Local/Municipal Authority Website
- ☐ Other – please specify: ____

10.5.7. Feedback

THANK YOU FOR ANSWERING THE QUESTIONNAIRE. IS THERE ANYTHING ELSE YOU WOULD LIKE TO ADD THAT WAS NOT COVERED IN THE QUESTIONNAIRE?

PLEASE WRITE HERE YOUR COMMENTS AND SUGGESTIONS FOR US.

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10.6. Multiple choice survey answers

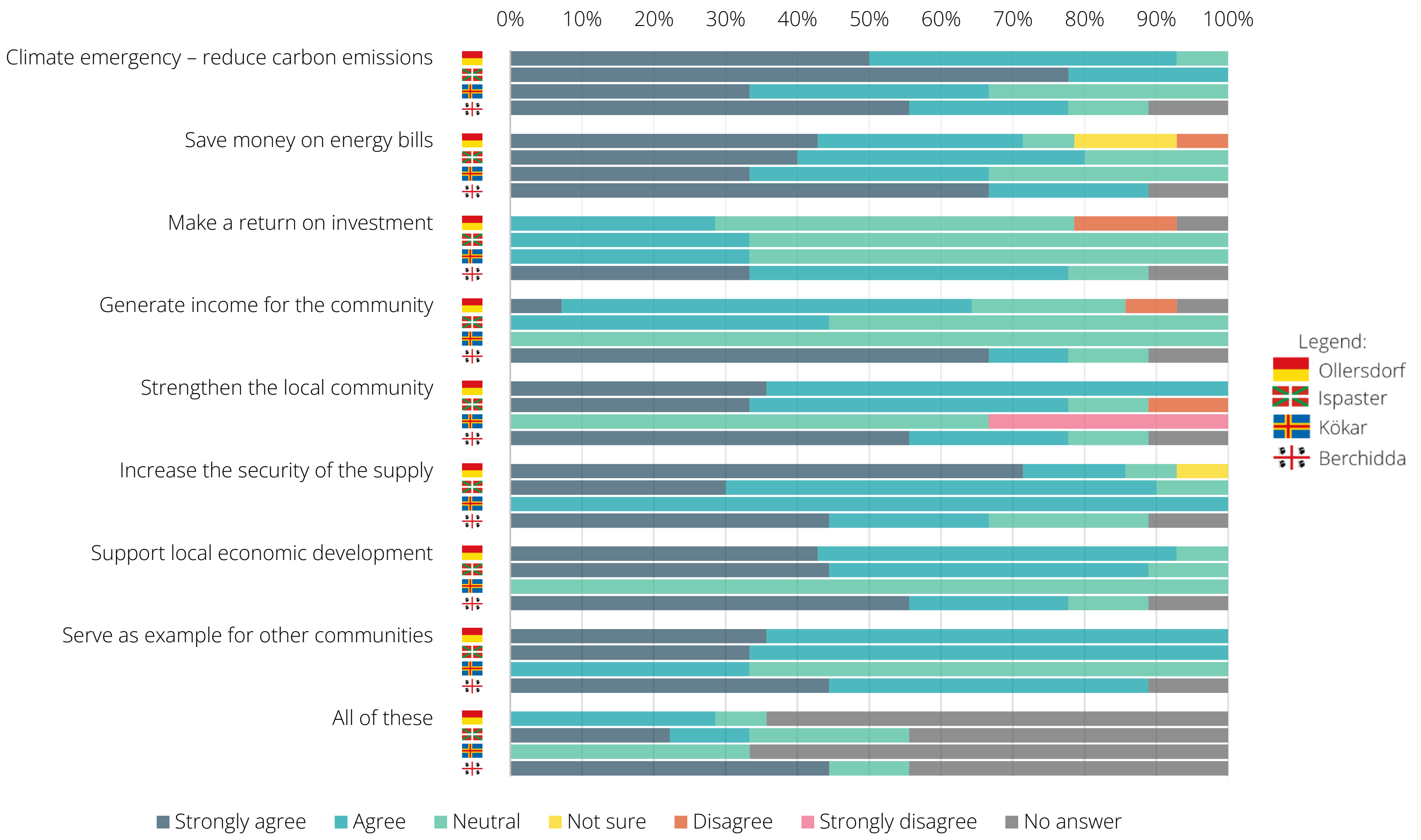

Figure 33: Stakeholders 'motivation to be part of an energy community

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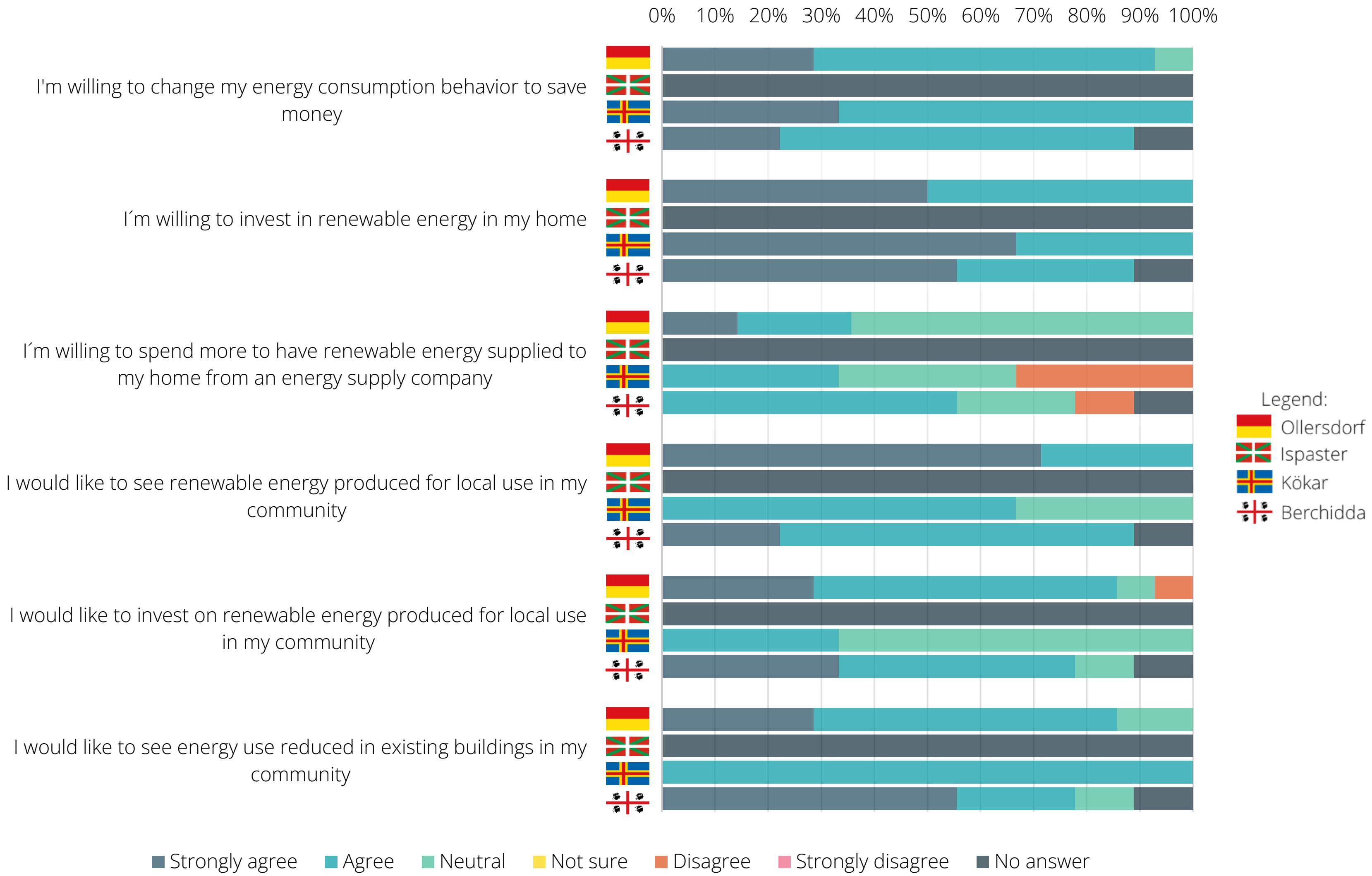

