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1. INTRODUCTION

The last years have witnessed an evolution of collective energy initiatives and energy communities in several EU countries. This includes the citizen energy movement (Bürgerenergie) in Germany or cooperative approaches in Belgium, France or Denmark. In most EU countries, however, the energy systems are still dominated by classical market actors. The Clean Energy Package (CEP) of 2018 had the intention to strengthen the involvement of new actors, in particular end-consumers, to foster their acceptance of renewable energy, and to mobilise private capital. This comes along with specific frameworks for energy communities and collective actions that are to enable new business models for decentralised energy systems.

Energy communities, according to the CEP, provide organisational frameworks for collective energy initiatives, which have new possibilities to act in the energy sector, including new rights to access the energy markets. The CEP, however, explicitly allows the existence and further development of collective energy actions (CAs) outside of the specific frameworks of energy communities. The provisions of the CEP for energy communities aim for approaches in which the primary purpose is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where they operate, rather than financial profits. This opens up a window of opportunity for initiatives that fulfil specific societal needs. At the same time collective energy actions are of high relevance for a broad transition, they can- according to a definition developed in DECIDE- be profit based, effectively controlled by members or shareholders or by a third party. Still, in case the initiative is controlled by a private undertaking whose primary commercial or professional activity is in the energy sector, the coordination of the collective energy action must include a decision majority of representatives from a public body, citizens, and/or civil society[1].

The CEP includes two types of energy communities. "Renewable Energy Communities" (defined in the recast of the Renewable Energy Directive) and "Citizen Energy Communities" (defined in the Electricity Market Directive), which allow citizens, public authorities and specific types of companies to collectively organize their participation in the energy system including energy generation, self-consumption, sharing, storage, and sales of energy. Renewable Energy Communities (RECs) address all types of renewable energy and have a local character. Citizen Energy Communities (CECs), on the other hand, can operate over a larger area and have an emphasis on non-discriminatory access to the electricity markets, either directly or through aggregation. The Renewable Energy Directive also defines "Renewables self-consumers", enabling collective self-consumption (CSC) in the same building or multi-apartment block or even beyond; they are not bound to a specific governance structure.

The EU framework leaves many details of the transposition process to the national level. Most EU member states have introduced basic regulatory frameworks for energy communities (ECs). Currently there is a broad discussion among different actors, such as communities and traditional market actors on possible business

[1] DECIDE position paper on Collective Actions, October 2022

models that may fit into the energy community framework but also on collective energy actions outside the CEP or hybrid approaches.

The aim of this report is to give insights into different existing and emerging approaches for business models for energy communities and collective actions, to group different business model categories of energy communities and collective energy actions and to provide specific examples for these categories. Also, the report analyses existing and emerging contractual conditions within energy communities and collective energy actions but also with the energy sector. This an investigation to what extent they could impact the development and replicability, increase investments into renewables and offer a fair arrangements between all involved parties.

The report compiles results from the tasks 3.2.2 ("Analysis of existing and emerging business models") and 3.2.3 ("Contractual conditions analysis") and includes findings from 26 interviews conducted with collective energy actions in Europe.

In Chapter 2 the methods and process will be explained, followed by a literature review in Chapter 3. Chapter 4 describes different types of business models for collective energy actions and the simulation tool for assessing business models developed in DECIDE. The following section (Chapter 5) addresses factors influencing business models as well as barriers to the successful implementation of business models for collective energy action. Subsequently, in Chapter 6, contractual conditions and governance arrangements are described, whereby social, economic and technical as well as replication and upscaling factors are discussed in more detail. The chapter also includes handy checklists that describe the relevant elements to be considered in pre-contractual and contractual agreements in the context of a collective energy action. Finally, Chapter 7, provides a comprehensive summary of the most important findings as well as concluding recommendations.

2. METHODS AND PROCESS

The report builds on a detailed review of recent literature related to business models for energy communities and collective energy actions. The creation of categories for business models was based on earlier work done in the EU BRIDGE Taskforce on energy communities, but was consolidated in an iterative process with partners and expanded to reflect key elements of a business model canvas approach, which was complemented by examples. Furthermore, business model canvases were defined in cooperation with the DECIDE demo/ pilots partners.

The report has a strong focus on understanding the factors enabling and hindering business models for collective energy actions and energy communities. A range of important insights was obtained in exchange with the DECIDE pilots. These findings were discussed at a workshop (28/10/2021) in the context of the EU Sustainable Energy Week, including views from other related projects and their initiatives. Further discussions took place at the DECIDE to ACT hybrid event on 5th of November 2021, where external speakers (DAFNI Greece; Genervest Greece; Hyperion EC Greece; Newcomers project; the Citizen Led Renovation project and HERON, a DECIDE pilot) were invited to share their experiences and to consolidate the findings. Factors impacting upscaling and replication were discussed at the DECIDE to Replicate Workshop in May 2022, again with the participation of external partners.

Regarding the contractual conditions, results presented in this report are compiled from a mixed-methods assessment combining quantitative and qualitative approaches. In some cases, DECIDE pilots and "DECIDERs" (initiatives involved in DECIDE as collaborators/replicants of DECIDE pilots) shared their information via a survey, in other cases the information was retrieved via qualitative documentation and focus-meetings. In order to get broader insight into the business models, the contractual conditions, the organisation and, above all, the barriers and obstacles to the establishment of collective energy actions, interviews were conducted with 26 initiatives. These initiatives are not related to the DECIDE project (no pilots or DECIDERs). They are located in ten European countries, namely: Austria, Croatia, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Serbia and Spain. The initiatives were contacted from June to October 2022. During these interviews, the representatives of the initiatives were able to provide additional information to the DECIDE team and clarify certain aspects related to their activities.

3. LITERATURE REVIEW

The recent years saw a shift from traditional energy-related business models that partly already included decentralized renewables, e.g. via feed-in tariffs or net metering, and to possible new business models, where decentralized actors become active players in the energy market.

There are several strands of literature relating to emerging business models for energy communities and collective energy actions. Recent papers for example examine the national transposition of renewable and citizens' energy communities and other provisions of the Clean Energy Package (CEP) and to what extent they allow for new revenue streams. Some of these papers have started to map new business model types into classes. Reis et al. (2021), for example, define several business model archetypes for energy communities, including: energy cooperatives; community prosumerism; local energy markets; community collective generation; third-party-sponsored communities; community flexibility aggregation. Other studies have highlighted the potential of energy service companies (ESCOs) to deliver useful services such as light, heat and useful work through long-term energy performance contracts (Hannon and Bolton, 2015; Sorrell, 2007; Steinberger et al., 2009, Peeters et al, 2022). Furthermore, several publications emphasise how the diffusion of smart meters, IoT-enabled devices and block chain technology may enable peer-to-peer (P2P) business models to become increasingly viable – potentially negating the need for traditional energy suppliers altogether (Davis and Cartwright, 2019; Verbong et al., 2013).

Another set of recent literature aims to understand the role and interrelationship of existing and new actors. Roby and Dibb (2019), for example, point out that a hybrid approach would mirror the changing definition of community energy, from one that focuses on isolated activities to a more network-oriented approach. Under this hybrid approach, local authorities, businesses and third sector organisations can act as intermediaries that offer technical advice, give access to information, policy advocacy/support, business partnerships and professional services; provide access to buildings, loans, staff time or expertise, to help setting up community energy businesses (Webb et al., 2017). Brown et al. (2019) outline the role of municipalities as new important actors that can better ensure distributional equity in distributed energy transitions as well as have the fiscal, planning and political tools to facilitate significant change.

There is also an increasing body of literature that focuses on governance issues. These analyses include the comparison of possible initiatives enabled by CEP with pre-existing approaches, often focusing on (suitable) organizational and governance structures. Horstink et al. (2020), for example, provide an overview of the diversity of collective renewable energy prosumer initiatives in Europe as well as a stock-taking of the demographic, technological, organizational, financial, motivational factors and their hindering or facilitating effect that characterize them. The authors assess how these approaches align with current energy policies and incentives, as well as the extent to which they would fit into the provisions of the CEP that, according to their analysis, could also be limiting. Dilger et al. (2016) provide a detailed assessment of cooperative business models arguing that in contrary to most of the traditional business models, these concepts emphasize the value proposition and the customers as central building blocks, going beyond a pure market orientation and allowing members to be highly involved in strategic and operational activities through a co-creation approach.

An important feature of the EU energy community provisions is sharing of energy. This allows for optimization of assets improving the business case. Aside from energy sharing based on decentralized technologies, communities could also share centralized infrastructure, such as a storage system or car-fleets. Müller et al. (2018) list the value propositions for shared storage at community level (neighbourhood/micro grid) which include an increase in self-consumption, grid investment deferral, primary and secondary reserve capacity and market arbitrage. Collective energy actions including energy communities, can take advantage of being oorganized as virtual communities (SmartEn, 2020). Organizing a virtual community can help prosumers to achieve economies of scale, while having access to the same benefits as an individual household. Members can share ownership of large solar or wind parks, which may be cheaper and easier to maintain. Virtual communities can also be designed to share electricity via the grid, organised through a common supplier that takes care of the matching between production and consumption. On the other hand, ECs or CAs based on proximity have more possibilities to unlock local value. In a multi-family dwelling for example, particularly if this includes electric vehicle charging, there is a value in shifting load profiles in order to keep the peak capacity of the overall building to a minimum (SmartEn, 2020).

This reports adds to the existing literature with analysis of the business model categories that are used by existing and emerging energy communities and collective energy actions with a focus on DECIDE pilots or DECIDE replicants but also considering initiatives that are not part of DECIDE. For each of the business model categories we provide analysis of the main aspects including examples of such initiatives across the EU. In addition, we analyse how organisational aspects of such initiatives affect their business models.

4. BUSINESS MODEL CATEGORIES AND EXAMPLES

In this chapter we first present a more general business model canvas that considers the specific characteristics of community energy projects. Then we present seven business model categories that have been identified through research of existing and emerging collective energy actions and energy communities. Each business model category considers main canvas elements including the value proposition, key activities and technologies, typical members, typical external actors involved, the organizational structure and examples of existing and emerging collective energy actions. Subsequently, we present the business model propositions of the DECIDE pilots using the canvas method. This is followed by a subchapter describing the business model of the collective energy actions interviewed. Finally, we present simulation tools to assess business models as well as the simulation tool developed within DECIDE.

4.1 KEY ELEMENTS OF BUSINESS MODELS FOR ENERGY COMMUNITIES AND COLLECTIVE ENERGY ACTION

Canvas methods, such as the Business Model Canvas, are often used to develop business models in the energy sector. Before we present a Business Model Canvas adjusted to collective energy actions and energy communities, we explain typical Canvas elements.

Business Model Canvases outline nine segments which form the building blocks for a business model in a visual way[2]. These elements include:

Value propositions: Products and services a business offers to meet the needs of its customers.
Key activities: The most important activities in executing a company's value proposition.
Key resources: The resources that are necessary to create value for the customer. These resources could be human, financial or physical.
Key partners: In order to optimize operations and reduce risks of a business model, organizations usually cooperate with external partners.
Customers: To build an effective business model, a company must identify which customers it tries to serve. Various sets of customers can be segmented based on their different needs.
Customer relationships: To ensure the survival and success of any business, companies must identify the type of relationship they want to create with their customer segments.
Cost structure: This describes the most important monetary consequences while operating under different business models.
Revenue streams: The way a company makes income from each customer segment.

Community driven initiatives, however, will have different activities than traditional energy market actors, trough possible new technologies, a range of new actors including citizens and end-consumers, while customer relationships are rather the way communities internally operate.

[2] *https://eship.ox.ac.uk/business-model-canvas-explained/* Based on Wikipedia

The figure below provides an exploratory visualization of a canvas for customer-side business models, including new challenges for collective energy actions and energy communities that need to be solved to find replicable business models. It serves as a guiding tool, for the subsequent assessment of different business model categories and for the business model development for the DECIDE pilots.

Figure 1: Business Model Canvas for energy communities and collective energy actions

Figure 1 shows a DECIDE-adapted Business Model Canvas reflecting customer-side business models (adapted from Reis, 2021). In the value proposition we can see that next to the economic value, environmental and social values are important as well. Key activities of energy communities reflect both new opportunities of the Clean Energy Package, but also activities we observed in collective energy actions. It is important to note that activities stemming from the CEP and their related revenues can only be realized if the appropriate regulations are in place. Collective energy actions however are not bound to activities of the CEP. Key resources include technologies, human capital (with citizens becoming active consumers and promoting innovation), as well as space needed for installation of technologies. Key partners include stakeholders that are involved with energy communities and collective energy actions but are not their members or stakeholders. These can include municipalities, DSOs, service or technology providers. Energy service providers including ESCOs for example may operate the energy community or collective energy action in technical terms, such as installing technologies, providing for energy sharing or data management. Also housing associations may be important as they already have an organizational structure among consumers that energy communities can build on. Customers include members and shareholders, such as households and SMEs in the EU framework; collective energy actions, however, are not restricted to a certain type of customers. Customer relationships refer to the governance of energy communities and member relationships in the case of energy communities, in case of collective energy actions also to external customers. Regarding the cost structure customer-side business models are characterized by potentially high up-front costs and long-term payback periods (Reis et al., 2021). At the same time, sharing of assets within energy communities will improve their profitability. Revenue streams for the consumers include reduced energy costs but also returns on investments (that are higher outside the non-profit driven framework of energy communities). Service providers or aggregators may achieve revenues from offering flexibilities on markets.

The following analysis looks into business models that result in benefits for the community (financially or in other ways). The business models of the activities used to create value/benefits for a community are grouped in seven business models categories. Therefore, **an energy community or a collective energy action can lead to/make use of multiple business models**. The analysed business model categories can (but do not have to) be operated by the community themselves.

Explanation for each column of the subsequent table

- **Name of business model category:** We classified the business models of existing and emerging energy communities and collective energy actions into 7 categories:

1) Collective generation and trading

2) Collective self-consumption (residential)

3) Collective self-consumption (associations, public and commercial)

4) Community owned grid

5) Collective investment in a community project

6) Collective investment in an independent energy project

7) Collective service provision

Business model components:

- **Description of business model category:** This description is based on the following elements of the business canvas model: *Value proposition. Key Activities and Revenue streams.*
- **Technologies:** Typical energy technologies hardware/software or technology solutions used with this business model type or in the specific use case. In the canvas model, this item would refer to the *Key Resources*.
- **Typical members/shareholders:** Members and shareholders refer to participants of the collective energy action or energy community that are directly involved in the business model (i.e., citizens, municipality, supplier, private companies etc.). In the Business Model Canvas, this part of the table would relate to the *Customers*.

- **Typical actors/key actors involved:** Refers to other actors that are not members/shareholders in the collective energy action or energy community but who are involved in the business model (i.e., aggregators, 3rd party energy service providers, DSO, technology provider etc.). In the Business Model Canvas, this part of the table would relate to the *Partners*.
- **Typical organizational structure -** Customer Relationship**:** This relates to *governance of member and customer relationships*, however customers being members and stakeholders of energy communities or collective energy actions. For the more narrow approaches of energy communities, RECs and CECs are basic organisational frames that can be complemented by cooperative laws or other contractual arrangements. Further details can be found in Chapter 5.
- **Examples:** Here we identify existing collective energy actions that use this business model category to identify potential benefits for their involved community.

Name of business model types	Description of business model category *Value proposition, Key activities, Revenue structure*	Technologies *Key resources*	Typical members/shareholders *Customer segments*	Typical actors involved *Key partners' side of the energy community/ collective energy action*	Typical organisational structure *Governance Customer relationships*	Examples
1. Collective generation and trading	Implementation and management of one or multiple energy generation facilities aiming to sell the energy or flexibilities on local or national energy markets or to the supplier/DSO by injecting to the grid for a set price. Revenues come from electricity trading with profits / dividends / interest to investors / members.	• RES electricity / heat generation technologies • Virtual power plants	• Citizens • Local authorities • SMEs	• Supplier • Flexibility market operator • Technology providers • DSOs • Plant operator • District heating system operator	• Cooperatives • Collective energy action by a company	• EcoPower, Belgium • BocagEn, Belgium • HERON planned– DECIDE pilot
2. Collective self-consumption (residential)	Jointly producing, storing and using locally or regionally produced (renewable) electricity e.g. peer-2-peer energy exchange. Any extra electricity can be traded externally. Organizing procurement or sales of the delta of generation and consumption. Relieve grid operators and balancing responsible parties by balancing generation, storage and consumption. Revenues / costs come from internal balancing of supply and demand and are accordingly distributed.	• RES electricity/ heat generation technologies • Hydro plants • Storage • Heat-pumps • E-vehicle charge spots	• Citizens (prosumers and consumers), e.g. owners and occupants • SMEs • (Housing) Associations	• Supplier • DSO • Technology and service provider, e.g. company managing the P2P SME market • Building managers and housing associations • Civil society organizations • Municipalities	• Cooperatives • (Housing) Associations	• Kněžice, CZ (municipality – 1,400 residents) • OurPower – DECIDE pilot • Abbatoir Plus Energy Disctrict- DECIDER (Belgium) • Schoonschip (the Netherlands) • TECSOL – village of Prémian (France)

3. Collective self-consumption (associations, public and commercial)	Energy generation from plants owned by the housing association, commercial areas or public spaces (e.g. kindergartens) used to cover consumption of the members of the community first maximizing self-consumption. Any extra electricity can be traded externally. Revenues / costs come from internal balancing of electricity and heat consumption and are accordingly distributed. *Note: This class exceeds class 2 by extending it to heating and cooling above of electricity sharing or self-supply*	• RES electricity / heat generation technologies • Rooftop and open space PV, biomass plants and CHPs, wind turbines, hydro plants, heat plants and heat grids, storage, recovery of excess energy from industry, heat-pumps, e-vehicle charge spots	• SMEs located in the area • Municipality • (social) housing associations • Other associations located in the district • Regional bodies	• District developers • Building managers • ESCO • DSO • Supplier	• Cooperatives • Associations • RECs and CECs	• Kricevzi tec park (Croatia) • Abbatoir Plus energy district - DECIDER • TREA, Estonia –DECIDE pilot
4. Community owned grid	The community owns and operates the electricity or heating grid that is used to supply the community. This may include: physical islands, districts, local communities, towns in the countryside and shared living projects. Revenues / costs come from internal balancing of electricity and heat consumption as well as remuneration of grid relief and/or emergency management by system responsible party and are accordingly distributed.	• Grid operation and supply	• Citizens of the region/area • Municipalities • SMEs • Locally owned grid operator and supplier	• Technology provider • Energy provider outside the island • Local government /administration • DSO or TSO • ESCO • NGOs	• Cooperatives • Associations • Municipalities	
	4a. Microgrids **-** Network of electricity users that owns and manages the grid that connects them, typically with a local source of supply that is usually attached to a centralized national grid but is able to function independently	• Grid operation and supply	• Citizens living in the geographical area • SMEs • Municipality • Locally owned grid operator and supplier	• DSO or TSO, • Technology provider • ESCO • NGOs	• Cooperatives • Associations • Municipalities	• Elektrizitätswerke Hindelang e.G. (EWH) – DECIDE pilot

