23.12.2021

DELIVERABLE NUMBER: **D3.2**

Structured overview of existing and emerging business models, related contractual conditions and recommendations for energy communities and collective actions

Deliverable due date: 30/11/2021
Submission date: 23/12/2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 894255.
The sole responsibility for the content of this document lies with the DECIDE project and does not necessarily reflect the opinion of the European Union.

decide4energy.eu

Deliverable information

Deliverable Number:	D3.2
Deliverable Title	Structured overview of existing and emerging business models, related contractual conditions and recommendations
Work Package Number	WP3
Work Package Title	Co-creating framework conditions
Lead Organisation	JR
Main author(s)	Andreas Tuerk (JR), Camilla Neumann (JR), Malgorzata Mątowska (THNK), Lucija Rakocevic (THNK)
Contributors	Leen Peeters (THNK), Phillipp Hartmann (BAUM), Ludwig Karg (BAUM), Silvia Assalini (ICLEI), Nicola Iezza (ICLEI), Claudia Winkler (JR)
Reviewers	TREA
Nature	Report
Dissemination Level	PU -Public
Deliverable Date	(123/12/2021)
Draft Number	1.0
Version history	
Version Number	1

Project Contractual Details:

Project Title	Developing Energy Communities through Informative & Collective actions
Project Acronym	DECIDE
Grant Agreement No.	894255
Project Start Date	02-06-2020
Project End Date	02-06-2023
Duration	36 months
Supplementary notes:	This document is only for use among the Partners of DECIDE

Main coordinator

Name	Leen Peeters
Organisation	THNK
Address	Philipssite 5 bus 1
E-mail:	leen@think-e.be

Consortium Partners

No	Organisation	Country	Acronym
1	Th!nk E	Belgium	THNK
2	Joanneum Research	Austria	JR
3	BAUM Consulting	Germany	BAUM
4	Prospex Institute	Belgium	PI
5	ThermoVault	Belgium	THERM
6	ENBRO	Belgium	ENBRO
7	Mittetulundusuhing Tartu Regiooni	Estonia	TREA
8	OurPower	Austria	OUR
9	Iron Thermoilektriki Anonymi	Greece	Heron
10	Domx	Greece	DomX
11	Universitaet Mannheim	Germany	UNIMA
12	ICLEI European Secretariat	Germany	ICLEI
13	Elektrizitätswerk Hindelang	Germany	HIND
14	University Schloss Seeburg	Austria	SEE

Table of contents

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 that are to enable new business models for decentralised energy systems. Energy communities, according to the CEP, provide for organisational frameworks for collective energy initiatives, which have new possibilities to act in the energy sector, including also 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. In contrary to collective actions that can be profit based, 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 fulfill specific societal needs. 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) 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; CSC is 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 models that may fit into the energy community framework but also on existing and emerging collective actions outside the CEP, and what the role of both approaches for a broad but also inclusive energy transition will be.

The aim of this report is to give insights into different existing and emerging approaches for business models, to group different business model categories of energy communities and collective actions and to provide specific examples. Also, the report analyses existing and emerging contractual conditions and investigates to what extent they could impact the development of energy communities, increase investments into renewables and offer a fair arrangement 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 will be updated in April 2023.

2. METHODS AND PROCESS

The report builds on a detailed review of recent literature related to business models for energy communities and collective actions. The creation of categories for business models was based on earlier work done in the EU BRIDGE Taskforce on energy communities[1], 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, initial business model canvases were defined for the pilots in cooperation with the DECIDE demo partners.

The report has a strong focus on understanding the factors enabling and hindering business models for collective 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; the Newcomers project; the Citizen Led Renovation project and HERON, a DECIDE pilot) were invited to share their experiences and to consolidate the findings made in DECIDE.

Regarding the contractual conditions, preliminary 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 with the DECIDE pilots. The current results are a first scoping exercise mapping the current status and main processes and structures of the assessed initiatives as a basis for further analysis.

[1] https://www.h2020-bridge.eu/wp-content/uploads/2020/01/D3.12.d_BRIDGE_Energy-Communities-in-the-EU-2.pdf

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, 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 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 services such as light, heat and useful work through long-term energy performance contracts (Hannon and Bolton, 2015; Sorrell, 2007; Steinberger et al., 2009). 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 the CEP with pre-existing approaches, 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/microgrid) which include an increase in self-consumption, grid investment deferral, primary and secondary reserve capacity and market arbitrage. Collective actions including energy communities, can take advantage of being organized as virtual communities (SmartEn, 2020). Organising 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 chategories that are used by existing and emerging energy communities and collective actions involved in DECIDE as pilots or replicants. 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 analyze how organisational aspects of such initiatives as well as external factors 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 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 actions. Finally, we present the business model propositions of the DECIDE pilots using the canvas method.

4.1. KEY ELEMENTS OF BUSINESS MODELS FOR ENERGY COMMUNITIES AND COLLECTIVE 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 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]. The 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: The most important costs that business occurs through its operations.
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, possible new technologies, a range of new actors including citizens and end-consumers, while customer relationships are rather the way communities internally operate with their members.

The figure below provides an exploratory visualization of a canvas for customer-side business models, including new challenges for collective actions and energy communities that need to be solved to find replicable business models.

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

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 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 actions. It is important to note that activities stemming from the Clean Energy Package and their related revenues can only be realized if the appropriate regulations are in place. Collective actions are not bound to activities defined in 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 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 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 actions, however, are not restricted to a certain type of customers.