Figure 34: Stakeholders 'motivation to engage in energy community activities

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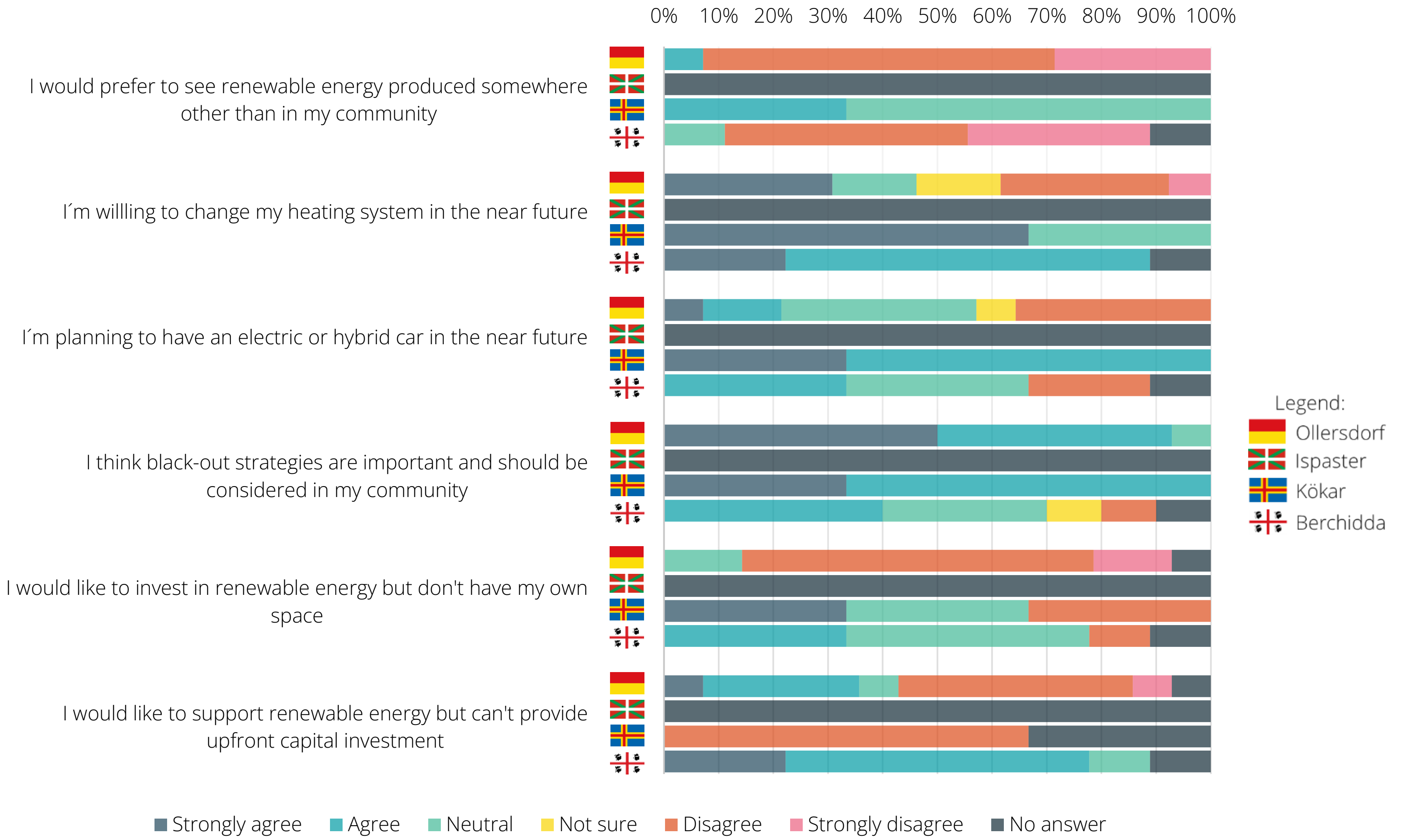