	4b. Natural non-interconnected island	• Grid operation and supply	• Citizens living on the island, municipality, supplier/DSO (locally owned) company	• Energy producers on the island • NGOs • Associations	• Cooperatives • Associations	• Sifnos Energy cooperative - Greece
5. Collective investment in a community project	Crowdfunding, Collective purchase of the technology to be used for a central use or for each of the members (PV, heat pumps, EVs) or collective purchase of energy service (refurbishment of buildings, energy management etc.)	• PV, wind • Building envelope retrofit • More energy efficient technology for heating and cooling etc.	• Citizens, • (Social) housing associations • Collective energy action manager	• Citizens • Cooperatives • Technology providers • ESCO, DSO. • Refurbishment companies	• Cooperatives • Associations	• Green Energy Cooperative (Croatia)
	5a. Collective action - Collective purchase/installation of technology	• Rooftop PV generation	• (Social) housing associations • Collective energy action manager	• Technology (PV) provider • ESCO • DSO	• Cooperatives • Associations	• ENBRO – DECIDE pilot • ThermoVault - DECIDE pilot • DomX – DECIDE pilot
	5b. Collective refurbishment of buildings in the community	• Building envelope retrofit • More energy efficient technology for heating and cooling etc.	• Citizens, municipality • Community manager	• Refurbishment companies • Technology providers	• Cooperatives • Associations	• Bristol Community Energy Fund • Križevci, Croatia – (COMPILE project)
6. Collective investment in independent energy project	Collective community investment in an energy project that is not related to the community and will not be used by the community directly – other than for financial benefits.	• RES generation	• Citizens • SMEs • private companies • Plant operator • Municipality	• Technology provider • DSO • Land/rooftop owner • Plant operator • NGOs	• Cooperatives • Associations	• Courant d'Air, Belgium • ZEZ, Croatia
	6.a Cooperatives	• RES generation	• Citizens • SMEs • Private companies • Plant operator	• Technology provider • DSO • Supplier • Land/rooftop owner	• Cooperatives • Associations	• Courant d'Air, Belgium
	6.b Collective energy action - crowdfunding	• RES generation	• Citizens • Private companies • Municipality	• Plan operator • NGOs	• Cooperatives • Associations	• Green Energy cooperative, Croatia

7. Collective service provision	Energy service provided by a third party or by the community providing the energy service. Energy service is meant not just service to the electricity grid operator, aggregation and sale on energy market, but also energy management, management of mobility etc.	• Large range of technologies, including storage, heat pumps, e-vehicles			• Cooperatives • Associations • CECs allowing market access • Collective energy actions: no governance form needed	
	7a. Mobility communities - Electric car sharing, optimizing charging patterns, flexibility provision to markets Savings come from an optimized charging strategy and market revenues.	• E-vehicles	• Citizens (customers) • EV managing company • Supplier	• DSO • Municipality		• Partago (Belgium) • Som Mobilitat SCCL (Spain)
	7b. Flexibility service to markets and the DSO - An aggregator pools the flexibility and gain revenues from energy and offers it to balancing power markets or to a grid operator. Other services to DSOs include congestion management. Financial benefits are market revenues.	• Software and hardware systems • Energy efficient appliances	• Citizens (customers) • Aggregator	• DSO • TSO • Service providers	• CECs • For collective actions no governance form needed	• Som Energia (Spain) • Energie Samen and ENDONA (the Netherlands) • ThermoVault – DECIDE pilot
	7c. Demand side management - Users have the capability to change their usage of energy (time, quantity) and are offering the energy produced/ saved on the market.	• Software and hardware systems • Energy efficient appliances	• Citizens (consumers) • Commercial and industrial consumers	• Service providers		• DomX – DECIDE pilot
	7d. Energy advice - Include the energy planning, technical guidance for energy renovation, monitoring of the energy consumption and evaluating the environmental impact of cities/communities. Revenues are related to energy savings.		• Citizens • SMEs • Municipalities • Company providing advice	• Service providers		• TREA – DECIDE pilot • Klimaan • Ecope

	7e. Energy Efficiency services - ESCOs develop, design, build, and arrange financing for projects that save energy, reduce energy, operations and maintenance costs at their customers' facilities. Return of investment via contracting model or sub-ordinate loan with interest.	• Energy-efficiency retrofits	• Citizens • Commercial and industrial consumers • ESCOs	• ESCOs • Service providers		• ThermoVault – DECIDE pilot • DomX – DECIDE pilot

Several of the business model categories already existed before the CEP was adopted. Some will continue to operate or even emerge outside the CEP. Collective residential generation and trading (category 1) exists for several years, yet the economic benefits for members are small. In Austria, for example, collective multi-apartment self-consumption of PV energy existed since 2017.

Moreover, some business model categories could be combined in an initiative to improve the overall business model. For example, collective self-consumption, residential (category 2) and commercial and public (category 3) could be combined in an initiative to assure complementary load profiles, increasing self-sufficiency. Optimised infrastructure will strongly help to improve the business model. An example of this are Plus Energy Districts (PEDs) with centralized heat and electricity storage that represent a mix of category 2 and 3.

Collective investment in a community project (category 5) and collective investment in independent energy projects (category 6) can be found in several EU countries. Here the economic benefits however are also still limited. Instead, environmental considerations are important drivers for members to invest. Collective energy actions we observe in DECIDE such as retrofitting heating technologies in households by service providers or ESCOs while making them smarter (category 7) is a relatively new and promising approach with a high replication potential. These approaches are not bound to the regulatory framework of the CEP. The main goal of these collective energy actions is competitiveness on the energy market and scalability, still the service providers target communities and may make use of community structures.

But also the CEP may trigger new approaches. The provisions of collective services to energy markets is a key feature of Citizen Energy Communities and several approaches are emerging, such as mobility communities, or communities providing energy services. As the regulatory frameworks on CECs as well as on flexibility markets are in their infancy, value propositions are vague. On the other hand, collective services may be key to enabling business models for energy communities, possibly in combination with other types such as collective self-consumption. Given the slow progress in implementing the EU provisions, collective energy actions that don't depend on these regulations may be an important driver to decentralize the energy system, particularly since some of them may even have the potential to be integrated in the CEC or REC frameworks at a later stage.

Emerging examples in more detail

In the following, a few examples of emerging types of energy communities and collective energy actions are presented. Some of them are combinations of the categories presented above. While the discussion on Plus Energy Districts clearly links them to renewable energy communities, ESCO models can operate as collective energy actions, and mobility communities may be a hybrid of both.

Plus Energy Districts (PEDs) and Zero-Emissions buildings

Basically, PEDs are synergetic with the concepts of energy communities as PEDs relate to technical characteristics and optimizations while energy communities provide a legal and regulatory framework for the organization and governance of a community. At the same time, energy communities provide new regulatory space for specific activities and market integration. Key features for PEDs as energy communities include (Tuerk et al., 2021):

- Buildings with high energy flexibility and low energy consumption
- Provision of flexibility across the district and to the market
    - More strategical installation of renewable energy systems and energy storage, optimizing assets across the district
    - Generation of heat or cold / Sector coupling
    - Centralized and locally shared technologies and infrastructure
    - Centralized storage systems
    - Centralized heat pumps
    - Car sharing

Overall the energy community concept could enable PEDs to become active elements in the energy systems, besides the mere generation of surplus energy. This may include multiple roles for using technologies and addressing the broader integration in the energy system (Tuerk et al., 2021).

The EBPD recast proposal defines 'zero-emission building' as a building with a very high energy performance, which contributes to the optimisation of the energy system through demand-side flexibility, where any very low residual amount of energy still required is fully covered by energy from: (a) renewable sources generated or stored on-site; (b) renewable sources generated nearby off-site and delivered through the grid (c) a renewable energy community within the meaning of the RED. Only few building will be able to fully cover their energy needs by renewable sources generated onsite. A major role will be attributed to nearby offsite renewable generation and to energy communities that can integrate and distribute renewable generation at a district level (EBPD recast, 2023, EU Parliaments approach).

Community ESCOs: solar-as-a-service, heat-as-a-service, community led renovation

External companies may establish partnerships with energy communities to jointly create and operate community ESCO aiming to provide energy efficiency services (Reis et al., 2021). Communities could, however, become ESCOs themselves, providing ESCO services on a non-profit basis. Several services could be offered. For instance, the solar-as-a-service business model allows end-users to become prosumers, with ESCOs financing the PV panels and taking over the responsibility for the installation, maintenance and upstream supply. This approach is taken by ENBRO, as being done by one of the DECIDERs in form of a collective energy action. Also heat-as-a-service may be a suitable model combining heat and power projects, with ESCOs owning the infrastructure and offering energy (Reis et al., 2021).

Another energy service could be community-led renovation promoted by the Estonian DECIDE pilot, led by TREA. Renovation loans are not easily available nor accepted by communities. Energy efficiency such as measures to improve renovation of buildings is already well established amongst some cooperatives (JRC, 2019). Other cooperatives created their programs in order to re-invest profits from renewable energy production (Bonhage, 2021). A mixed solar-as-a-service and renovation approach may be a suitable approach also for apartment associations that are widespread in

Eastern European countries for example in situations where there is no access to loan money due to e.g. real estate price (borderlands, distance form bigger cities). Apartment associations also could team up and tender for construction together in order to decrease administration and costs. Even if large parts of the needed investment in energy renovation will have to come from private investments, public money on renovation will also be needed. Energy communities' activities that need to be financed are awareness raising, mobilising home owners, energy audits and renovation advice identifying contractors and training them, advice on financing and monitoring effective savings after renovation (Bonhage, 2021).

Mobility communities

Services in the field of electro-mobility are becoming increasingly popular. For instance, Som Mobilitat and Mobicoop are purchasing electric cars charged with green electricity and renting parking spaces in cities to offer electric car sharing services (JRC, 2019). Energy communities encourage electric vehicles as mobility solutions, providing fossil-fueled free transportation services as extra sources of flexibility (Reis et al., 2021) Thus, e-mobility based business models may develop clean mobility solutions, while alternative value streams are exploited. E-mobility cooperatives are created by engaging shareholders (households, SMEs, public entities, social and technical entrepreneurs, etc.) to provide community public transportation, car-sharing or car-pooling services. Mobility services such as car sharing could be combined with revenues from flexibility markets or from optimization of charging patterns.

Revenues may be generated by (Borges, 2020):

- Peak shaving - storage for the household
- Grid services - aggregation of small scale
- Grid storage - minimise renewable curtailment
- Harness EVs as a stored energy source, using parked cars rather than peak plants.

4.2 BUSINESS MODEL FOR DECIDE PILOTS

This chapter presents a preliminary assessment of the DECIDE pilots' business models as Canvases and compares the different approaches that include both, energy communities and collective energy actions. While the ENBRO, DomX, HERON and ThermoVault pilots are collective energy actions, they may transform into an energy community in the long run. The OurPower, TREA and Hindelang demos aim to become energy communities. The ENBRO business model will be described in a planned update of this report.

THERMOVAULT - Collective energy efficiency services

ThermoVault fits under category 7 of the business model categories.

ThermoVault offers a software and hardware solution of electric energy services for residential electrical thermal appliances. Their services unlock the most cost-effective forms of energy storage, while simultaneously allowing for the integration of more renewables through aggregation. Its retrofit solution for existing electrical water and space heaters results in direct energy savings for residential customers, as well as offering valuable services to utilities, plumbing companies, appliance manufacturers and system operators, transforming their end-users into green, active and profitable stakeholders of the energy transition. The company currently controls over 5 MW of storage and thus overcomes the limitations for small scale flexibilities on low voltage grids that are present in Belgium. Thermovault targets B2B2C customers (e.g. (social) housing associations) as they have pre-existing organisational structures.

Figure 2: BMC for Thermovault

The initiatives of Thermovault could become a renewable or citizen energy community at a later stage when the organisational structure for these is well established, but it's not a requirement.

TREA - collective self-consumption and renovation

TREA applies two business model categories: category 2 and category 7.

TREA runs the Estonian DECIDE pilot located in the Annelinn district, one out of seventeen districts in Tartu. Almost 1/3 of Tartu's population is living in Annelinn. Most of the buildings are apartment buildings built in the soviet-era and need reconstruction due to the current technical situation and energy efficiency issues. Most of these buildings are connected to a district heating network in Tartu and have both, hot water and space heating, supplied by district heating. Aim of the pilot is to introduce benefits of reconstruction, renewable energy production (PV) and on site-consumption. In addition, energy monitoring equipment and monitoring solutions is implemented to analyse current consumption and state of comfort in building prior to renovation. Apartment associations[3] get support in planning the reconstruction of their building and applying for national reconstruction grants. Aside from this, TREA provides information and awareness raising to explain the procedure and possible benefits of including rooftop PV. Such installation would be part of collective self-consumption realized in collaboration with the apartment associations and DSO.

Figure 3: BMC for TREA

From an organisational viewpoint the area could become a renewable energy community that offers multiple services, solar PV and on the longer term electric vehicle charging and flexibility services.

[3] „An apartment association is a non-profit association established by apartment owners (…) for the purpose of shared management of the legal shares of the buildings and plot of land which are part of the object of apartment ownership and representation of the shared interests of the members of the apartment association". (Apartment Associations Act, § 2; *https://www.riigiteataja.ee/en/compare_wordings?grupiId=100109&vasakAktId=523122015010*)

domX – Collective energy efficiency service

DomX fits under category 7 of the business model categories.

The Greek DECIDE pilot domX offers a retrofit solution for the automation of legacy gas-based heating systems. The system brings several advantages to end-consumers, including improved heating efficiency (up to 35%), smart and remote control, improved comfort and direct participation in flexibility aggregation services. Through DECIDE, 50 residential end consumers of have been experiencing the advantages of smartly connecting with their heating system and the reduction of energy costs achieved through improved heating efficiency and additional revenues from the offering of balancing services to the supplier. Exploitation will focus on engaging more consumers through HERON's gas portfolio, currently consisting of over 4.000 subscribers.

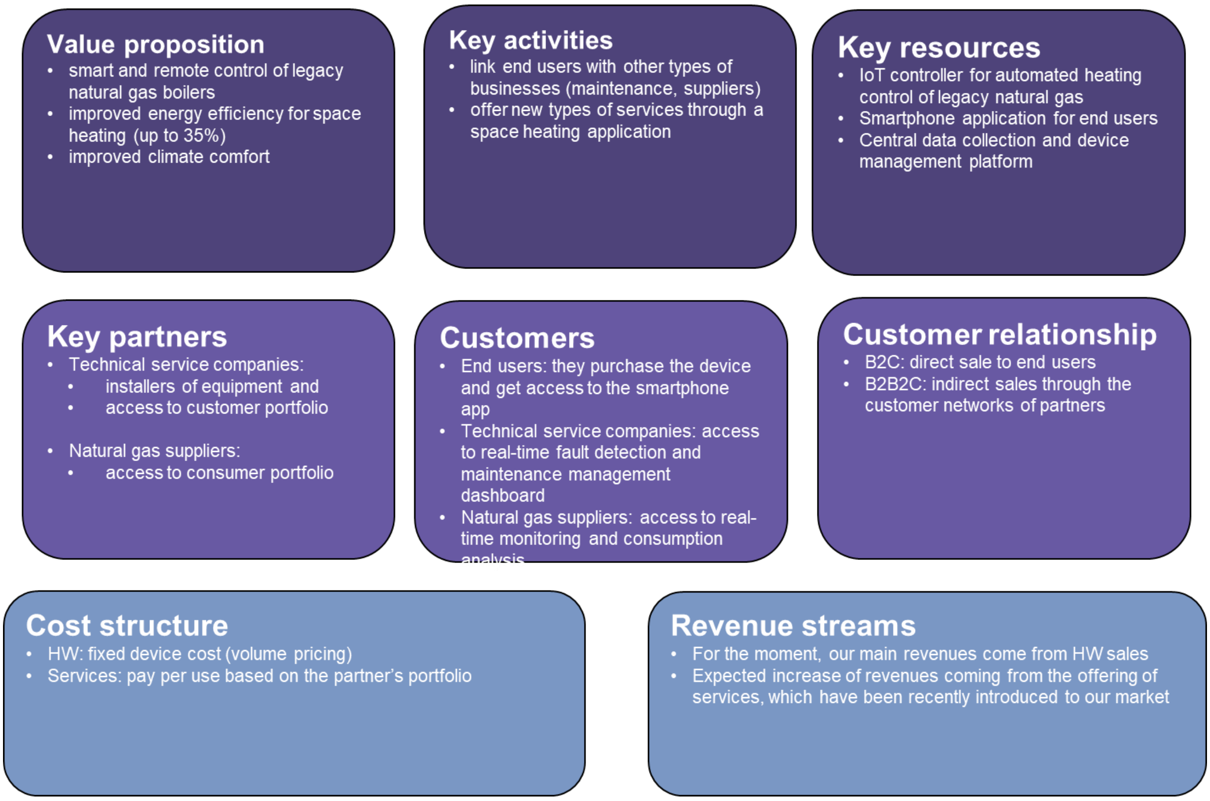

Figure 4: BMC for domX

HERON - implementing a community solar business model

HERON utilizes two business model categories: category 6 and 7.

HERON, part of the TERNA energy investor, is one of the largest independent electricity retailers and a rapidly developing natural gas supplier in Greece owning a customer portfolio, consisting of more than 300.000 subscribers. HERON has developed a community solar business model that is described in the canvas below. Within DECIDE, HERON is equipping 200 electricity consumers with real-time power meters for consumption and 15 electricity prosumers with real-time power meters for consumption and production from local or community RES.

The canvas describes the current available product, which is EN.A (ENergy Autonomy): a retail, community solar add-on tool. End customers buy a virtual share of HERON's and TERNA ENERGY's PV capacity and benefit from the respective energy production revenues for 20 years. The participation in the program gives access to the revenues of HERON's and TERNA ENERGY's PV assets through a flat fee (minimum €100 which can be re-adjusted). There is no need for PV ownership or installation, and no long-term contracts are needed. This model combines the benefits of virtual economic net metering, a simple opt-in/opt-out structure and is scalable. Customers can increase their participation to completely offset all bill-related costs and become "zero-billers".

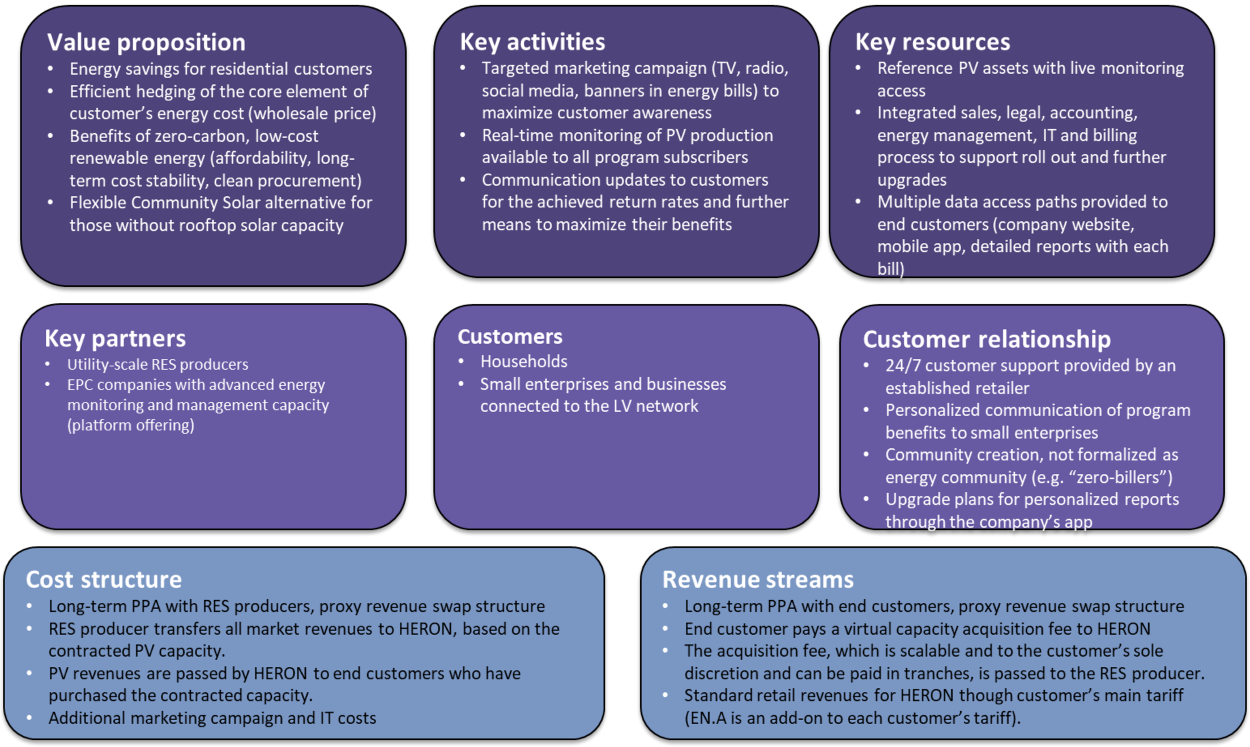

Figure 5: BMC for HERON

Hindelang - a community onwed energy system

Hindelang utilizes multiple business model categories: category 1, 2, 4 and 7.

Hindelang is a German village in the mountainous, touristic Allgäu region. The cooperative Elektrizitätswerke Hindelang e.G. (EWH) was founded in the 1920's by citizens of Hindelang for the electricity supply of their village. Since then, 330 citizens and SMEs (plus municipality) are members of the cooperative, an "energy community" that puts a strong emphasis on sustainable energy production and service towards its clients. EWH generates electricity from local resources, organizes local energy supply to approx. 5.000 inhabitants and operates the grid of Bad Hindelang. While today Hindelang has a close to 100 % RES electricity supply for the village (60 % from local sources), few customers are active in reducing consumption or turning to RES based heating for their homes and businesses. In the Hindelang demo the aim is to strive for more efficiency in electricity and use excess electricity for heat pumps (to heat homes with RES). Within DECIDE, both organisational structures to prepare the implementation of renewable energy supply as well as advanced cooperative structures for upcoming projects are formed to increase the acceptance by stakeholders.

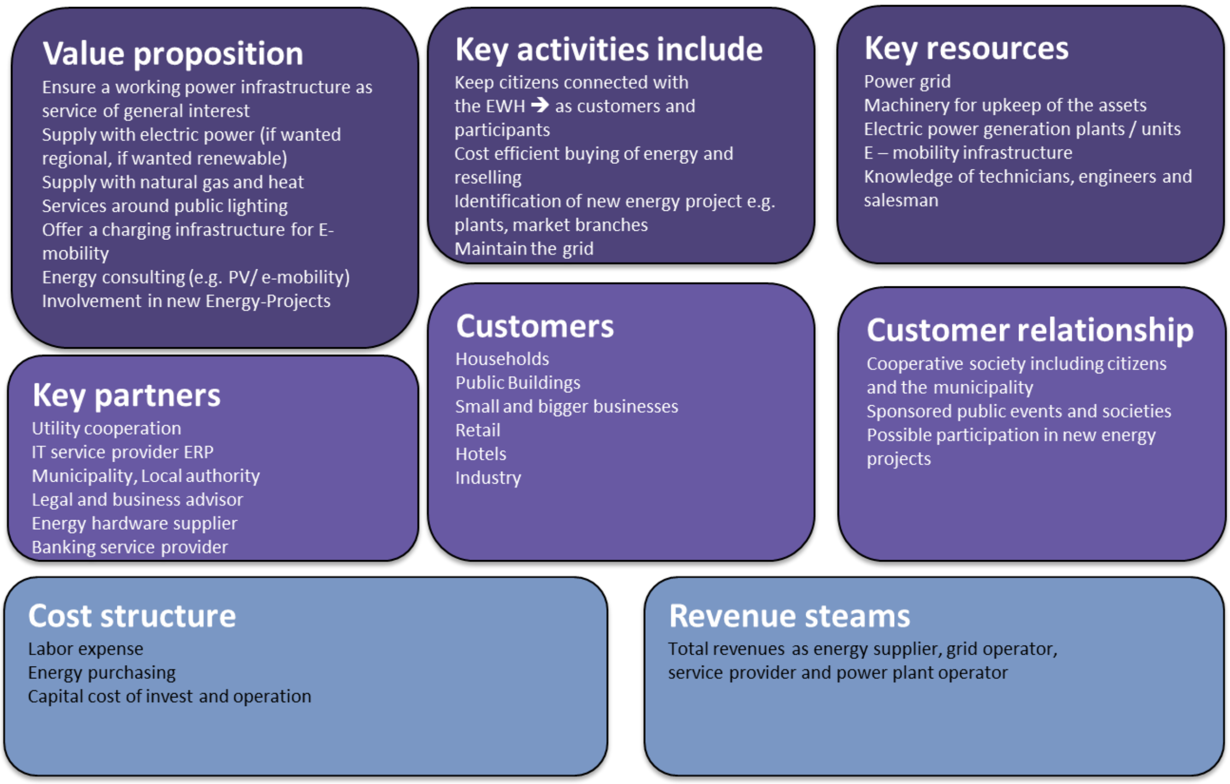

Figure 6: BMC for Hindelang

OURPOWER - A peer-to-peer marketplace for RES electricity

OurPower utilizes category 1 business model.

OurPower Energiegenossenschaft SCE mbH (OUR) is an emerging energy cooperative in Austria operating a peer-to-peer marketplace for RES electricity generated by its members. OurPower handles the online matching services as well as the whole process of electricity supply and billing. OurPower started its supply business in August 2019, and customer acquisition is underway. Interest and support of small scale power producers are huge. OurPower's portfolio of generators will comprise all kinds of embedded RES generators from small rooftop solar PV, a small wind farm and several small hydropower plants to biomass plants. OurPower promotes collective financing (crowd investment) and citizen engagement. OurPower addresses two different customer segments: private homeowners with solar PV rooftops and communities of citizens financing solar, wind, and biomass projects.

Figure 7: BMC for OurPower

Summary:

This chapter presented initial business models for the DEDICE pilots. It shows the significant differences for those DECIDE pilots that are aiming to become energy communities in the short term and those that are collective energy actions regarding technical sets ups, but also revenue structures. The collective energy actions show some similarities in combining retrofit of household technologies while making them smarter and optimizing their use. They can also prefinance renewables including energy advice. Overall the collective energy actions in DECIDE are narrower in their activities but have a large potential for economies of scale. Also they are not bound to the non-profit restrictions that many EU members prescribe for energy communities (see 5.1) and can include larger players and investors. These approaches are, however, less focussed on societal benefits, such as social cohesion or energy poverty reduction. The DECIDE energy communities on the other hand focus on establishing new RES generation, possibly combined with new services such as energy efficiency or mobility services. They are more tailored to the local conditions but may need subsidies for the time being.

4.3 BUSINESS MODELS AND FINANCIAL SET UP OF INTERVIEWED ENERGY COMMUNITIES

In this subchapter, the 26 collective energy actions surveyed and interviewed are described in more detail and information is provided on the country of the initiatives, as well as the existing and planned types of business models.

Figure 8 indicates the number of initiatives interviewed per country. Most initiatives were interviewed in Austria and Italy with six and five interviewees respectively. In Germany and Spain, four RECs were interviewed each. While two energy communities were interviewed in Ireland, only one initiative per country was interviewed in Croatia, Greece, the Netherlands, Portugal and Serbia.

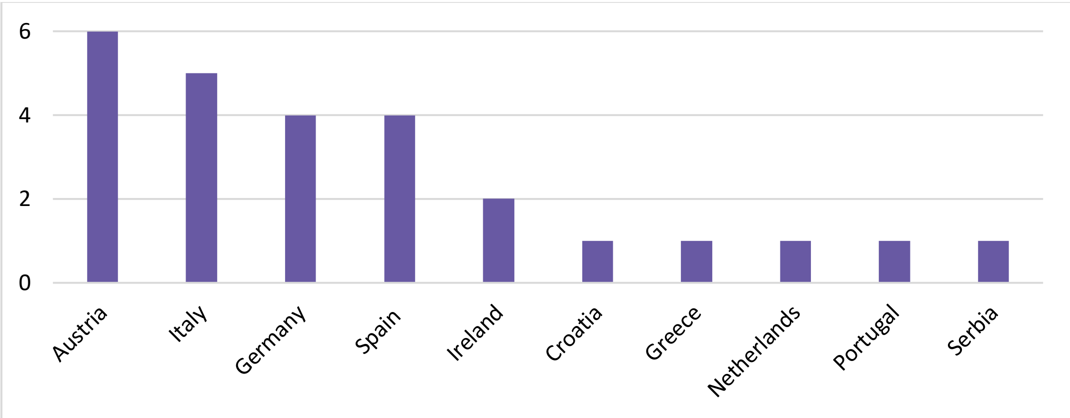

Figure 8: Number of initiatives per country (total number of interviewed initiatives = 26)

Figure 9 shows the distribution of existing business models. The total number of registered business models is 49. It is thus possible for an initiative to use multiple business models. The most frequently used business models are Collective service provision (Type 7) and Collective residential self-consumption (Type 2) with 15 and 14 of the 26 initiatives using these BMs respectively. Besides, 7 initiatives use BM type 3 (Collective self-consumption (associations, public and commercial)) and 6 initiatives use BM Type 1 (Collective generation and trading).

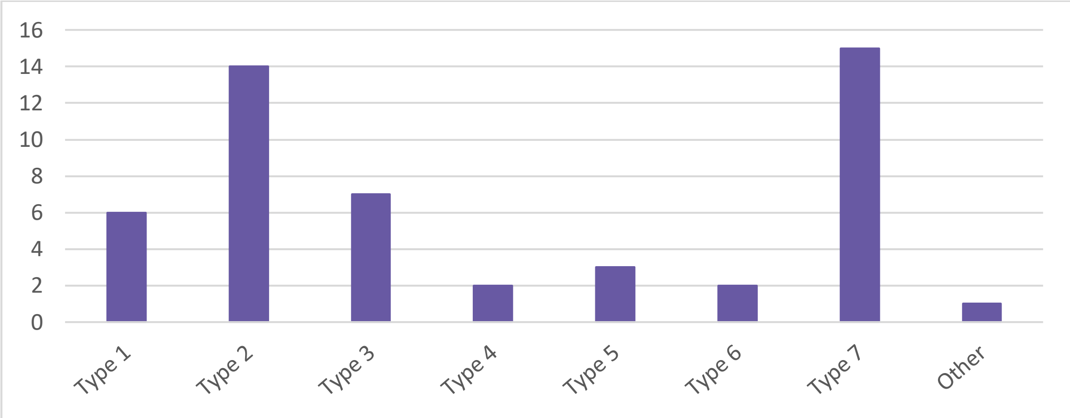

Figure 9: Existing business model types

The bar chart below (Figure 10) shows the business model types planned for the future. By far, the most frequently mentioned business model in planning is Type 7: Collective service provision, which is being planned by half of the initiatives.

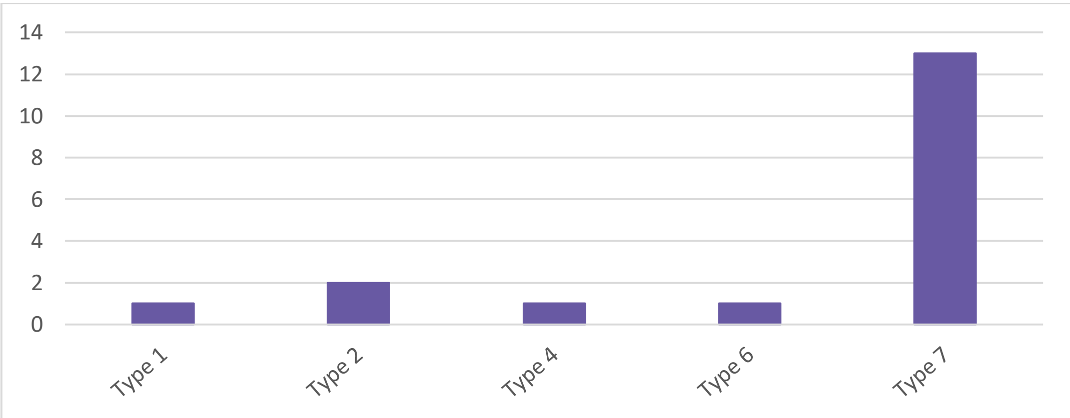

Figure 10: Planned business model types

4.4 SIMULATION TOOLS FOR ASSESSING BUSINESS MODELS

Many tools have been developed within different research projects to help collective energy actions assess their business models. Within DECIDE project we have grouped various activities done within collective energy actions into seven business model categories as shown in Figure 11 below.

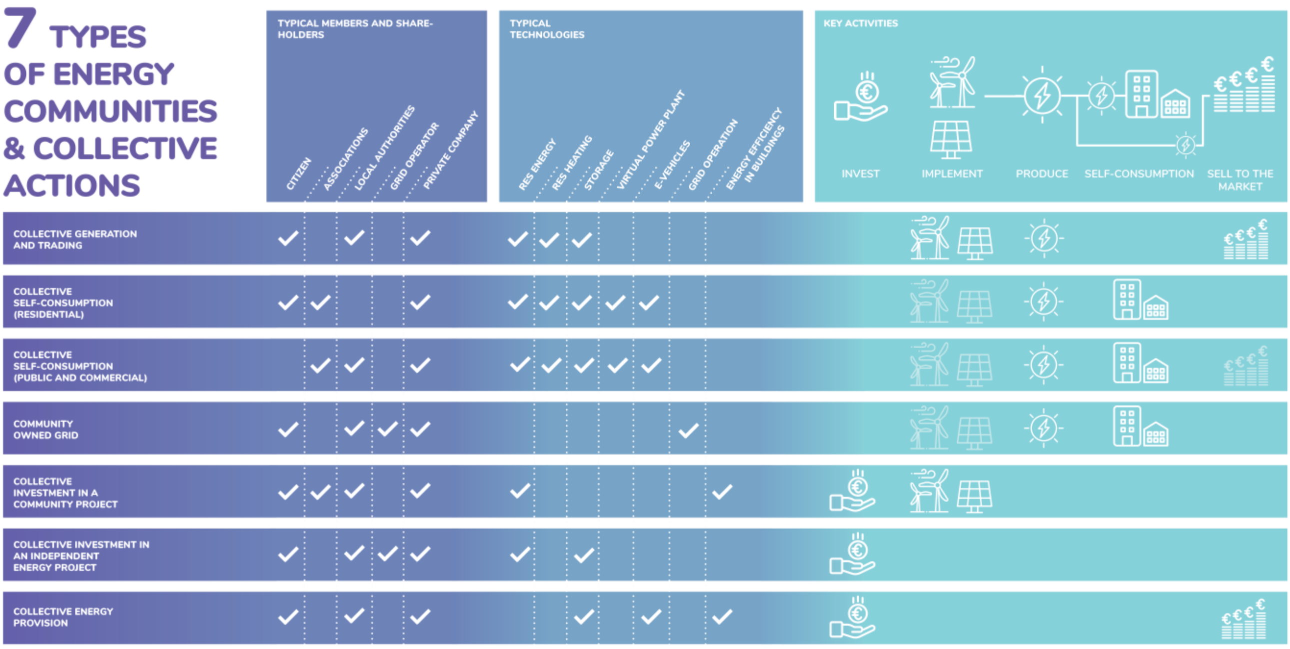

Figure 11: Seven types of energy communities and collective energy actions

Here we will assess various tools publicly available to collective energy actions and explain which ones could be used for which type of business model category. In addition, under DECIDE project a business model tool has been developed to analyse collective energy actions using the following categories:

- Collective generation and trading
- Collective self-consumption (residential)
- Collective self-consumption (public and commercial)
- Collective investment in a community project and
- Collective energy provisions, covering peer2peer exchange and aggregation.

The details of the DECIDE BM tool are provided in the subchapter below.

Name of business model categories	Software tools	Public/Project/Commercial
1. Collective generation and trading	• DECIDE Th!nk E BM energy sharing tool (presented in this chapter)	• Project
2. Collective self-consumption (residential)	• DECIDE Th!nk E BM energy sharing tool (presented in this chapter)	• Project
3. Collective self-consumption (associations, public and commercial)	• DECIDE Th!nk E BM energy sharing tool (presented in this chapter)	• Project
4. Community owned grid	• GridRule[4] – Compile project	• Project/Commercial after the project
5. Collective investment in a community project	• DECIDE Th!nk E BM energy sharing tool presented in this chapter) • ValueTool[5], Compile project • CARES[6] – tools and guides for shared ownership • CSOP[7] – SCORE project • PowerFund[8] – PowerPoor project	• Project • Project • Public • Public • Public
6. Collective investment in independent energy project	• CARES[9] – investment checklist and tool	• Public • Project/Commercial after the project
7. Collective service provision	• InteGridy[10] -BM tool – 62 innovative energy BM	• Project/Commercial after the project
7a. Collective service provision: Mobility communities	• EVrule[11], Compile project	• Project
7b. Collective service provision: Flexibility service to markets and the DSO	• X-Flex- Seriviflex tool	• Project
7c. Collective service provision: Demand side management	• ComPlot[12] – Compile project	• Project/Comercial after the project
7d. Collective service provision: Energy advice	• Green Pocket EnergieCockpit (Ecrew)[13]- monitoring energy consumption and providing advice	• Public
7e. Collective service provision: Energy Efficiency services	• CARES[14] – consultancy services • CSOP[15] – SCORE project • PowerFund[16] – PowerPoor project	• Public • Public • Public

[4] https://main.compile-project.eu/products/gridrule/
[5] https://main.compile-project.eu/products/coolkit/technical-tools/#section-4-valuetool
[6] https://localenergy.scot/resource/shared-ownership/
[7] https://www.score-h2020.eu/csop-calculator/
[8] https://www.powerfund.eu/
[9] https://localenergy.scot/resources/?pg=1&category=10
[10] https://energy.venturely.io/business-modelling-tools/
[11] https://main.compile-project.eu/products/coolkit/technical-tools/#section-5-evrule
[12] https://main.compile-project.eu/products/compilot/
[13] https://ecrew-project.eu/the-app/
[14] https://localenergy.scot/resources/?pg=1&category=10
[15] https://www.score-h2020.eu/csop-calculator/
[16] https://www.powerfund.eu/

DECIDE simulation tool – Sharing energy in a community

Within DECIDE a simulation tool was developed to investigate the potential (both environmental and financial) for energy sharing in communities and apartment buildings. This subchapter starts by providing an explanation of the developed simulation tool, followed by a description of the simulations carried out in this research project. For this study, 20 Belgian communities (in the form of apartment buildings) were simulated with the tool, following the implementation of the new protocols by the Belgian distribution system operator for energy sharing in one building (from January 2022), peer-to-peer trading and self-consumption (from July 2022).