Figure 35: Stakeholders 'motivation to engage in energy community activities

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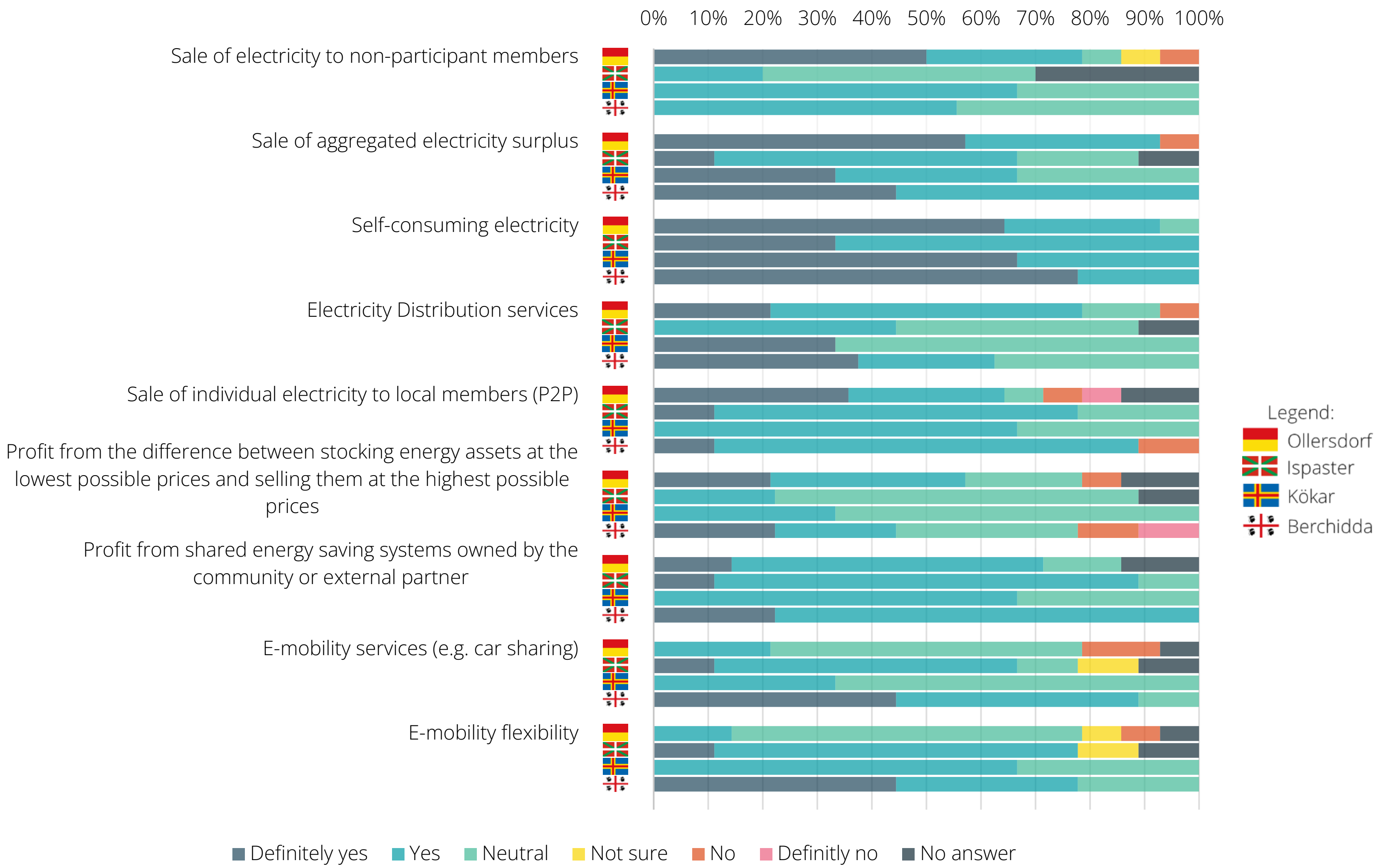

Figure 36: Identifying revenue streams the stakeholders would like to have in their community

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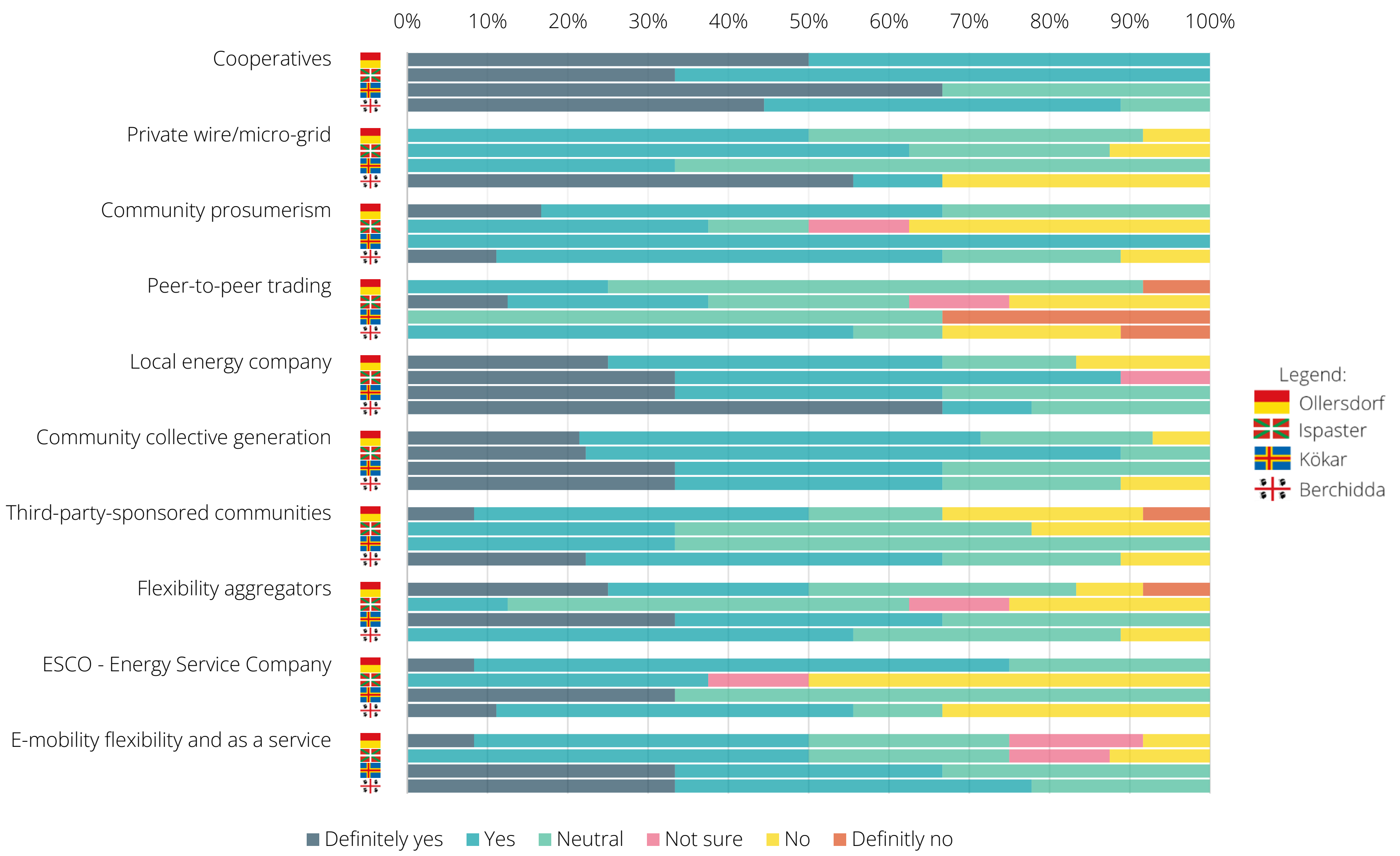