The underlying simulation model of the tool is capable of using different energy profiles to start the calculations. The left side (input) of Figure 12 shows that for each unit of the community (house, apartment, common areas…), an energy profile is loaded and automatically included in the calculation. This allows the model to simulate different communities, both small and large depending on the parameter set for the type and number of units.

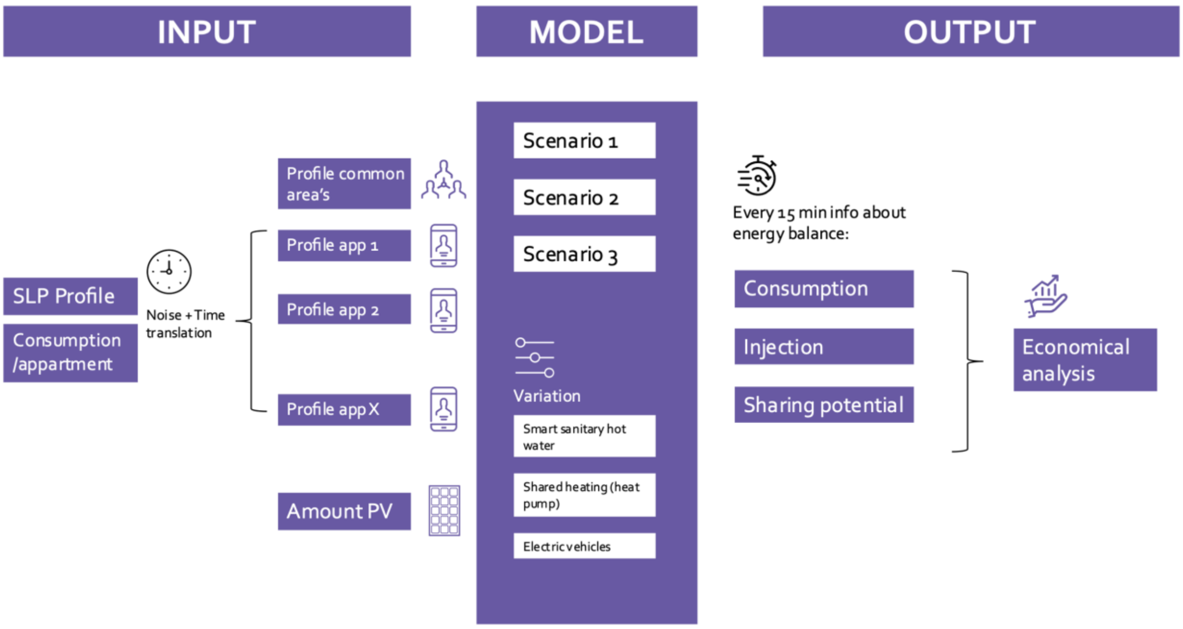

Figure 12: Infographic of the simulation model

In the simulations performed for the DECIDE project, synthetic load profiles (SLP) provided by the Belgian federal regulator (CREG) were used. These are determined based on historical data and take into account the annual calendar. An SLP represents a type of consumption that takes into account work and vacation days, the daily schedule (weekday and weekend days), and climatic influences (winter, summer). To simulate a realistic scenario, the profiles were shifted in time and noise was added on top of the value of the SLP. Thus, from one or two basic SLPs, it was possible to obtain enough variation to assign each unit its own realistic profile.

Depending on the combination of units and appliances, the model is able to simulate scenarios with and without energy sharing. The tool calculates per quarter-hour the amount of energy taken, injected, and shared for each unit of the community. An economic analysis is also made for each quarter-hour. The model is able to calculate with dual, as well as dynamic tariffs. As a final result of the simulations, a payback period and annual total revenue (or savings) are displayed for each scenario. For each simulated case, the following scenarios are discussed:

- Scenario 1: The entire community participates in energy sharing, the production installation will be connected to common areas and shared from there on with community members.
- Scenario 2: The entire community invests in shared energy production, the surplus energy will be injected into the grid and the financial proceeds from this will go to the community.
- Scenario 3: The community participates partially in energy sharing, the production installation will be connected to one individual member of the community and from there further shared with other participants.
- Scenario 4: Individual energy production installations, no investments in shared energy production is needed as each unit will have its individual installation. (no energy sharing)

The tool in action

For this study, 20 Belgian communities were simulated with the above described simulation tool. The examined communities are all apartment buildings of different sizes, and for each apartment building the different scenarios described in the previous section were simulated. Where relevant, the same scenario was re-calculated for different constellations of installed PV panels on or around the building, thus investigating the economic potential of energy sharing for small and large amounts of PV on a building. This resulted in a total of 78 simulations carried out in the study.

In order to draw research conclusions, the buildings were categorized according to the potential of installing solar panels on or around the building and the number of apartment units in the building, leading to one defining parameter:

$$\frac{kWp}{\#\, units}$$

Where kWp is the peak power of the installed solar power installation and the number of units are the participants of energy sharing in the community. Two examples can help to better illustrate this parameter:

- A 5 story apartment building with 50+ apartment unit will have a small kWp/#units as the available roof surface is low compared to the number of units.
- A 2 story building with only 4 units will have a large kWp/#units as there is a lot of roof surface to divide between the units.

Results

A number of interesting conclusions for Belgium energy sharing within apartment buildings can be drawn from Figure 13. The Figure shows the ROI for all simulated building configurations, indicating trend lines for different scenarios. It is important to mention that Belgium apartment buildings are organised in a way that the electricity consumption of the common areas is shared among all the apartment buildings.

80% RULE OF THUMB

For apartment buildings which can allow for installation of less than 5.22 kWp of installed peak power per participating apartment, scenario 2 is the optimal. Therefore, energy sharing described under scenario 1 or 3 do not lead to a better return on investment for the cases studied. The study shows that 80% of the studied buildings do not have the potential to exceed this limit. If the apartments studied are considered representative of Flanders, similar conclusions can be drawn for 80% of Flemish apartment buildings.

EXPANDING SHARED CONSUMPTION

If one chooses not to participate in energy sharing and to follow the optimal scenario, Scenario 2, a PV installation sized to the consumption of the common areas will entail a financially very interesting situation. With this a high self-consumption ratio will be achieved (25-45%) leading to a large annual benefit and consequently a short payback period. In this case, it is interesting to find ways to increase the consumption of the common parts to maximize self-consumption (dependent on needs, the common consumption could be: EV charging stations, common heat pump, etc.).

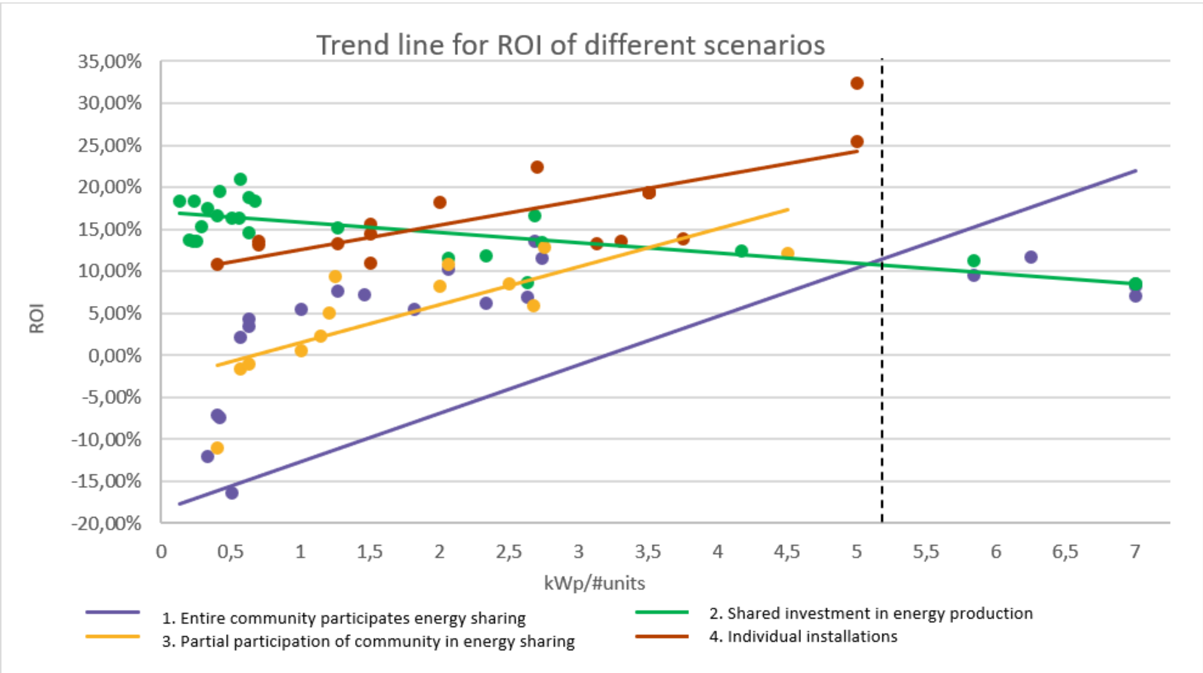

Figure 13: ROI of the different scenarios

20% EXCEPTIONS

Energy sharing within a community (Scenario 1) is financially attractive only when the production of energy is large enough to cover not only the consumption of common areas, but also to leave enough additional energy for consumption among individual apartments. The participating apartment units must be able to individually derive a greater benefit from the use of this additional shared energy than the administration and management costs associated with it. Scenario 1 should always be compared to the baseline scenario without energy sharing (Scenario 4), however, this scenario is the least efficient with respect to material use, and is often not feasible from a technical (space for cabling) or legal (legislation) viewpoint.

5. FACTORS IMPACTING BUSINESS MODELS FOR COLLECTIVE ENERGY ACTIONS

The success of the use of presented business models in providing benefits to the community of energy communities and collective energy actions is dependent on multiple factors among which are the regulatory framework, local socio-cultural and economic context and available financing and funding schemes. In this chapter, we discuss how these factor affect business models. In addition, we identify barriers to successful implementation of business models for energy communities and collective energy actions.

5.1 THE ROLE OF THE NATIONAL REGULATORY FRAMEWORK

National regulatory frameworks for energy communities and collective self-consumption are decisive for creating viable business models. This includes, for example, spatial boundaries, energy allocation rules or requirements for (non-)profitability of collective energy actions.

Spatial boundaries

Renewable energy communities require proximity of decision makers to the renewable energy projects. Proximity of the renewable energy projects can be determined using several approaches, such as:

- *Typology of the public grid*, which facilitates, for example, the implementation of local grid tariffs. While this is more in line with existing grid management of distribution system operators REC activities may be interrupted if they, for example, cross a Low Voltage (LV) area.
- *Administrative structures* (e.g. municipalities), aiming at a better consideration of settlement and community structures that may not coincide with grid limitations. Such kind of boundaries can vary a lot across a country.
- *Distance*, i.e. providing a clear boundary for all RECs. However, REC activities may be interrupted if the distance is set too limited.
- *Case by case judgement* based on certain criteria, taking into account activities planes by RECs. However, there is an ex-ante uncertainty if an REC will be approved recognized if the criteria are unclear.

The implementation decisions impact the viability of specific business models. For example in Spain, there is no final energy community framework in place, collective self-consumption was expanded however to a radius of 3000 meters. Within this scheme no grid tariffs have to be paid. In this model – in contrast to RECs – initiatives do not have to be organized as a legal entity. There is a large number of initiatives emerging in Spain being based on this model as a consequence of the favourable conditions.

Allocation of energy

The allocation of generated energy to participants of energy communities is an important factor that affects profitability. While basic rules are set in national regulations, additional rules can be set by the energy community itself. Some countries (e.g. Finland) have proposed fixed sharing coefficients, meaning the allocation of energy is fixed for participants independent of their actual energy needs. Other countries (e.g. Spain) have proposed dynamic coefficients, or a choice between these two options. The timeframe in which coefficients can be changed and which can amount up to one year also differs among countries. In case of dynamic models, different time intervals representing consumption are proposed (e.g. 15 minute time intervals or longer).

Requirements for (non-)profitability

Another important factor impacting business models is how strictly EU countries define the EU requirement for energy communities that according to RED II[17], *the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits*. A range of EU countries so far have defined energy communities strictly as non-profit organisations. National legislation on cooperatives and social enterprises often contains supportive rules to reinforce their non-profit nature such as, for instance, requirements to keep a reserve fund on hand, containing a certain amount of the revenues. Legislation may also require reserves and assets to be commonly held, non-distributable and dedicated to the common interests of the members (RESCOOP, 2021). In practice – as confirmed in discussions within DECIDE – this could mean that the financial benefits for consumers are limited, hindering the broader roll-out of energy communities.

In this context, Greece is rather an exception. The Greek law distinguishes two types of energy communities: non-profit and for-profit cooperatives. In non-profit cooperatives surpluses are not distributed to members, but remain in the energy community in the form of reserves which are distributed by decision of the general assembly. The surplus of for-profit cooperatives can be distributed to members under certain conditions and after the deduction of the regular reserve. Each type varies in composition and minimum number of members.

5.2 SOCIO-CULTURAL AND ECONOMIC CONTEXT

Several recent studies, but also the insights of our DECIDE workshops, show the high relevance of the socio-cultural context to realizing energy communities and collective energy actions. Among the main factors discussed here are economic context, land use and energy poverty.

The geographical location of community-based energy initiatives and thus the regional economic differences play a role in the development of different energy community business models. In general, EU member states with higher levels of disposable income have a higher concentration of community energy initiatives (JRC, 2020). Community energy is mostly prevalent in the higher-income countries of Northern and Western Europe, and less in Southern and Eastern Europe. This means that the level of citizen welfare can play a role in providing the purchasing power and sufficient capital to cover the necessary investments (JRC, 2020). Research shows that a mix between social capital, civic minded behaviour, environmental concerns and interpersonal trust are important factors that motivate members to join energy cooperatives (Bauwens, 2016). This interdependency of social and financial interests can strongly influence the size, type and design of successful community energy initiatives. The correlation between regions with higher levels of education and engagement in community energy projects is another factor highlighted in the scientific literature (Ruggiero et al., 2019).

[17] https://eur-lex.europa.eu/eli/dir/2018/2001/oj

Land use for possible energy projects is an important factor from two aspects: limited available land in more remote areas (e.g. islands) and land use conflicts (e.g. agriculture and tourism) (see DECIDE to ACT Workshop, 2021).

Another socio-economic factor related to energy communities and collective energy actions – and at the same time a possible driver to promote such initiatives – is energy poverty mitigation, which is found mainly in southern and eastern European member states. Greece has explicitly embedded the reduction of energy poverty as a prime goal of energy communities in its legal framework, also establishing specific measures. Energy poor or vulnerable households can participate in Greek's net metering scheme without a membership in an energy community (Frieden et al., 2021). As another example, Portugal has put a focus on mitigating energy poverty via energy communities in its COVID recovery plan (Portuguese Government, 2021).

5.3 FINANCING AND FUNDING SCHEMES

In general, financing mechanisms planned or implemented in EU countries include:

- Reduction of grid surcharges;
- Investment support;
- Operational support; and
- Crowdfunding and micro-loans.

In this section, some support mechanisms will be explained in more detail.

Reduction of grid surcharges

Some EU countries, such as Austria, Portugal and France, are currently developing or have already implemented local electricity tariffs specifically for RECs or collective self-consumption. Also, in the Czech Republic lower grid tariffs for collective self-consumption are being discussed. In Greece, virtual net metering allows electricity sharing even over a larger area without charging grid tariffs to consumers.

The reduction of grid fees often also includes a reduction of taxes and surcharges and thus has a supportive character, while the adoption of local grid tariffs is motivated by the EU-requirement to set cost-reflective tariffs (Peeters et al, 2019). In practice, both intentions cannot be clearly differentiated. It needs to be noted that reduced tariffs generally do not apply to the entire consumption of an energy community but only to the electricity exchanged/self-consumed within the community.

Investment support

Several EU countries are providing investment support for energy communities, additionally to support schemes for specific technologies/activities (e.g., PV, storage renovation) that exist in most EU countries. The Czech Republic, for example, will provide investment support for energy communities from its *Modernisation Fund*. Currently, 1.5% of the Fund (i.e. approximately 2.1 billion CZK - 81 million Euro) is earmarked for supporting the set-up of community energy (State Environmental Fund ČR, 2020). In Austria, emerging energy communities can apply for a grant of 25.000 Euro as a start-up support (FFG, 2021). Denmark announced in late 2021 to provide support for local energy communities and local climate initiatives of about 5.0 million DKK (0,672 million Euro) annually between 2022 and 2025 (Danish Government, 2021).

Operational support

In Ireland, RECs are part of the Renewable Electricity Support Scheme (RESS) (Irish Government, 2020). A part of the auctioned support volume is set aside for community-led projects. As outcome of the auction projects receive contracts to provide electricity at a guaranteed price for up to 16.5 years. In Italy, electricity self-consumption within the energy community is supported with 110 €/MWh (Frieden et al, 2020).

Crowdfunding and microloans

Crowdfunding has bloomed with the development of fast communication tools such as the internet, and is perceived as an alternative method of funding for SMEs and start-ups (Compete4SECAP). Crowdfunding helps to bridge the financing gap between (small) loans from friends, family, and banks and (large) investments from venture capital. It can be organized in four different ways: donation-based, reward-based, lending-based, and equity-based. Donation-based contributors do not receive anything for their contributions. Reward-based campaigns contributors receive goods or services in exchange for their contributions. Contributors to a lending-based crowdfunding campaign receive interest payments in exchange for financing a project. Lending-based crowdfunding is a form of micro-lending, where contributors can select a project with an associated rate of return and maturation date. Finally, the contributors to equity-based crowdfunding campaigns receive shares in the venture in exchange for their contributions. Because of the very broad spectrum of investors, i.e. supporters of the "project idea", crowdfunded projects have substantial social and environmental benefits incorporated in the outputs (Compete4SECAP).

5.4 BARRIERS TO REALIZE BUSINESS MODELS

Several barriers stand against effective growth and operation of energy communities and collective energy actions, as we learned from the DECIDE pilots and DECIDERs, public workshops the DECIDE project held with other related projects and initiatives as well as the conducted interviews. Barriers identified for energy communities and collective energy actions include:

Data access

Access to data is being discussed in several member states. DSOs often provide data only once a day or even less frequently, which will not be suitable for peer-to-peer trading or flexibility provisions. In Belgium and Austria smart meters will have an interface through which the energy community can read out real-time data, but energy communities will have to pay for the interfaces and communication infrastructure.

In the interviews, some RECs also complained about coordination problems with grid operators, resulting in delayed data. In addition, one REC interviewed mentioned that the digitalisation process needs to be faster. To empower consumers, citizens should be able to see their energy consumption in order to actively participate in the energy transition and change their consumption behaviour. At the moment, it is difficult for this energy community to get consumption data because there are no smart meters and it is not possible to access real-time data.

Uncertainties related to ownership of installations

According to EU provisions the production units are owned by an energy community. “Ownership” may, however, be interpreted differently across different member states and may lead to different rules regarding the legal relationship of the communities to “their” installations. For instance in the case of Austria, ownership will presumably not be defined in terms of civil law but rather refer to “economic or operational ownership”, allowing some ownership of the installation by non-community members. Increasingly, existing market actors have started to roll-out energy communities. Also, in Portugal different options for “external” ownership, including contracting, are discussed, where the energy community may be responsible for the operation while the involvement of external investors would be possible. In Greece, in contrast, the installations must be owned by the community. Thereby, the interpretation of ownership follows the cooperative model, i.e. the membership equally determines which shares of the installations are held. For collective energy actions there is no restriction in external ownership. Third parties can invest in and operate decentralized technologies for consumers.

However, no problems with ownership were mentioned in the conducted interviews.

Multi-layer decision making

This includes complex rules for public tendering, housing regulations or specific national or regional energy regulations. While these barriers are not specific for collective energy actions and energy communities they can still delay project implementation.

One example for the power of incumbents is Greece, where there is a large number of emerging energy communities. They need to first to get a governmental permit that is rather easy to obtain. In a second step, however, they need to get a connection term agreement with the DSO. Yet, the DSO can refuse such an agreement if the grid is not capable of absorbing the planned amount of renewables, which is a barrier in particular for big projects.

Discussions within DECIDE showed the prevailing strong role of incumbents also in other DECIDE partner countries. Often, national regulatory frameworks are insufficient to prevent incumbents from slowing down the deployment of energy communities. This relates, for example, to the choice where and when smart meters are rolled out, or (limited) access to markets for aggregators that may operate collective energy actions .

Difficulties to get loans for citizen-driven initiatives

Difficulties in obtaining bank loans were observed in several DECIDE partner countries as well as in some of the European energy communities interviewed. In some cases no loans for small non-profit organization are available, since they cannot offer any collateral. In general, only limited information is available about funding schemes for private and corporate actors. For larger actors such as established market actors rolling out energy communities loans are easily available.

Making money out of it – problems with price determination

Several RECs interviewed emphasized that their primary goal is not to generate profits but rather to cover costs. However, determining a fair price has proven challenging for many energy communities, and the energy crisis has further exacerbated this difficulty. The crisis resulted in a significant increase in feed-in tariffs for electricity producers. For individuals who previously wanted to sell the surplus from their own photovoltaic system on the roof of their house, it was suddenly more attractive to feed the electricity into the grid and receive payment from the government, rather than participating in a REC. In addition, in some countries, certain temporary subsidies are not eligible for RECs, and in many cases, high prices have led to a reduction in renewable energy subsidies, while the electricity levy has decreased significantly.

Billing problem

Some energy communities interviewed experienced billing problems. The reason was that the billing software did not work properly . The transmission of the smart meter data to the billing software was not yet working.

Lack of knowledge, experience and awareness

Due to the fact that the targeted members in renewable energy communities and collective energy actions are citizens and companies that do not primarily work in the energy sector, there is often lack of specific knowledge (technical, management, legal etc.) to organise and build an initiative and to implement projects.

A lack of education and awareness for new and a more environmental-friendly generation and use of energy are also barriers. A change in existing energy culture patterns and technological knowledge is needed (DECIDE to ACT Workshop, 2021).

According to the interviews, the need for information about setting up an energy community is very high. In many countries there is a lack of institutionalised platforms for information exchange, awareness raising and capacity building at local or regional level. Communication has been very time-consuming, a long process with many failures. In addition, a lot of time has to be spent on developing management tools and calculation tools. It would be helpful to have more support such as guides on this topic.

Bureaucracy

In the interviews, it was reported that the organisational effort, the complex administrative procedures, was a challenge. Many contracts had to be concluded, which required a lot of time. It is challenging to have board members with enough time. One challenge is to get continuity in the board.

Sharing concepts

Problems with the distribution model for how generated energy is shared to all participants, were also frequently mentioned in interviews. Many RECs would be interested in a demand-oriented distribution by a dynamic key instead of a static one. While by the dynamic distribution energy is allocated proportionally to the consumption or generation, the static distribution grants each participant the same share. Some countries, such as Austria, have only limited options for dynamic allocation keys.

6. CONTRACTUAL CONDITIONS AND GOVERNANCE ARRANGEMENTS

The previous DECIDE report "Structured overview of existing and emerging business models, related contractual conditions and recommendations for energy communities and collective energy actions"[18] analysed existing and emerging contractual conditions and investigated to what extent they could impact the development of collective energy actions, increase investments into renewables and offer a fair arrangement between all involved parties. We proposed a classification of the contractual obligations that the collective energy actions have towards their members and employees, into: fairness and democracy in governance and just transition; incentives for additional investments in renewable energy; replication in a broad social and economic range; communication and ethical behaviour. As formal contractual capability enables access to market services and facilitates collaboration with external factors, the goal of this report is to provide the collective energy actions with clear guidance and specific examples – precontractual and contractual obligations checklists – on what they should consider when laying the ground (inception, preparation and foundation, and initial operation) of their activities.

This chapter adds on previous work presenting the findings of the survey and interviews of the European collective energy actions. The results are presented are grouped by topic into **social, economic, technical** and **upscaling factors** defined within DECIDE project. The grouping of the factors is based on the grouping of the Key Performance Indicators developed within the project[19] to be used to assess and monitor a collective energy action, including energy communities. For each of the factors we provide an initial set of recommendations, including contractual and pre-contractual checklists - to inspire and maintain inclusive collective energy actions and energy communities and to foster their development, upscaling and replication.

6.1 SOCIAL FACTORS

Social factors are grouped into two topics one relevant for collective energy actions and its employees and other for collective energy actions and its members.

6.1.1 Collective energy actions and its workforce

First, we present a set of social factors that collective energy actions should take into consideration while organizing their activities is the relationship with their workforce.

We considered the following factors:

- Number and diversity of key personnel,
- Skills of key personnel,
- Commitment of key personnel,
- Communication among key personnel.

[18] *https://decide4energy.eu/fileadmin/user_upload/Resources/Deliverable_3.2_Final_upload.pdf*

[19] Key Performance Indicators are being currently finalised by the DECIDE team and will be published soon. The work builds on a first set of indicators developed within the COMPILE project together with Stanislas d'Herbemont (RESCOOP), see Deliverable 4.2 "The Community Maturity Framework", which can be found here: *https://main.compile-project.eu/downloads/*

Collective energy actions with a **single-leadership structure** (Ruggiero et al., 2019) are at high risk of failure, if the single spokesperson drops out for any reason and other members are not prepared to take over their responsibilities. Unclear leadership may incur diffusion of responsibility (can lead to delay or lack of actions) and lack of ownership for failures. Moreover, diversity of key personnel (gender, age, socio-economic background) helps design the initiative which takes into account the challenges and needs of diverse groups. Potential members might be more likely to join the initiative if they can identify with the identity of key personnel.

Collective energy action is more risk-proof if key personnel have a **diverse expertise and skills available internally** (e.g. legal, technical, communication specialists, lobbying, accounting etc.), as they provide multiple perspectives and access to various networks to use for the initiative (Seyfang et al., 2013). Moreover, they can help develop variety of services or actions an initiative can engage in, improving its business model and possibility for diverse member engagement. It helps in reducing the dependency on external help / resources and ensures that skills are applied specifically to the initiative's demand. However, for a diverse key personnel team to work well it requires clear assignment of responsibilities and strong cohesion among the team members.

Further, **commitment of the initiative's key personnel** (ibid.), their willingness to invest time and resources in order to promote the collective is crucial. Key personnel act as ambassadors and frontrunners, spreading their commitment to members. In its contract with the key personnel, the collective energy action could define a number of hours that the key personnel should use to promote the initiative on social media and during dedicated meetings with the members.

Finally, an **effective communication** of the initiative with its personnel and among key personnel is as important as a clear communication with its members (Susur et al., 2019). Regular coordination of targets, actions and challenges ensures a smooth functioning of the collective energy action. Informal and unstructured exchange impedes transparency and causes friction, loss of information and miscommunication as decisions are distributed in a partial manner. It is thus important to foster formal, structured and regular communication with the initiative's employees and volunteers.

6.1.2 Collective energy action and its members

Here we have analysed different social factors that collective energy actions should take into consideration while organizing their social structure, including the relationship they have with their members, based on the "Scalability Framework Pool of Criteria" produced by the DECIDE project[20]. Our aim was to challenge and scrutinize assumptions that the initiatives might have about social factors impacting their structure, organisation and a day-to-day operations to see whether they present a fair deal for all involved parties and for society as a whole. We considered the following factors:

- Number and diversity of members of the initiative,

[20] And further developed from indicators defined in the COMPILE project: see: Developing a tool to assess the maturity and growth of energy communities 2022 (Sebastian Seebauer, Michael Brenner-Fliesser, Andreas Tuerk (Joanneum Research), Stanislas D'Herbemont (*REScoop.eu*))

- Commitment of members,
- Quality of interaction,
- Efficacy of interaction,
- Decision making process,
- Jointly agreed mission and shared vision.

Acquiring a number of **committed and diverse members** is the key aspect of creating an engaged collective (Blumer et al., 2013,). An initiative should take into consideration the importance of retention of original members, to ensure knowledge management and a shared organisational identity on one hand, and rotation and integration of new members, to be integrated in the decision making and division of responsibilities on the other hand. This helps to ensure that the new concepts are being assessed by the collective so that it continuously adapts to a changing energy system. Further, a **broad membership** (Hatzl et al., 2016) by gender, age, and other characteristics of social background reduces risk of political protest from socially excluded groups, ensures support of various social groups and helps better reflect the needs of all members of a community. However, high diversity may complicate the development of a shared vision, and may reduce efficiency in the collective's operation. It is thus crucial for a collective energy action and/ or an energy community to continuously attract new members and ensure their diversity in a planned manner.

Once engaged, **commitment of members** is important to ensure minimum rebound effect. After initial excitement and interest, mature collective energy actions find it increasingly harder to engage their members in regular decision-making. Continued involvement of members typically manifests in the attendance at general assembly meetings. It is thus necessary not only to involve the members in the decision making process, but also to encourage them to participate in regular meetings. Even if collective energy action is not aimed at participation of members in decision making process, member feedback is key to improving services and ensuring that initiative actions are needed and relevant to its members. Hence, continued involvement through relevant actions is needed to ensure member commitment.

Another important aspect of the social factors that should be taken into account by the initiatives is the **quality of interaction between the initiative and its members or customers** (Goedkoop & Devine-Wright, 2016). Arnstein's Participation Ladder describes the "levels of participation" as going from information, consultation, medium consultation, low participation to full participation in ascending order (Arnstein, 1969). We have observed that the higher the level of the participation, the stronger commitment of members. Participatory decisions tend to be better, because they have been scrutinized and refined from multiple perspectives. Moreover, close interaction ensures transparency and that all members carry decisions. Collective energy actions, including energy communities should insist on their members/customers to participate in the General Assembly meetings and express their opinion (i.e. through the voting process), they should also envisage consulting their members/ customers on a regular basis. In cases where collective energy action is organized to have less participatory approach and General Assemblies or collective decision making is not foreseen, the interaction with members or customers can be through regular information, advice sharing or asking for satisfaction feedback.

Further, the **efficacy of interaction** between collective energy action and its members or customers, ensures that volunteer workforce drives the initiative's mission forward and is not squandered in internal squabble (QUEST, 2016). It also allows rapid reaction to changes in the energy system. It is thus very important to streamline the communication and interactions (e.g. decision making process) by using easily accessible language instead of drawn-out debates using technical/legal terminology.

Transparent and simple **decision making procedures** do not only influence the decision making process itself but also help in enhancing trust in the initiative. As new members join a collective energy action, and their activities evolve, the procedures currently in place should be thus crosschecked to confirm whether they are deemed democratic and inclusive by all members, and whether they fit to the current set of activities.

Interviewed collective energy actions

To evaluate whether **transparent and inclusive decision making procedures** have been taken into account by the 26 initiatives, we addressed this topic in the survey and interviews. The assessment addressed the following questions (some with possibility of multiple answer selection):

1) Which subjects are the members of the initiative?
2) How are the voting rights allocated?
3) Which members have voting rights?
4) Do you take any specific action to assure diverse member participation?
5) How often do members interact with the decision makers in the initiative?

Below we provide the results for these questions:

It is clear from Figure 14 that a very large share of members of collective energy actions are natural persons: consumers (20) and prosumers (20). Local authorities are members of 13 out of 26 surveyed initiatives. Private enterprises are members of 7 out of 26 surveyed initiatives and only in 3 (out of 10) countries, mainly in Germany (3) and Italy (4).

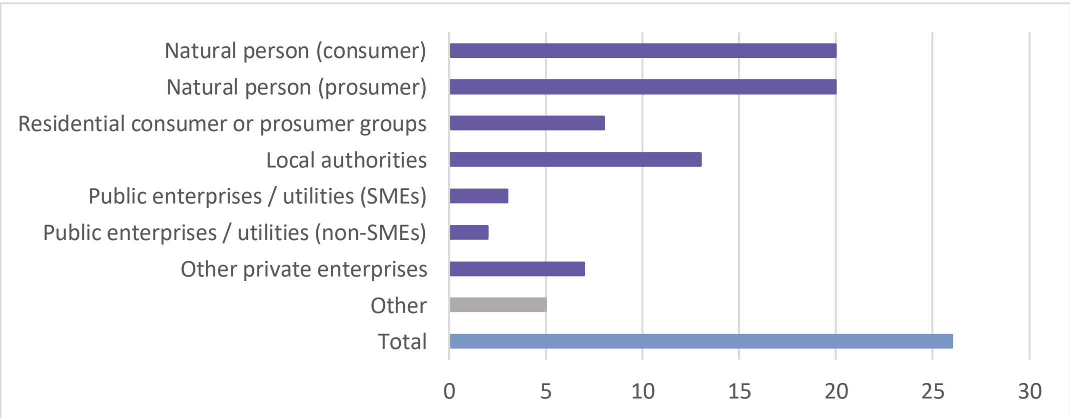

Figure 14: Which subjects are the members of the initiative?

Further, to understand to what degree collective energy actions' members actively participate in the decision making process, we have asked the initiatives how they allocate voting rights to their members. As demonstrated in Figure 15, 20 out of 26 surveyed initiatives declared using "one vote per member" method. It is interesting to see that only 2 initiatives do not allow their members to vote. Last but not least, 2 initiatives mentioned that voting rights are given only to shareholders. We could assume that the latter is, at first glance, an undemocratic rule. However, both initiatives (from Austria) giving the voting rights only to their shareholders, are effectively allowing all members to vote – according to the membership contract, all the initiatives' members are obliged to buy shares and are thus shareholders. However, this evokes another characteristics of such initiatives – participation is open to everyone but not inclusive, as one needs to invest in initiative to be able to participate. Such policy excludes those potential members that are financially constrained.

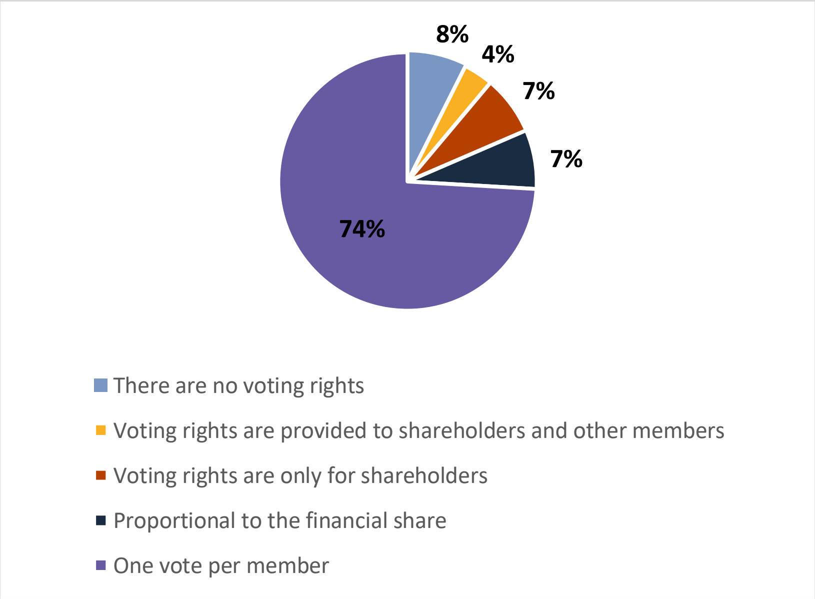

Figure 15: How are the voting rights allocated?

We have also asked the surveyed initiatives, which members of their community have voting rights (Figure 16). Unsurprisingly, natural persons (consumers and prosumers) are the biggest groups of members entitled to vote. There are only two initiatives which did not give voting rights to prosumers, and these are: an initiative from Ireland (it gave the voting rights to "residential prosumer groups" instead) and an initiative from Portugal (which did not give voting rights to any of its members). Further, most of the initiatives give voting rights to other types of members such as local authorities, public enterprises (both SMEs and non-SMEs).

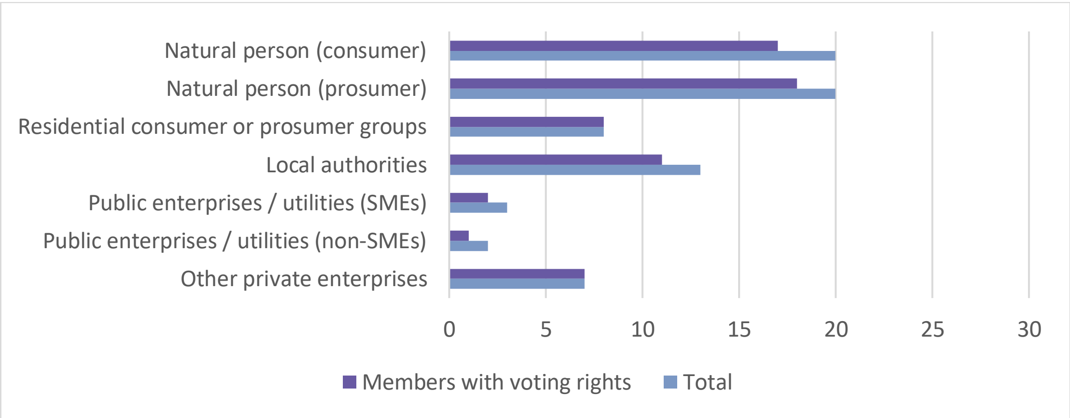

Figure 16: Which members have voting rights?