Figure 37: Identifying which type of Business Model archetype the stakeholders considered more suitable for their energy community

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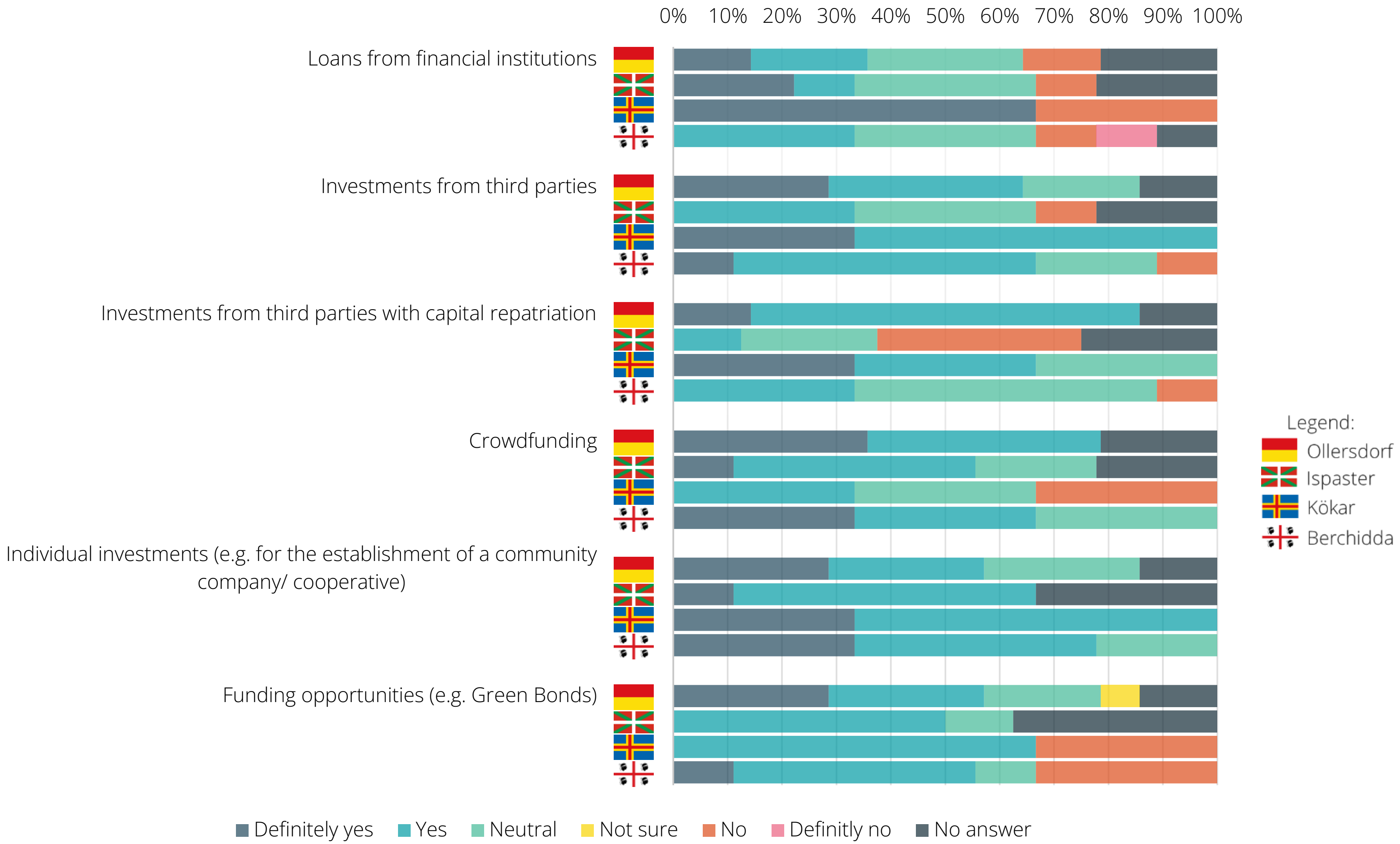

Figure 38: Identifying which type of financial sources the stakeholders would consider more suitable for their energy community