Furthermore, we asked the collective energy actions if they offer special actions to assure **diverse member participation**. As shown in Figure 17, most initiatives (12) do not currently take any specific action to address different groups of people. However, nine initiatives, i.e. almost one third, rely on targeted communication and five initiatives are currently working on planned specific actions. Four of them organise targeted events. Accordingly, the focus does not yet seem to be on diverse member attraction in all CAs.

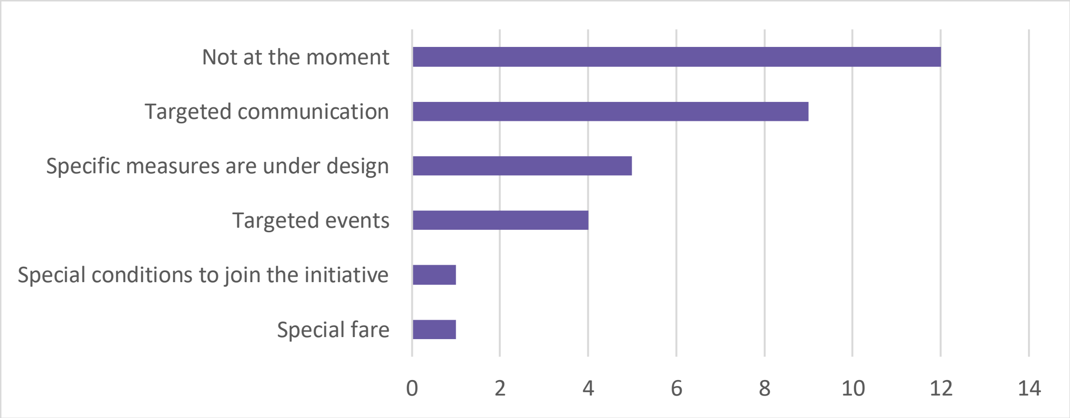

Figure 17: Do you take any specific action to assure diverse member participation?

Figure 18 shows the **amount of interaction** between members and the decision makers of their initiative. As seven initiatives each indicated, members interact with their initiatives' decision makers on a monthly or annual basis. Only six initiatives indicated that they allow a more frequent interaction, on a weekly (4) or daily basis (2). One initiative even stated that this exchange never takes place. In the case of this initiative, however, this is due to the fact that the REC is only in the process of being established.

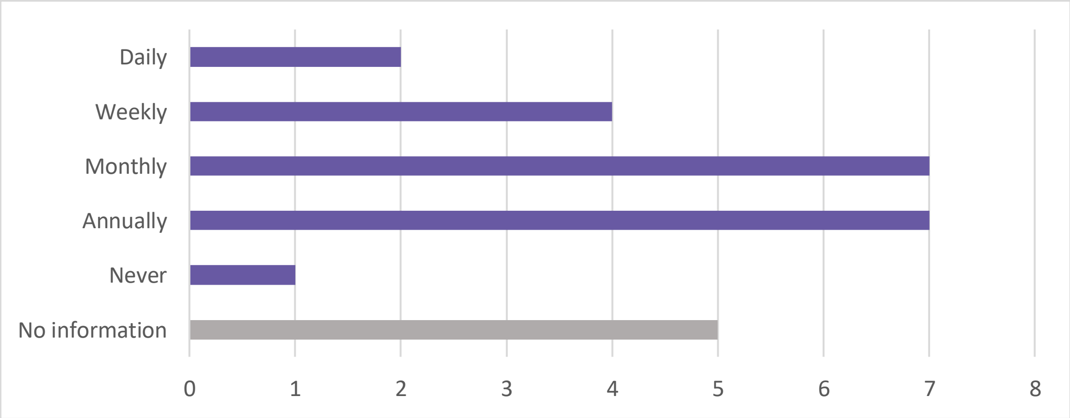

Figure 18: How often do members interact with the decision makers in the initiative?

Information sharing and communication are vital elements of a well-functioning collective energy action. One area where energy communities and collective energy actions need to be very attentive is communicating technical information to non-technical audience, e.g., members of the energy community or participants in a collective energy action. This requires a deep understanding of the subject, and additional resources spent by an initiative on information campaigns, brochures or leaflets.

To assess whether collective energy actions invest their time and resources to making complex technical concepts easy for members of their initiatives to understand, how this information is shared, and who is informed, the assessment addressed the following question:

1) How is information shared with members and potential members?
2) When important changes linked to the initiative's organisation or governance are introduced, which members are informed?

As shown in Figure 19, the most popular media and means of **communication / information sharing** are websites and social media; these information channels are leveraged by 16 and 15 initiatives which corresponds to a percentage of about 60% of the collective energy actions interviewed. Capacity building events and information campaigns are used by 12 and 10 initiatives respectively. Leaflets are hardly used by the interviewed energy communities.

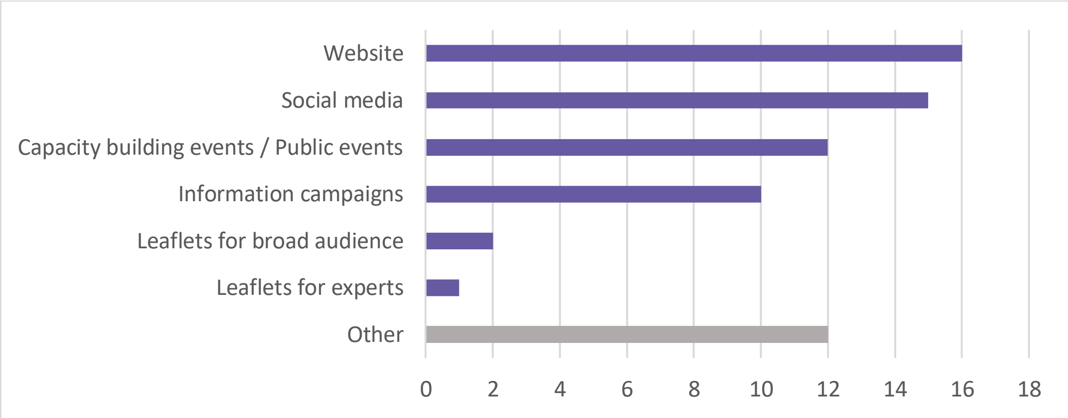

Figure 19: How is information shared with members and potential members?

The majority of the interviewed initiatives, 70%, informs all members / shareholders in advance about planned changes (Figure 19). Three initiatives give the information only to members / shareholders who are affected by the decision. Two initiatives inform only those members / shareholders who have voting rights. Among the four initiatives that employ other ways of informing members about the planned changes, some do not expect any changes in the near future which will directly affect the end consumers.

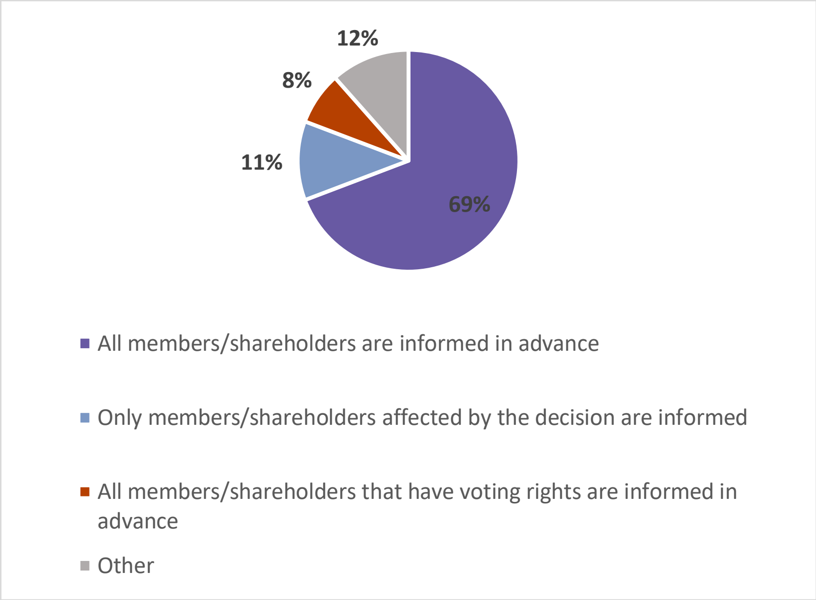

Figure 20: When important changes linked to the initiative's organisation or governance are introduced, which members are informed?

Last but not least, a **jointly agreed mission and shared vision** ensure cohesion among the initiative's members. While mission and vision can be broader, after an initiation phase, areas of business activity are narrowed down to a specific number of actions/services, so that the initiative can have a well-defined role in the energy system. In order to establish a shared goal of the initiative, it is highly advisable to agree on and declare the initiative's mission in written form.

To evaluate what were the **shared visions** (Seyfang et al., 2013) and common goals of the surveyed initiatives, we asked them on which area of action they have been focusing: environmental, social and/or economic. The initiatives could have chosen multiple answers. Figure 21 shows the percentage of the collective energy actions that rated the areas as "very important". More than 90 % of the initiatives stated that the environmental aspect is very important to them. An economic aspect is also present in a large proportion of the registered initiatives, with 65% for whom this is very important. The social value which includes local and community values is less present in the registered initiatives compared to the other key values, but again half of the people indicated that this aspect is very important.

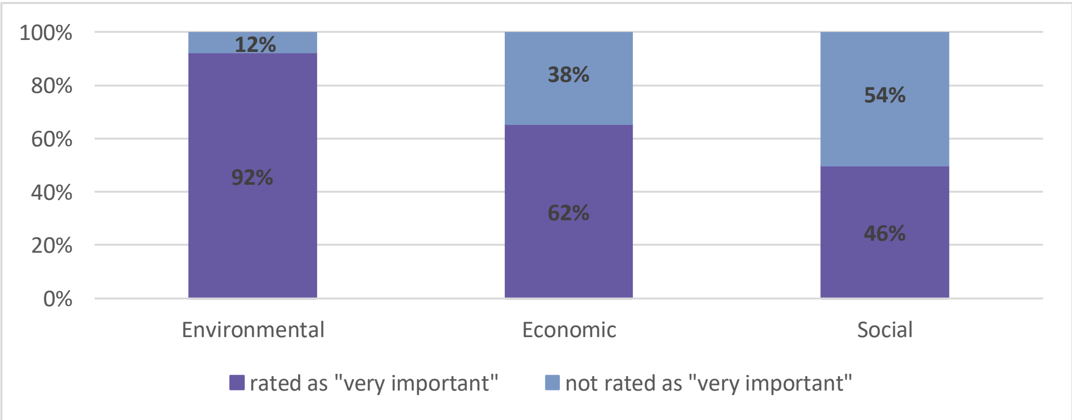

Figure 21: Initiatives' primary goals

Figure 22 provides view of the answers grouped per country an initiative is located in.

It is clear from this graph that a very large share, more than 90% (24 out of 26), of the surveyed initiatives have an environmental goal. Also an economic aspect is present in majority (65%) of the surveyed initiatives. The social value (which includes local and community values) is less present (50%) in the surveyed initiatives compared to the other key values. Based on surveyed initiatives, it seems that there is a strong Austrian and German focus on environmental and economic activities, while Italian initiatives declared to focus rather on environmental and social activities.

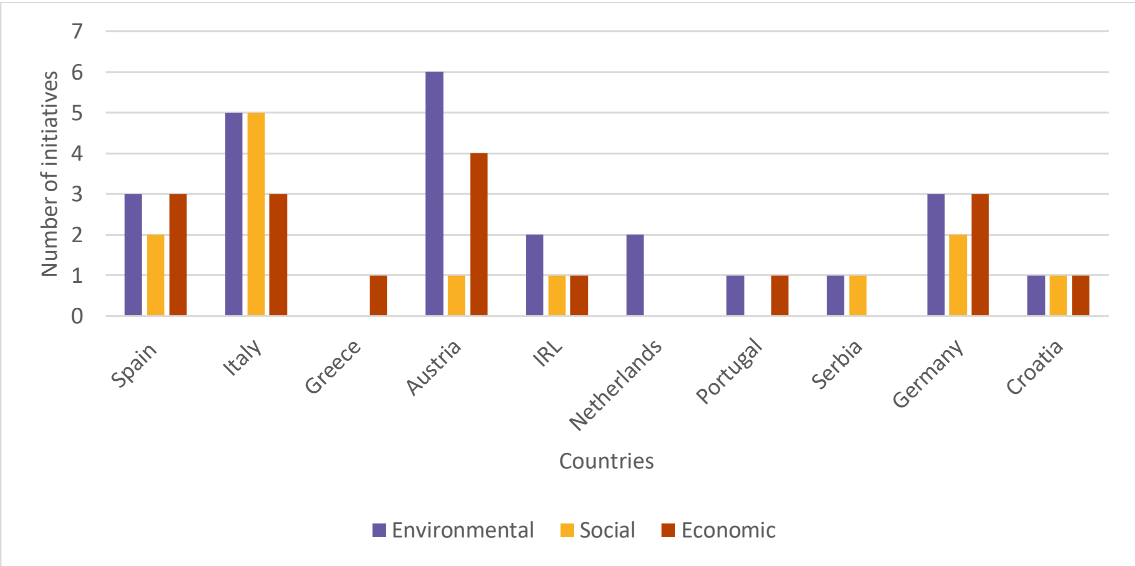

Figure 22: Initiatives' primary goals per country

6.2 ECONOMIC AND TECHNICAL FACTORS

The above mentioned social factors play a major role in shaping relationships between collective energy actions members' and employees, and as shown above, should be considered in legal obligations. In this subchapter's analysis, we will investigate whether the collective energy initiatives contribute to increased investments in renewable energy and how the **economic** and **technical** factors should be taken into consideration in the contracts proposed to their members and employees. For this analysis, we looked into the following range of economic and technical measures:

- Return on investment for members of the initiative,
- Economic stability,
- Cash flow ratio and debt structure/level,
- Business plan,
- Scope of value proposition,
- Number of services provided,
- Maturity of applied technology,
- Proportion of energy produced/consumed,
- Support of external experts.

Return on investment (ROI) is one of the most important economic factors that should be taken into consideration both by the initiative and its members as it serves as a benchmark for shaping new marketing strategies and tactics for the business and provides an incentive for continued membership (Caramizaru & Uihlein, 2020). Moreover, sound investments are needed for a collective energy action to be able to support its employees and further growth. When interpreting this indicator, the initiatives should consider payback flows (e.g., reduced energy prices, interest rates) and re-investment of profits (ibid.). A well-thought investment agreement should include an expectation of profits to secure the investor's interests and safeguard the initiative.

Second important financial aspect that should be considered by the initiative, already at the outset, is the **economic stability** (Seyfang et al., 2013). Similar to a runway for startup companies, i.e. the timeframe within which the initiative can keep operating before it is at risk of running out of financial resources, an initiative should carefully assess and plan its economic stability and allowed risks. It is important to note that in case of community initiatives, resources include monetary capital, but also volunteer workforce. In addition, one should take into account the dependence on subsidies and the likelihood of those subsidies changing or stopping. High dependence on subsidies indicates risk of initiative stopping once the subsidies are not available any more.

An appropriate **cash flow ratio**, measuring the number of times an initiative can pay off current debts with cash generated within the same period, is closely linked to the above mentioned financial stability. It allows to estimate the level of independence of the initiative from external funding institutions, mostly banks. Further, the debt structure indicates how the collective energy action could finance new/expanded activities without expecting an immediate return on investment. For instance, a debt level of less than 30% and provided by members (rather than non-members or banks) gives an initiative solid basis for development.

A strong, detailed **business plan** outlining your initiative's goals and explaining how they will be achieved, should be prepared at the outset. It helps to define milestones, monitor the progress and ensure defined vision of members can be realised. Moreover, clearly identified and planned the **scope of the value propositions** (financial gain, social prestige, environmental action, etc.) can attract and retain more members with selected interests.

One of the key elements of a good business plan, is ensuring that the initiative has a diverse portfolio and offers to its members **several different services/activities**. Diverse portfolio means both, including services that are aimed at different energy vectors (electricity, heating/cooling or transport), technologies, user or type of service/activity (technical, economic, social etc.). A diversified portfolio is more robust against adverse, unforeseen market developments as well as political and regulation changes. Moreover, diverse services or activities can allow for flexibility, change of focus of the initiative and its scalability, attracting diverse members.

Following on the financial factors, an initiative should also consider in their contracts a set of technical measures. The **maturity of applied technology**[21] is a key aspect. A newly developed technology increases the risk of technical difficulties in implementation or even breakdown and maintenance and makes it difficult to learn from best-practice examples and to convince local communities and politicians. It is therefore wise for

[21] Maturity of the applied technology depends on size of the market, price and experience in application of the local market.

the initiatives to focus on proven technologies which are successfully used by other collective energy actions. If innovative technologies are used, the risk can be decreased by using public innovation funding through European research projects, or through use of subsidies (if available). The decision should also take into account national environment or policy towards implementation of innovative projects.

Further, an appropriate **proportion of energy produced and consumed** should be decided by the initiative based on the applicable restrictions, obligations and incentives. An overreliance on production makes the initiative dependent on incentives (e.g. feed-in tariffs) and energy price volatility. Moreover aim for high self-consumption can be beneficial, but also does not help flexibility of the electricity grid. Hence local, regional or national regulation and incentives should be taken into account. A right balance between production and consumption should be decided. This can be modified as the initiative grows and changes, together with the regulatory and incentive changes.

Last but not least, an initiative should not fully rely on the **support of external experts** (Hatzl et al., 2016). Having access to expert knowledge internally, offers support during critical phases and co-design of the (local) energy system. External actors such energy utilities and grid operators, local to national governments, environmental NGOs, civil society, etc., should be consulted but not be relied upon.

Interviewed collective energy actions

To better understand the financial set up and financial benefits of the interviewed collective energy actions, we asked the following questions:

- What are the existing and planned domains of activity?
- What are the financial benefits for the members?
- How are financial benefits shared?

Figure 23 shows the percentage of initiatives where domains of activity exist (purple) or are planned (yellow). It can be seen that over 80 % of the initiatives generate electricity and almost half of the initiatives consume the generated electricity themselves. About one third of the respondents use the energy to charge electric cars and provide energy efficiency services. Approximately 20% have mobility services (such as car sharing or bike sharing), distribution of electricity and energy storage. Energy storage and generation of electricity are the two domains of activity planned by most of the energy communities interviewed (41% and 37%). Aggregation of generated electricity and peer-to-peer electricity sharing came third and fourth, with 26% and 22% respectively.

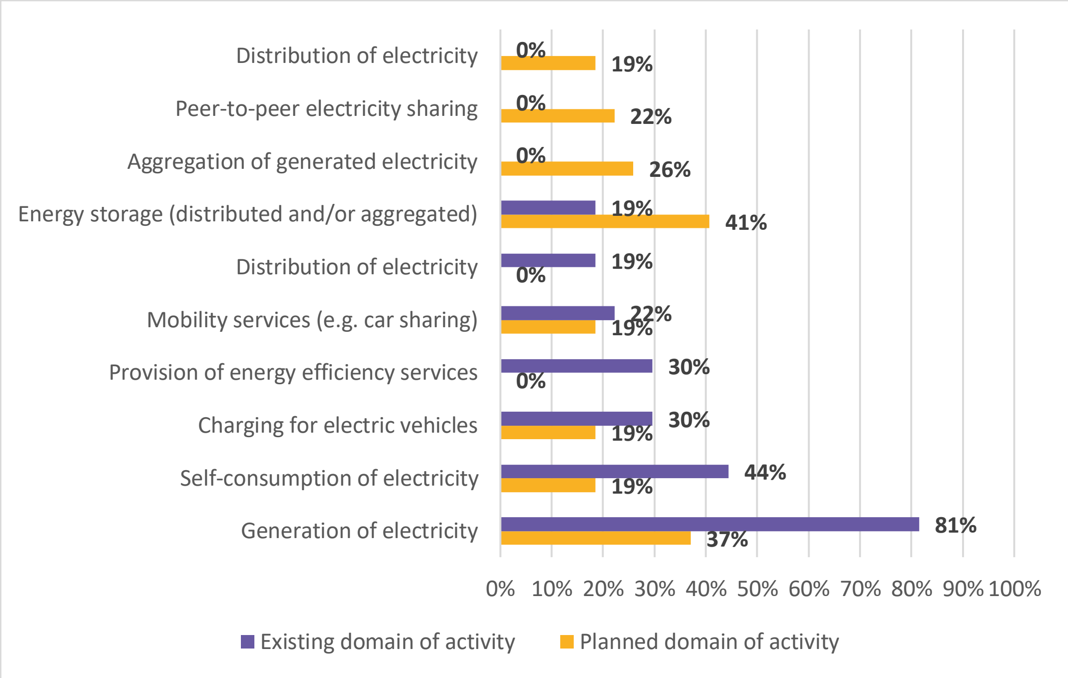

Figure 23: What are the existing and planned domains of activity?

Figure 24 demonstrates the **financial benefits** for the members of a CA. Note that different financial benefits are not mutually exclusive, but that multiple benefits may apply within a specific initiative. As visible, about one third of the initiatives each offer reduced costs due to self-consumption (10), savings in energy costs to their members due to operation of their devices or their services (9) and Return of investment (9). Furthermore, seven initiatives provide a special tariff for energy or grid usage. Only in two initiatives discounts for purchasing appliances are available.

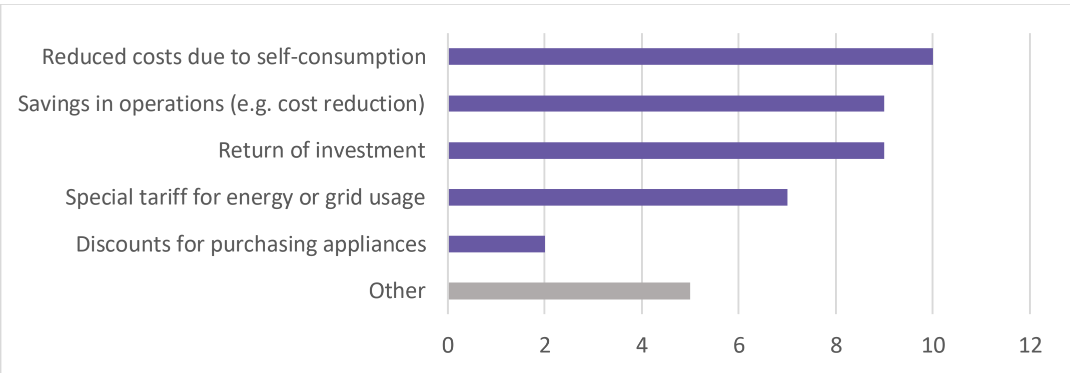

Figure 24: What are the financial benefits for the members?

The following chart (Figure 25) shows how the financial benefits are shared in the different initiatives. In about one third of the CAs, the financial benefit is shared according to the share of the investment. One fifth of the initiatives take into account the members´ need. Only four initiatives share the benefits equally ("one person, one share" rule). Several initiatives deploy other rules in sharing benefits, e.g., offering cheaper electricity in comparison to the current electricity price.

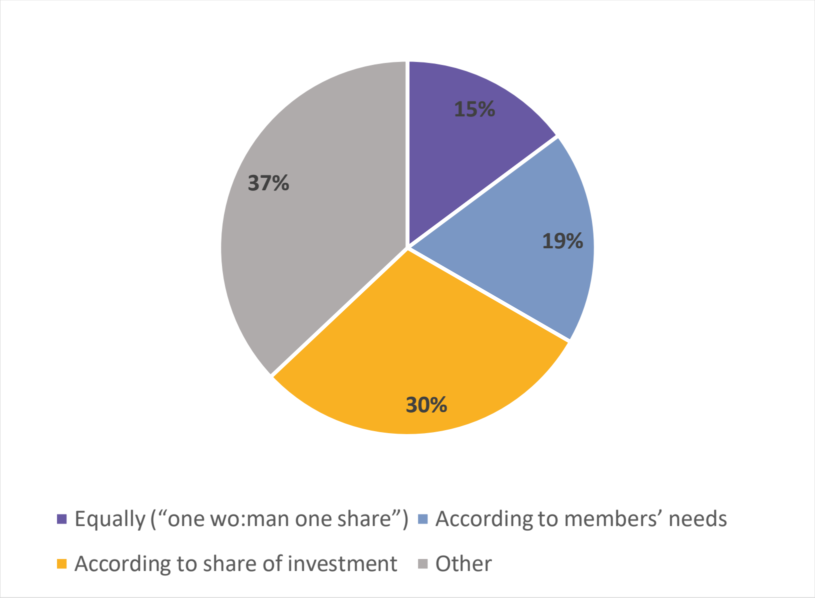

Figure 25: How are financial benefits shared?

6.3 REPLICATION AND UPSCALING FACTORS

In the previous two sections we have analysed a range of social, economic and technical aspects that have a strong impact on the relationship between the initiatives and their members and employees and should be thus addressed accordingly in contractual obligations. In this section, we will focus on the factors that subsequently foster the collective energy actions capacity for **replication** and **upscaling** of its activities/services and processes. For this analysis, we looked into the following range of measures:

- Reliance on public funding,
- Integration into existing structure,
- Reciprocal Knowledge transfer with other collective energy actions,
- Communication/participation,
- Social targeting,
- Geo-targeting,
- Skills and competences.

In addition to the economic factors developed upon in the previous section, the issue of **reliance on public funding** (Ceschin, 2013) is a key aspect influencing the initiative's ability to further upscale and replicate in different geographical, legal and cultural context. Financial aids, subsidy programs, investment grants, tax exemptions and similar can give an initiative a practical support to kick off its activities but they also create a niche environment protected by market forces where a collective energy action may develop at significantly smaller financial risk. As an initiative establishes itself on the market, reliance on public funding should gradually phase out – an initiative should focus on using the funding on targeted services/ operations and to be able to extend its operations without the need of using funding.

Further, an initiative should always aim at an **integration of its services into existing infrastructure** (Blumer et al., 2013). Building an own infrastructure dedicated to the collective energy action can be very expensive and time-consuming and may incur additional maintenance costs. Leveraging existing physical assets such as grids, power lines and other technical facilities reduces the overall investment volume for providing services.

When analysing the initiatives' ability to further upscaling and replication processes, **knowledge transfer** with other collective energy actions and exchange of information is crucial. Mature and robust business models are adaptable to various contexts. Key personnel of the collective energy initiative should invest their time and resources to diffuse their knowledge to other, less mature initiatives.

Another factor essential but also critical for **scaling-up** of an initiative are the **communication** and **participation** aspects. When becoming bigger in size, an initiative will not be able to offer to all its members or participants the same means of participation. However, all members still need to have the opportunity to participate, for example through topic or sector specific discussion groups, activities or feedback mechanisms.

Further, in order to successfully scale-up its activities, an initiative should focus on **social targeting** (Rigo et al., 2020), i.e. through gaining a robust understanding of the potential members/users. This allows the community to offer fitting solutions and targeted marketing action. The more aware an initiative is about the issues faced by the community members, the more relevant services it could employ. Similarly to social targeting, possibilities for scaling-up and replicating might be strongly hampered by regional conditions (grid load, conditions of buildings, weather, etc.). Knowing them better helps to understand possibilities and barriers of expansion – an initiative should thus focus also on **geo-targeting**.

Finally, the **internal availability of skills** (i.e. legal and technical) amongst the initiative's employees, volunteers and members increases the initiative's chances for an effective scaling-up and replication of its activities (ibid.). Often an expansion might be connected to a number of specific legal and/or technical restrictions (connected for example to the use of the grid or to building laws). Having the possibility to rely on experts who are aware of these limitations and probably even work arounds might increase the expanding possibilities. In addition, professionalization, the possible use of professional management tools, and an increase in human resources will be required once the initiative is replicated.

Interviewed collective energy actions

To assess whether the interviewed collective energy actions feature replication potential, the assessment addressed the following questions:

- How was your organization established?
- How do you see your initiative growing or being replicated?

It was hypothesised that if an energy community or a collective action was established on a basis of an already existing organization, e.g., municipality, non-profit or for-profit organisation, the initiative can use previously established channels of communication for information sharing purposes.

As Figure 26 shows, most initiatives, more than half of all those interviewed, were founded by individuals. In total, 18 initiatives were established on a basis of a pre-existing structure, e.g. by a NPO (6), a municipality or other public body (5), a for-profit organisation (4) or an existing organisation related to the energy sector (3). Note that here, too, multiple answers were possible and initiatives were often established by an individual but also on the basis of an existing structure.

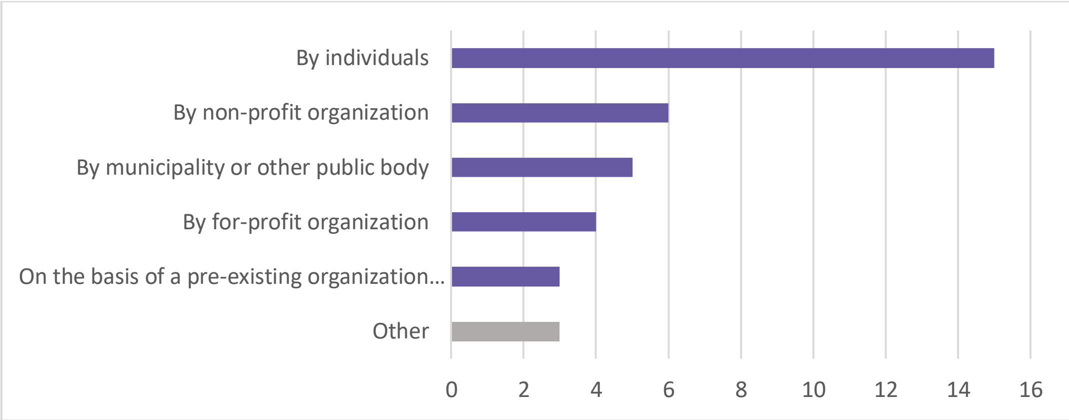

Figure 26: How was your organization established?

Overall, the replication of the initiative can be assessed positively (see Figure 27). Ten collective actions indicated that they have already been approached by other parties to support them in setting up a similar initiative. This shows that the creation of an energy community is on the rise and skill and experience sharing is highly desired. Seven initiatives consider that they have potential for being replicated, as there are more or less equal initiatives in their region, member state and the EU. Four initiatives indicated that there are similar initiatives with different contexts and objectives known in the same region/member state. None of the initiatives consider that their model cannot be replicated.

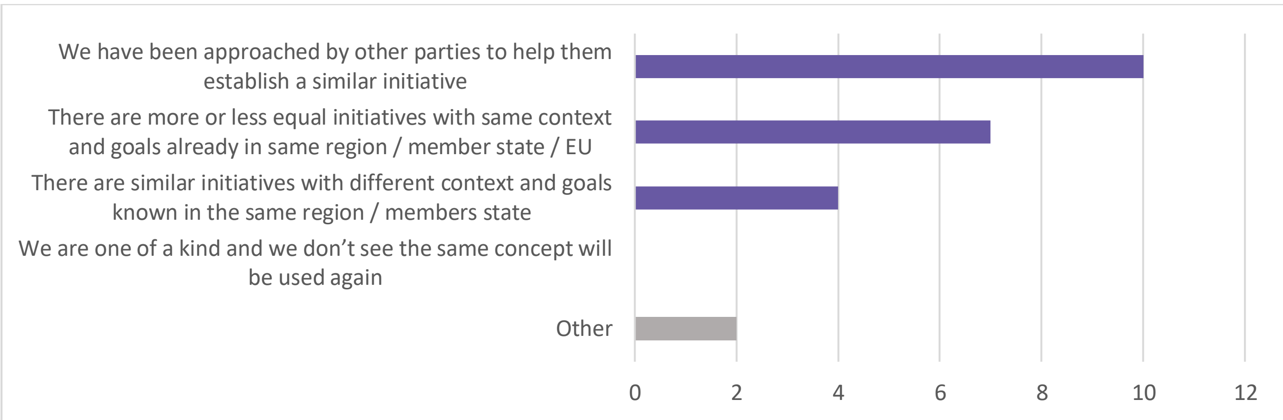

Figure 27: How do you see your initiative growing or being replicated?

6.4 CHECKLISTS FOR CONTRACTUAL AGREEMENTS

The following subchapters contain checklists that provide a handy list of relevant elements to be considered in pre-contractual and contractual agreements in the context of a collective energy action. Social, economic and technical as well as replication factors are taken into account. The checklists are also provided as factsheet[22] which is easier to distribute to the initiatives.

[22] DECIDE Knowledge Hub *https://knowledge4energy.eu/resource?t=DECIDE%20-%20Factsheet%204%20-%20Checklist%20for%20contractual%20agreements*

6.4.1 Defining legal documents

Social factors

- ✓ Include measures that ensure/allow diversity of members
  - Include required/recommended share of diverse members (age, gender, ethnicity, socio-economic status)
  - If buy-in or shared are required for membership, decrease lower limit for members living in energy poverty
- ✓ Plan ahead on how to attract new members
- ✓ Plan for annual information sessions/social activities for members to learn about opportunities and get feedback for current organisation
- ✓ Update regularly your policies and procedures, fostering inclusive and democratic participation
- ✓ Agree on the initiative's mission and vision in a written form
- ✓ Ensure that the initiative's employees have:
  - diverse expertise (their skills may include negotiation, communication, accounting, engineering, planning, lobbying, legal knowledge, etc.). Ensure there is at least 2 or 3 key personnel in the leadership of the organisation
  - diverse characteristics (sex, age, socio-economic background) to reflect the collective/community

Economic and technical factors

- ✓ From the outset, plan carefully a timeframe within which sustained revenues must be achieved by your community not to put it at a risk of collapse
- ✓ Define Business plan : start with a clear business plan and timeline of implementation of activities
- ✓ Avoid financial dependence on external funding – aim for a credit rate below 30%
- ✓ Define a need to have variety of services, technologies, activities (use KPI to set this)
- ✓ Define limitations for which risks can be taken when it comes to maturity of the technology used
  - High share should be use of proven technologies
- ✓ Ensure a justified balance between production and consumption
- ✓ Define key expertise and the share of internal to external expertise – to decrease complete dependence of the initiative on the external factors

Replication and upscaling factors

- ✓ Engage in an association, umbrella organization or projects where knowledge transfer can happen
- ✓ Require engagement in innovative and research projects which can be used for upskilling and financing of innovative actions/solutions with higher risk

6.4.2 Contracts with members

Social factors

- ✓ Encourage participation in meetings
- ✓ Encourage and allow members to express their opinion (on activities, mission and vision, operation, technologies used, etc.)
  - Through voting process or
  - Anonymous surveys
- ✓ Consult your members/ customers on a regular basis
- ✓ If aiming for democratic leadership and inclusive initiative, ensure that all members have voting rights (not only shareholders)
- ✓ Streamline decision making processes by using easily accessible language instead of drawn-out debates using technical/legal terminology

Economic and technical factors

- ✓ Define a well-thought investment agreement, which should include an expectation of profits to secure the investor's interests and safeguard the initiative
- ✓ Define maximum risk that will be taken with the new investments
- ✓ Ask for feedback on changes in business plan or new services

Replication and upscaling factors

- ✓ Provide anonymous feedback or data that can be used to communicate results
- ✓ Encourage voluntary sharing of experience with other members or public

6.4.3 Contracts with employees

Social factors

- ✓ Ensure that the leaders of your initiative have diverse expertise
- ✓ Foster formal, structured and regular communication with the initiative's employees and volunteers
- ✓ Encourage employees to provide feedback through anonymous surveys
- ✓ Encourage employees to initiate new activities – provide benefits for such actions
- ✓ Oblige/encourage employees to develop their skills with number of hours a year of training/learning activities

Economic and technical factors

- ✓ Communicate need for new expertise and find possibilities for upskilling existing employees before reaching to external expertise or use external expertise temporarily

Replication and upscaling factors

- ✓ Devote specific number of hours a month/year to communicate lessons learned to public and other potential initiatives
- ✓ Engage in local/regional/nation media to attract diverse and increase members

6.5 CONTRACTUAL CONDITIONS AND GOVERNANCE WITHIN THE COMMUNITY AND WITH EXTERNAL ACTORS

This chapter describes contractual and governance arrangement within and energy community and with external actors. Partnership **agreements within energy communities of collective actions** describe the relation of an institution and its members or shareholders.

While no legal form is specified for collective energy actions and collective self-consumption in the CEP, the CEP demands the creation of a legal entity for energy communities. The type of required legal entity selected by Member States for founding an energy community is impacting the business case of the specific energy community. If the operational costs are too high for small initiatives under a specific type of legal entity, another organisational form may be beneficial. On the other hand, predefining the organisational form is sometimes discussed among policymakers to facilitate implementation. Also, governance aspects of energy communities are not only determined by the national energy community regulations, but by the rules embedded in the specific corporate laws. A general distinction can be made between the proposed use of existing types of legal bodies, the prescription of a single – potentially new or adapted – legal form that may be specific to energy communities (e.g., Greece), or the definition of criteria without prescribing or proposing specific legal forms.