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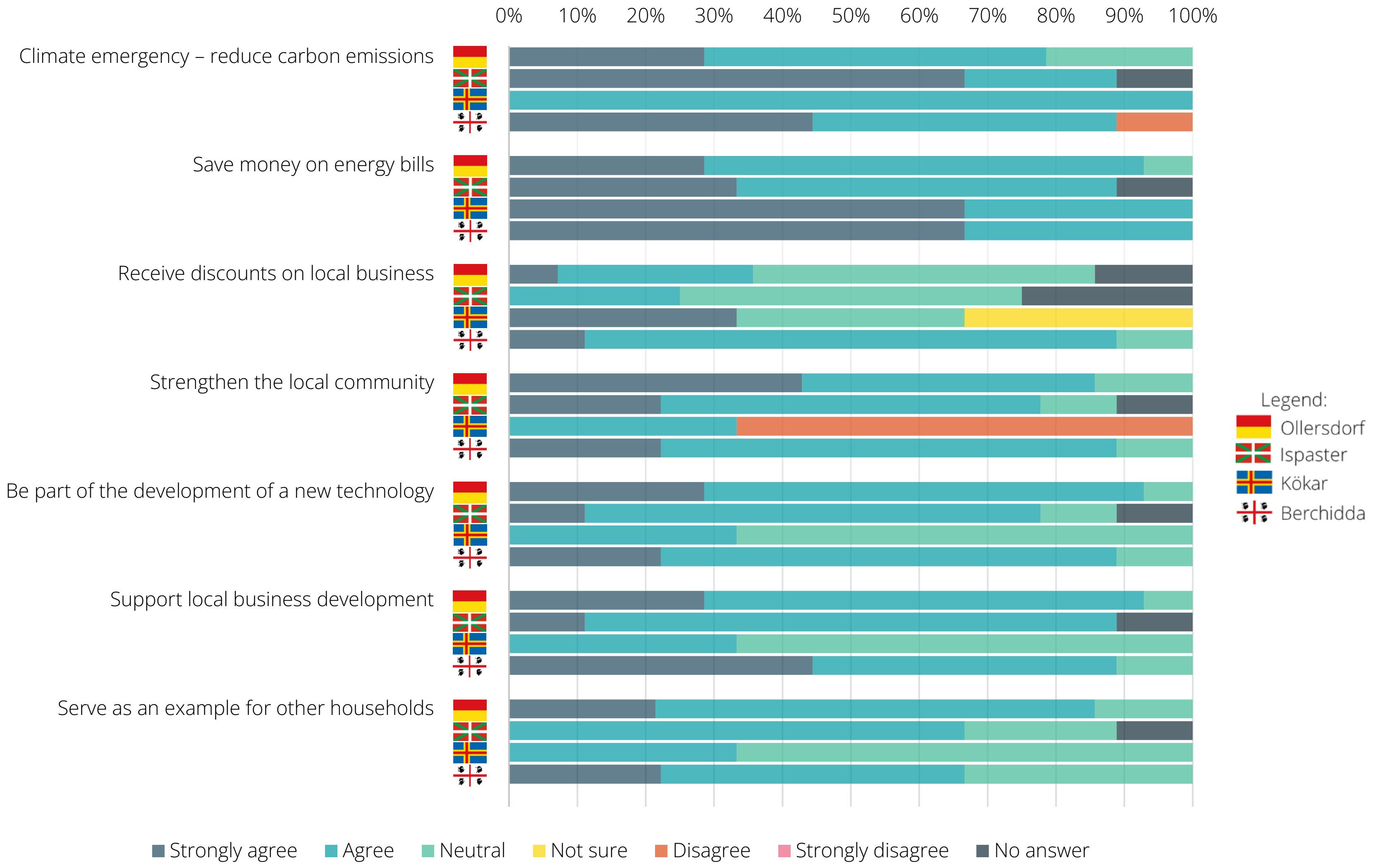

Figure 39: Stakeholders 'motivation to adopt flexibility measures in their home

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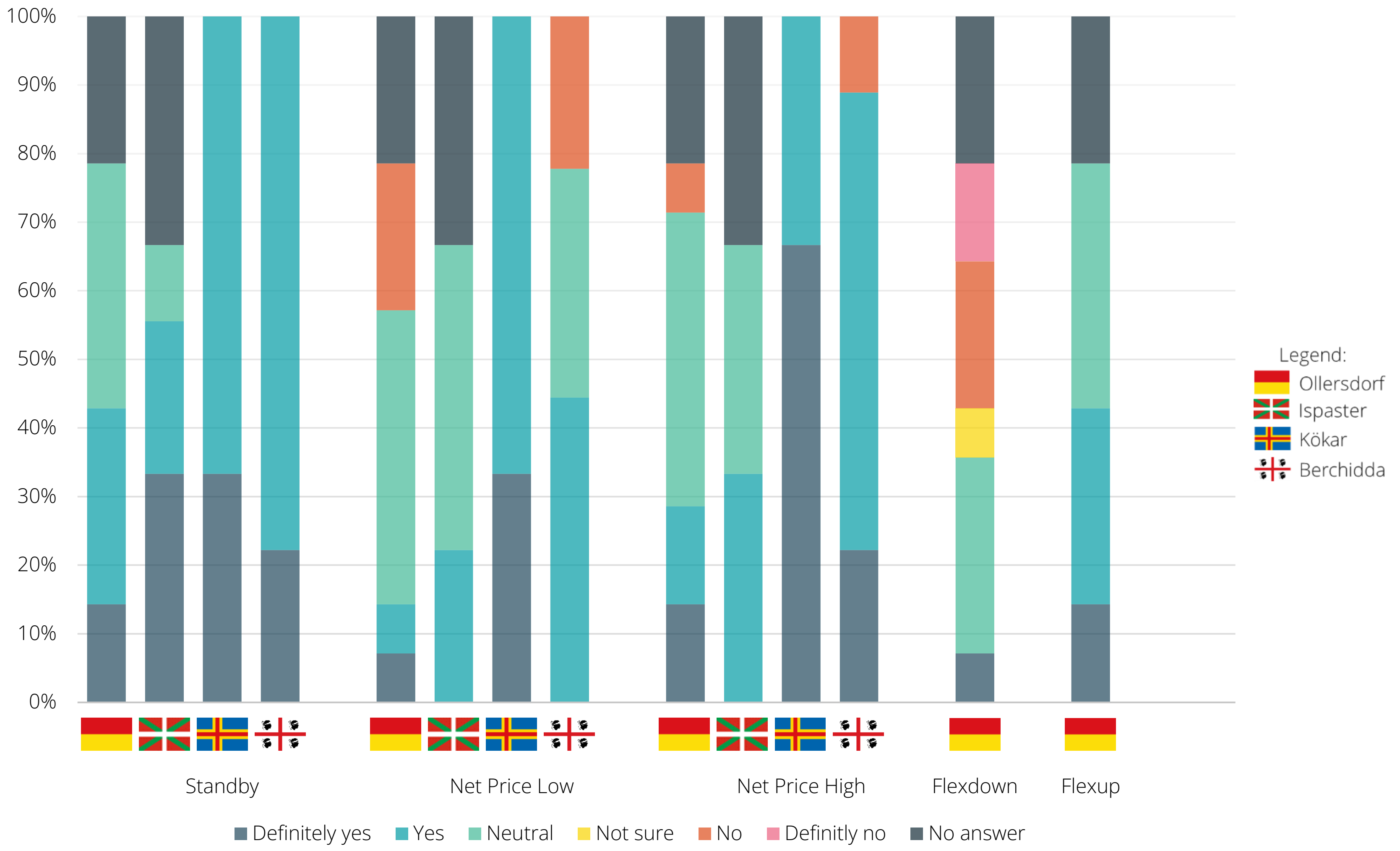

Figure 40: Identifying which flexibility options they would consider adopting in their home

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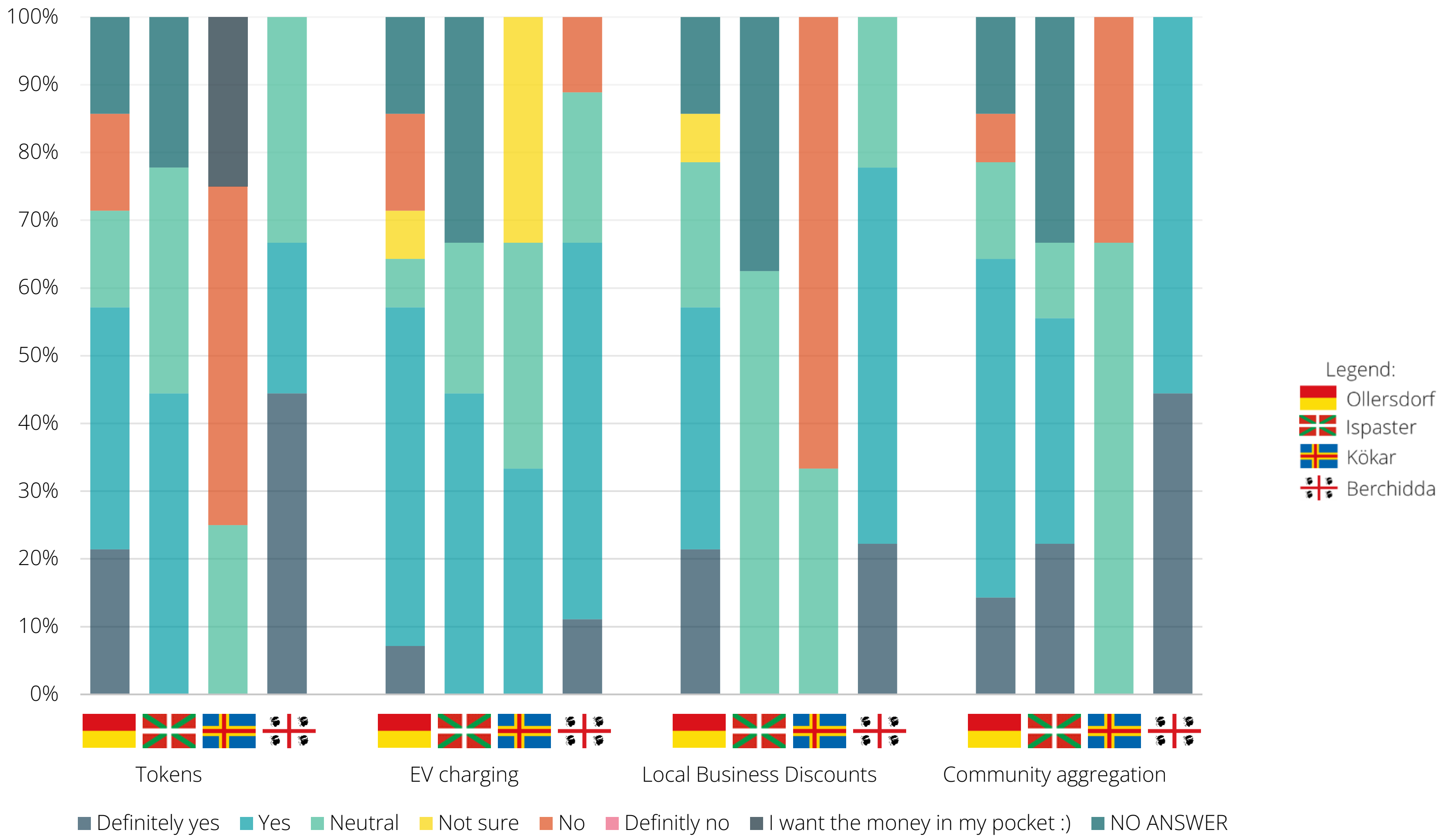

Figure 41: Identifying how they would prefer to collect the earnings from the flexibility adoption

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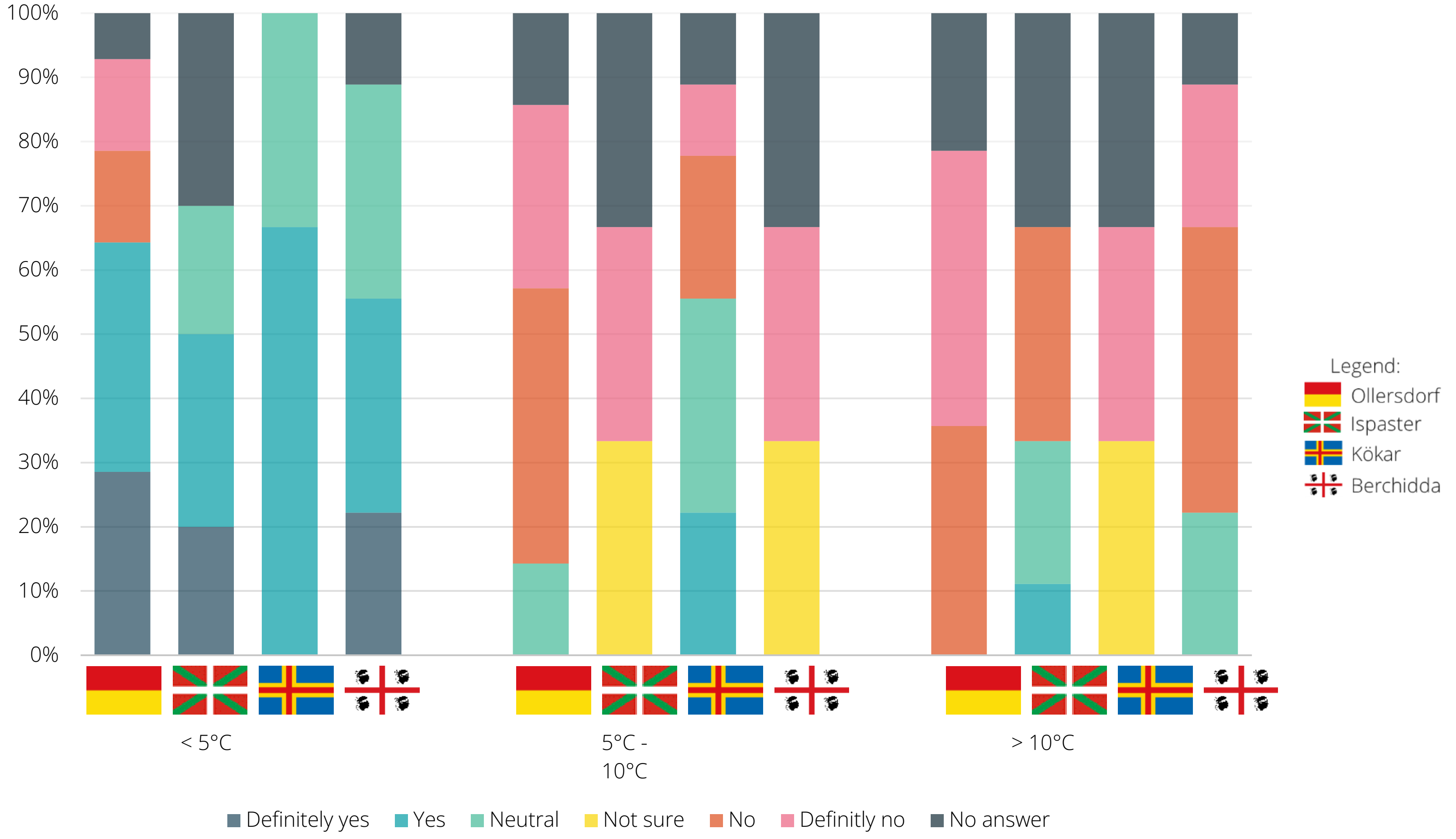