Typical forms of institutions are:

- Cooperatives are unions of persons (mostly natural, sometimes legal) for the purpose of joint economic business operations. A cooperative is appropriate when the pursuit of an economic goal exceeds the capacity of the individual, but at the same time the independent existence is to be preserved. In contrast to corporations, the business policy does not depend on the interests of outside investors, but is determined by the members. The typical cooperative implements a model of "one-man-one-vote".
- Limited Company is an institution owned by natural or legal persons (public or private) where shareholder liability is limited to the amount of their original investment, and shareholders are not responsible for the company's debts. Voting rights correspond with the amount of investment a single investor or small group of investors can control the company.
- Special institutional arrangements come in various mixtures of private and institutional members, often with specific control rights and liabilities. A good example is the German GmbH & Co. KG, which is frequently used for the establishment of a so called "citizen energy society" – which is similar to the notion of an Energy Community in the EC directives.

    A GmbH & Co. KG is a hybrid institution. It consists of a "general partner" (Komplementär) which is liable with its complete business assets. The other members are "limited partners" (Kommanditisten) whose liability is usually limited to the amount of liability entered in the commercial register.

    In a typical constellation, the general partner is an existing or newly founded limited liability company (GmbH), which has neither an income nor an asset interest in the GmbH & Co. KG. In this case, the "performance" of the GmbH is limited to the management of the entire institution and the liability with its paid-in capital stock. For this the GmbH receives a management and liability remuneration. The limited partners are natural or legal persons who make an investment and receive a contractually agreed return, which depends on the amount of the investment, the business results and the modalities for distribution agreed in the partnership agreement. The liability of limited partners is limited to their contribution. The limited partners determine the modalities for the management in the framework of the general partner GmbH, whereas the management operates largely independently.

    Municipal utilities or other suppliers can take on the role of general partner GmbH and thus contribute their technical and operational know-how. Limited partners can also be legal entities. There are examples of energy companies in which several private individuals invest significant capital as limited partners and in addition a cooperative acts as a limited partner, bundling small investors and representing them in the GmbH & Co KG. Compared to a cooperative, a Gmbh & Co KG often has more credibility and simpler decision-making processes.

Overall, there is a tendency by Member States to define cooperatives as a preferred entity. Cooperatives are also often an organisational form for collective energy actions. In Greece a specific type of cooperative is required for energy communities focusing exclusively on energy-related activities, while Sweden plans to form an "Economic Association". Slovenia requires CECs to be defined as cooperatives, with the intention that the members of the energy community should not lose their rights as customers. Austria leaves the choice of organisational form to the energy community: RECs and CECs can be organised as an association, cooperative, partnership or corporation, association of housing owners or a similar legal body. Portugal leaves the choice to the energy community as well.

The legal form was also recorded for the collective energy actions interviewed - the distribution can be seen in Figure 28. More than half of the RECs, 58%, are registered cooperatives as their legal form. About one tenth (12%) are registered associations and 8% are registered non-profit companies. Six collective energy actions, 23%, were marked as "Other", including each one NGO, a Public entity, an unincorporated association, a private-driven energy cluster and a public-private consortium. Furthermore, one of the energy communities currently has no organisational structure.

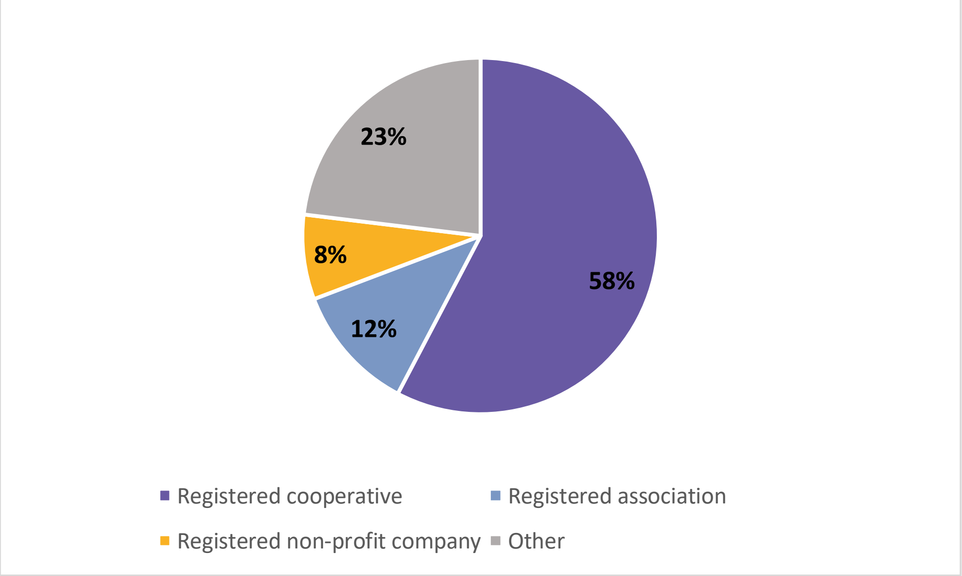

Figure 28: What is the legal form of the initiative?

Experiences made in Austria and confirmed by our Austrian DECIDE pilot state that the effort for creating legal bodies such as associations may be prohibitively high and members need to take over liabilities. In some countries housing associations, widespread in Eastern European countries are possible members of energy communities, with an internal organisational set up that can be built on. Also collective energy actions, may target housing associations for the same reason, such as done by the DECIDE pilot of ThermoVault.

Contractual arrangements with external actors are of high relevance as Energy Communities are supposed to participate in the energy system or on the energy markets. Since in most of the cases 100% self-sufficiency of an EC is neither possible nor a reasonable goal, such institutions need to cooperate with others while providing or receiving services on a contractual basis. In many practical cases local utilities or distribution grid operator provide support to ECs on a contractual basis. The legal framework in various countries allow for the participation of a (small) utility in an EC.

More or less the same holds true for any collective energy action with the difference that a CA does not necessarily implement a formal institution or follow the directives or legal frames that have been set out for ECs.

The following list of potential contractual situations is not exhaustive but shows the complexity of the eco-system in which an EC or CA can operate:

- **Service contracts** between ECs / CAs and other parties in the energy system or market comprise
  - Operation of measuring units and billing systems for the community (e.g. in tenant power models)
  - Technical operation of generation plants
  - Technical operation of controllable consumption appliances (e.g. EV chargers, heat pumps etc.)
  - Technical operation of storage

    - Technical operation of local parts of a grid (e.g. in a self-consumption district).

- **Energy trading** of an EC or CA comes in multiple forms and requires respective contractual settings. They cover various models of selling energy that cannot or shall not be consumed by the initiative itself. Widespread models are:
    - Contracts with grid operators and/or utilities for the delivery of energy according to existing feed-in laws
    - Power Purchase Agreements (PPA), which are long-term agreements to purchase (mostly green) energy from a specific asset at a predetermined price. In most cases buyers are companies nearby requiring large amounts of electricity. The signing of a PPA can be understood as the sale of a product and its environmental attributes (e.g. guarantees of origin).
- **Flexibility trading** is a novel element in the energy market. While huge Virtual Power Plants may provide their flexibility to existing reserve markets, ECs and possibly CAs may in the future aggregate their small flexibilities and trade them on a contractual basis on newly developed (regional) market places. Examples of EC funded projects that develop such models and mechanisms are Platone, FEVER, EdgeFlex, X-Flex, Flexens etc.
- **Energy Sharing** is a widespread goal of ECs and CAs. Depending on the legal and regulatory frameworks it comes in different flavours in European countries. In general terms it means that a community jointly operates electricity generators and uses a (big) part of the generated power in their own consumption appliances. Other but in case of “tenant power” or “district power”, in cases of Energy Sharing the public grid is involved and grid fees have to be paid. Nonetheless, synchronous generation and consumption in a limited area can reduce systems cost and increase resilience. Contracts with (local) grid operators or public funding institutions can remunerate such “system favourable” generation-consumption models.

Because of the importance for energy sharing, the following table tries to give a structure to the discussion and the set of contracts that may be involved.

	Synchronicity of generation and consumption	Balance sheet **self-supply**
Individual Contracts („Collective energy action“)	- (Shared) financing of a generation plant or a group of plants. - Financial contributions via individual agreements with plant owner and/or operator (e.g. municipal utility) - Electricity supply contracts individually with bonus scheme in case of synchronisation (of the group or the individuals) - ICT to prove synchronisation and, if necessary, to establish grid efficiency.	- Electricity supply contract per individual - Special regulations and prices for purchases from local or regional plants - In the case of "prosumers": Offsetting of own generation and consumption - ICT for measuring self-supply (e.g. net metering).
Group model („Energy Community“)	- Legal entity of citizens (and, if applicable, businesses) for the financing and operation of a joint generation plant - Bonus from the supplier or grid operator for the entire group for optimised synchronisation (settlement with the company) - If applicable, collective energy purchase by the company and internal trading / billing - ICT for optimisation with regard to synchronisation in the group	- Legal entity of citizens (and, if applicable, businesses) for the financing and operation of a joint generation plant - Group supply within a building or neighbourhood (usually at a grid node) - Optimisation of self-supply through flexibility within the group - Sale of surpluses via existing markets, supply of residual energy on the basis of a contract between the company / community and a supplier - ICT needed for internal billing and, if applicable, for connection to external markets and grid

NB: A special case of energy sharing can be implemented with a block-chain and “smart contracts”. Such automatically negotiated and closed contracts record energy deliveries and strive for a non-monetary balance in a given period of time. Few such novel contractual models are in operation, mostly outside Europe. Far advanced models have been developed by EC project *Platone* and a German project *Pebbles*.

- **Umbrella organizations** are lately developing to ease the establishment of ECs. On a contractual basis to deliver various types of support to new and scaling communities:
  - Provision of knowledge in early stages and in support to the development process
  - Coverage of initial costs or provision of startup-investment
  - Coverage of risks, e.g. with financial guarantees
  - Provision of key personal against remuneration
  - Provision of technical or organisational services (software for membership management, billing, tax declaration etc.).

Good examples for such umbrella organizations are EcoPower in Belgium and Goiener in the Basque country. Austria supports the development of ECs with its "Austrian Energy Community Coordination Office". European wide associations such as Fedarene are kind of umbrella associations that help their members. Lately, some regional or municipal governments strive to establish such support institutions. The legal frameworks should allow for and support the establishment of umbrella organisations.

6.6 ENERGY SHARING IN PRACTICE

For energy communities most countries have proposed static and dynamic sharing coefficients, some also variable sharing coefficients. Static coefficients mean the allocation of energy is fixed for participants independent of their actual energy needs, variable coefficients take into account forecasted demand patters while dynamic coefficients are based on real time data and specific allocation formulas. The boundaries between the concepts however is fluent, ex-ante versus ex-post allocation seems as a more appropriate differentiation. In Spain, the allocation mechanism is set beforehand based on variable coefficients. To use variable coefficients, communities must inform their retailers of the allocation coefficients for each hour for the upcoming year. The value of these coefficients may be determined based on the power to be billed by each of the participating consumers, the economic contribution of each of the consumers for the generation installation, or any other criterion. Spain is investigating an ex-post mechanism but highlights the data needs as significant drawback. Variable coefficients combined with the possibility to change them every 3 months seems a viable solution to Spain that can also consider quite fast new loads. In most other countries, sharing coefficients are changed less frequently.

In France the sharing of electricity is made on a 30 minute time step based on static or dynamic coefficients (article D.315-6 code de l'énergie). In Portugal in 2022 the Decree-Law no. 15/2022, was published providing for dynamic sharing based in real time data next to static and variable coefficients. Static coefficients can vary among others, by working days and holidays or weekends that may or may not take into account the seasons. Sharing can follow a model defined by the regulator ERSE. Energy sharing can also be carried out on the basis of monitoring energy in real time. However, in some countries, the modus of dynamic sharing is proposed by DSOs such as in Austria, where energy communities in practice have no free choice of the sharing mechanism despite the legislation doesn’t restrict any sharing approach. Dynamic distribution in Austria means that a community-wide quotient between community generation and community demand is equally applied to every member’s individual consumption quarter hourly. This means that members with higher consumption in a quarter-hourly interval receive more energy in absolute terms. In case the community has a few large consumers small ones are disadvantaged. An alternative mechanism is being discussed in which all entities get the energy demand of the smallest consumer, then all get the demand of the second largest consumer etc.

The figure below (Figure 29) shows the effects for a fictive Austrian energy community. In case there are small consumers (users 1-6) and three big ones (commercial entities-users 7-9) the bigger ones will get the most electricity. After the DECIDE stakeholder Workshop in September 2022 in Vienna, alternative options were developed together with the Austrian Coordination Office for Energy Communities. An alternative option could be that all entities receive the consumption of the smallest consumer, then all receive the consumption of the second smallest consumer etc. ("even sharing coefficient"), which would favour smaller consumers. This is only one example, showing there is the need of a range of different algorithms that best suit the composition of the energy community.

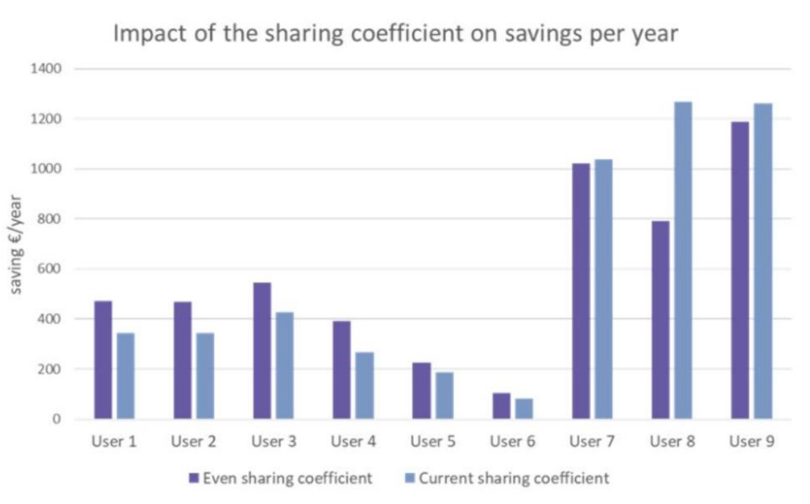

Figure 29: Impact of the sharing coefficient on savings per year

6.7 SUMMARY ON CONTRACTUAL CONDITIONS AND GOVERNANCE ARRANGEMENTS

In the light of the above-mentioned findings, we consider that the DECIDE pilots and DECIDERs are only part way through assuring fairness and democracy in governance and just transition. It has been observed that only one initiative allows new members to join free of charge. For most of them, new members should be living in a specific area, which goes hand in hand with the geographical limitations of Renewable Energy Communities. Further, almost a third of the initiatives are not taking any specific actions to assure diverse member participation. Only four out of ten initiatives confirmed that they are working on specific measures or organising targeted events to support diversity and inclusion of participants. Regarding the quality and amount of interaction, it seems that the participants can liaise with the decision-making bodies using electronic means or in person meetings. Such communication happens usually once per year. Most of the initiatives allocate voting rights to consumers, prosumers, private SMEs and microenterprises, which is fundamental for transparency and equality in decision making. Almost half of the initiatives seem to be transparent in their decision-making processes and inform all their members/ shareholders (regardless of their voting rights) about planned changes. Once a member of an initiative, one can leave it by simply unsubscribing on informing the leaders of the initiative in written form.

Regarding the incentives for additional investments in renewable energy, we can assume that taking financial advantage from reduced costs of energy is the most common way to benefit from being a member of an energy community or a collective energy action. Initiatives with financial benefits usually share them according to share of investment and rather rarely distribute them equally. According to our hypothesis, a successful initiative should be applying a socio-economic model that could be replicated in different contexts, which would ultimately lead to an increase in renewable energy investments. It seems that both the pilots and DECIDERs consider their initiatives as potentially replicable and have already observed similar initiatives in their regions and Member States even if some initiatives have not intention to replicate themselves. Finally, some of them have already helped to establish a similar initiative. Regarding information sharing and communication, we consider that most of the initiatives communicate with their members through their websites and social media, an important number prefers “face-to-face” communication. It seems that members of these initiatives can easily access information, including technical specifications. Further, most of the initiatives were established on basis of pre-existing structures, and could potentially use existing channels of communication to liaise with their members.

The contractual conditions enable those business model categories (see chapter 2) that aim for establishing a formal community structure. In some of the collective energy actions this is not the case. While the contractual conditions are highly relevant for ensuring fairness, interaction of members and the possibility to grow, the membership fees should be low to decrease the joining barriers, especially in low income segments. A good example is Greece where energy poor households can join for free. When it comes to contractual arrangements with the energy sector service contracts between ECs / CAs and other parties in the energy system are of high relevance. Also the design of sharing mechanisms that are executed in most countries by DSO are of high relevance as the impact the profitability of energy communities.

7. CONCLUSIONS AND RECOMMENDATIONS

This report provided a comprehensive mapping of existing and emerging business models that can be used by energy communities and collective energy actions. Different emerging types of business models in different stages of maturity are presented. The concept of sharing PV electricity within a community already exists in some countries in form of collective self-consumption; however, this brings only small financial savings for the involved households. While in some EU countries collective energy actions already existed for several years, energy communities, according to the CEP, open up new regulatory opportunities and revenue streams.

The CEP defines legal entities of CEC and REC as market players beyond the 'pure' market economy. This leads to the need to provide ways to recognise value of non-monetary benefits in business models. Non-monetary benefits include, for example, the mitigation of energy poverty, decarbonisation and decentralisation of energy producers, inclusiveness of sustainable development and other social targets that haven't been captured in traditional energy market models. Energy communities may be built on social targets such as: reinvestments of earnings from successful self-generation in PV etc. to 'cross finance', e.g., energy efficiency investments; education of community members; change in consumption patterns or energy culture in general; as well as energy poverty abatement. So far most of the energy communities are RECs and as our EU wide survey showed focus on residential self-consumption. At the same time a fast roll-out of renewable energies and the need for strong energy savings needs multiple approaches. This includes existing and emerging collective energy actions outside the CEP that may not need public subsidies, are profit oriented, include larger companies and traditional investors enabling economies of scale, while still involving or supporting communities. For a fast, sustainable transformation of the energy and building sectors collective energy actions as well as the cooperation of the residential sector with business will be of high relevance. Most of the pilots and initiatives which have collaborated with the project, do not fall under the EU definition of a REC or CEC. This is why we introduced a concept of "Collective Energy Actions“ that allow also profit-oriented models and third party ownership of assets, while still guaranteeing an involvement of civil society.

As discussed in several DECIDE workshops multiple small energy communities that are emerging in several EU countries may need an umbrella structure to increase the economics, services they could provide as well the benefits to the energy system reducing a fragmentation. Umbrella structures for REC or other collective energy actions could be CECs, municipal utilities or other forms of organisations.

The report shows the broad range of factors that can influence the business models for energy communities and other collective energy actions. For energy communities the national regulatory context and the access to financial resources is very important. A combination of approaches however might be needed to achieve a business case. Socio-cultural and economic factors are equally important for energy communities and other collective energy actions. Finally, contractual conditions and the governance structure are very important to enable a fair distribution of benefits, inclusive and scalable initiatives. In this report we provide easy checklists and recommendations for designing, growing and replicating energy communities and other collective energy actions.

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