Figure 42: Identifying how much space heating comfort they are willing to comprise in order to reduce their energy demand (Left is less than 5°C, middle is between 5°C and 10°C, and right is more than 10°C.)

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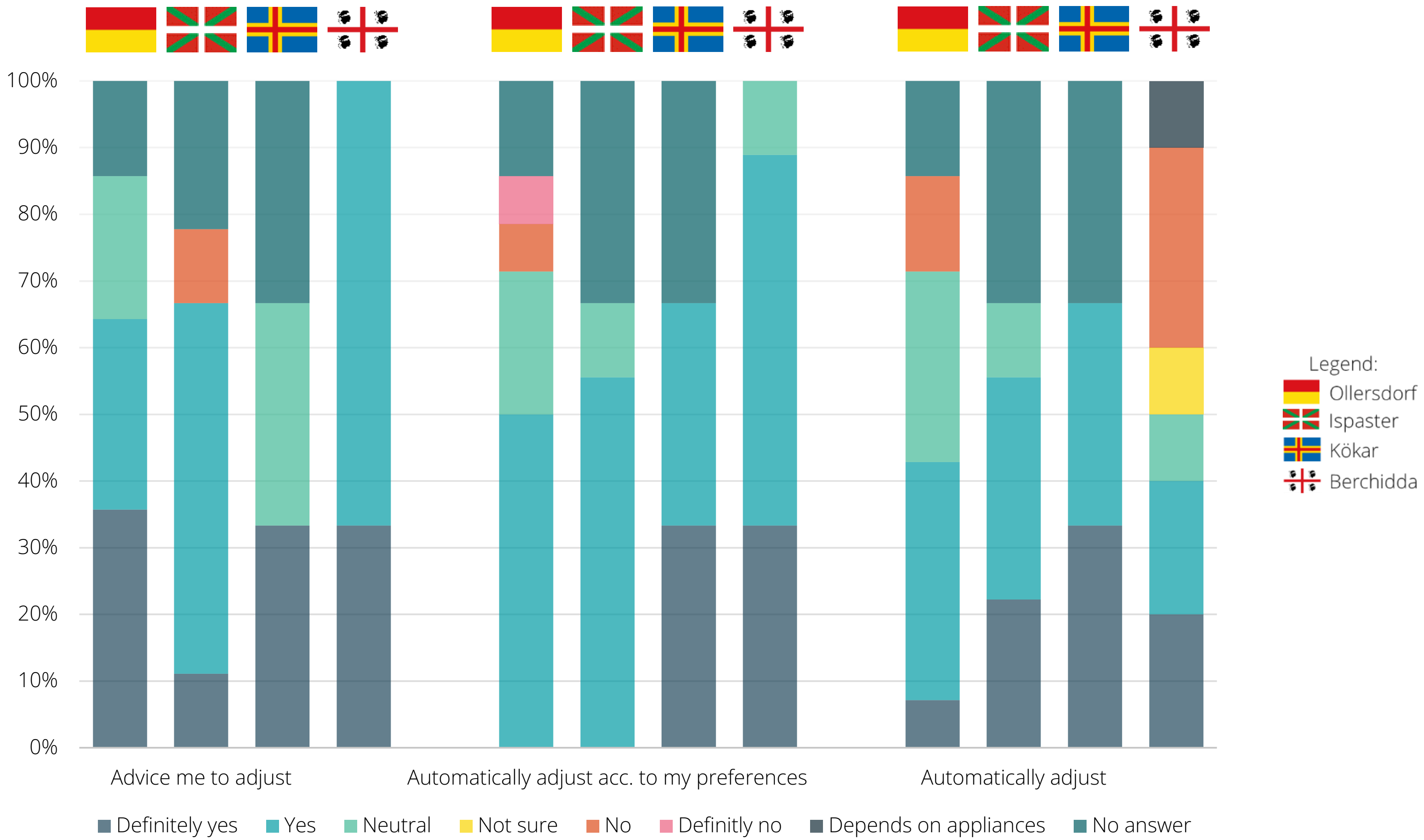

Figure 43: Identifying the configuration of the flexibility aggregation platform they would prefer

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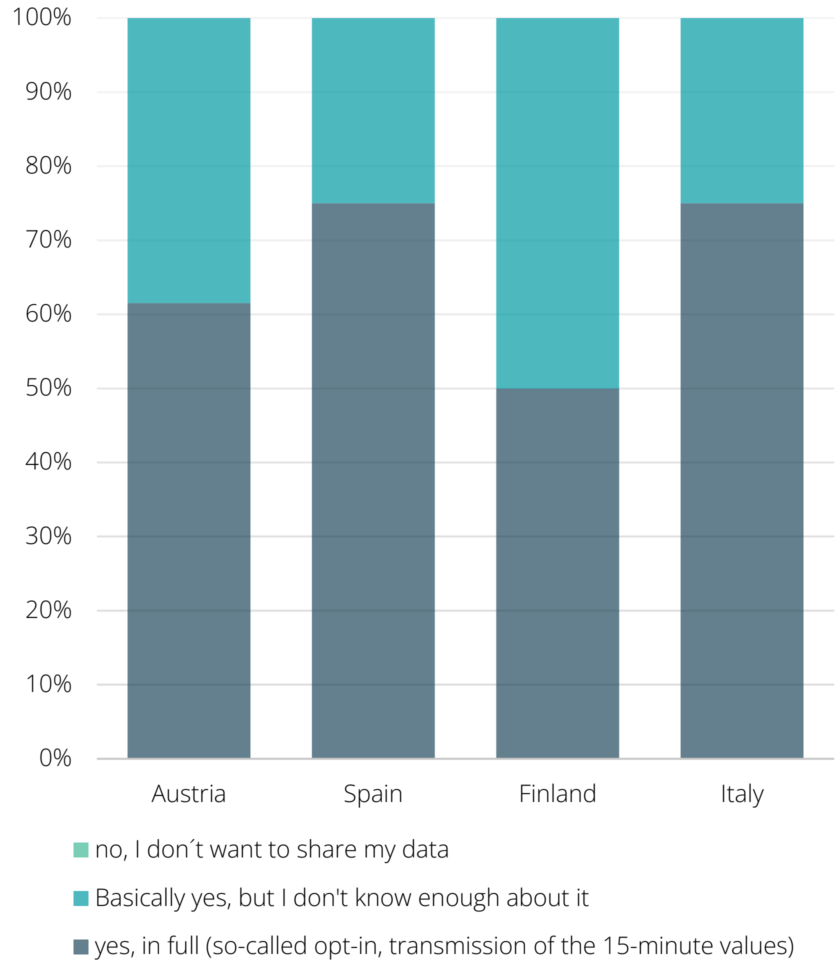

Figure 44: Identifying if they would grant access to their smart meter data to be able to join a flexibility aggregation platform in their energy community

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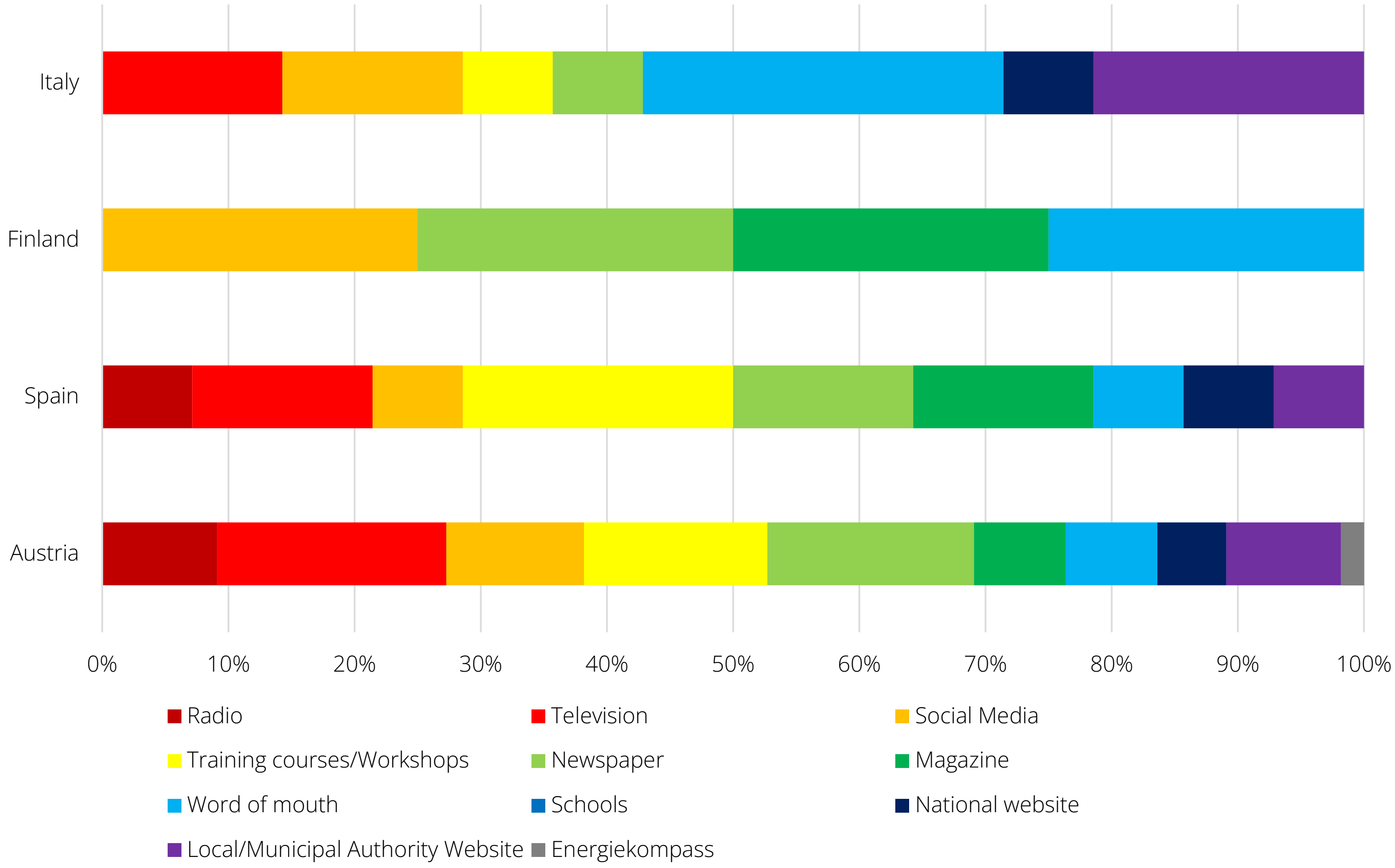

Figure 45: Identifying which means they use to access information about renewable energy and efficiency

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