Customer relationships refer to the governance the energy communities and member relationships in the case of energy communities, in case of collective 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 the profitability of assets. Revenue streams for the consumers include reduced energy costs but also returns on investments. Service providers or aggregators may achive 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 7 business models categories. **An energy community or a collective energy action can lead to/make use of multiple business model categories**. The analyzed 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 actions into 7 categories:

1) Collective generation and trading

2) Collective self-consumption (residential)

3) Collective self-consumption (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 Renenue Streams
- **Technologies:** Typical energy technologies hardware/software or technology solutions used within 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:** This 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, DSOs, technology providers etc.).
- **Typical organizational structure -** Customer Relationship**:** This relates to governance of members and customers (the latter being members or stakeholders of energy communities or collective actions). For the more narrow oragnisational approaches of energy communities in the CEP, 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 categories	**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 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 energy or flexibilities on local or national energy markets or to the supplier/DSO 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 based on the difference between generation and consumption. Relieve grid operators and balancing responsible parties by balancing generation, storage and consumption. Revenues/costs from internal balancing of supply and demand being accordingly distributed.	• RES electricity/ heat generation technologies • Rooftop and open space PV, biomass plants and CHPs • Wind turbines • 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 (public and commercial)	Energy generation from plants owned by commercial entities or publics spaces (e.g. kindergardens, public buildings) used to cover consumption of the members of the community first maximizing self-	• RES electricity / heat generation technologies • rooftop and open space PV, biomass plants and CHPs,	• SMEs located in the area • Municipality • (social) housing associations	• District developers • Building managers • ESCO • DSO • Supplier	• Cooperatives • (Housing) Associations	• Kricevzi tec park (Croatia) • Abbatoir Plus energy district - DECIDER • TREA, Estonia –DECIDE pilot

	consumption. generation. Any extra electricity can be traded externally. Revenues/costs from internal balancing of electricity and heat consumption and accordingly distributed.	wind turbines, hydro plants, heat plants and heat grids, storage, recovery of excess energy from industry, heat-pumps, e-vehicle charge spots	• Other associations located in the district • Regional bodies			
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	Crowdfunding, Collective purchase of the technology to be used for a central use or for each of the members (PV, heat pumps, EVs)	• PV, wind • Building envelope retrofit	• Citizens, • (Social) housing associations	• Citizens • Cooperatives • Technology providers	• Cooperatives • Associations	• Green Energy Cooperative (Croatia)

a community project	or collective purchase of energy service (refurbishment of buildings, energy management etc.)	• More energy efficient technology for heating and cooling etc.	• Collective action manager	• ESCO, DSO. • Refurbishment companies		
	5a. Collective action - Collective purchase/installation of technology	• Rooftop PV generation	• (Social) housing associations • Collective 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 projects	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 • Green Energy cooperative, 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 a 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 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 energy planning, technical guidance for energy renovation, monitoring of the energy consumption and evaluating the environmental impact of 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 subordinate 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 Clean Energy Package was adopted. Some will continue to operate under or even emerge outside the CEP. *Collective generation and trading* (category 1) already exists several years in a few Member States. In Austria, for example, collective multi-apartment self-consumption of PV energy has existed since 2017, yet the economic benefits for members are small.

Moreover, some business model categories could be combined to improve the overall business model. For example, *collective self-consumption, residential* (category 2) and *collective self-consumption, commercial and public* (category 3) could be combined to assure complementary load profiles, thereby increasing self-sufficiency. Optimised infrastructure will strongly help to improve the business model. Plus Energy Districts (PEDs) serve as an example that represent a mix of category 2 and 3.

Also, *collective investments in a community project* (category 5) and *collective investments in independent energy projects* (category 6) can be found in several EU countries. Here as well, the economic benefits are still limited. Instead, environmental considerations are important drivers for members to invest. Collective actions we observe in DECIDE, such as retrofitting heating technologies in households by service providers or ESCOs while making them smarter (category 7- *collective service provision*), are 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/strengthen community structures.

Further, the Clean Energy Package may trigger new approaches. The provision 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 efficiency services. As the regulatory frameworks for flexibility markets are still in their infancy, value propositions are vague. On the other hand, collective service provision may be key to enabling business models for energy communities, possibly in combination with other activities such as collective self-consumption.

Emerging examples in more detail

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

Plus Energy Districts (PEDs)

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 strategic installation of renewable energy systems and energy storage, optimizing assets across the district
- Centralized and locally shared technologies and infrastructure
- Mobility services

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).

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 ESCOs, 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 (Reis et al., 2021). This approach is taken by the DECIDE pilot ENBRO, as being done by one of the DECIDERs in form of a collective action. Also heat-as-a-service may be a promising model combining heat and power projects, with ESCO 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 the Tartu Regional Energy Agency TREA. Renovation loans are not easily available nor well accepted by communities. Energy efficiency activities such as measures to improve the renovation of buildings are already well established amongst some cooperatives (JRC, 2019). Other cooperatives created their programs in order to re-invest profits from renewable energy production into energy efficiency (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 loans due to, e.g., real estate prices. Apartment associations could team up as well and together tender for construction in order to decrease administration and costs. Next to investment costs energy communities' activities that need financing are awareness raising, mobilising home owners, energy audits and renovation advice identifying contractors and training them, advice on financing as well as 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 (Reis et al., 2021). 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 (based on Borges, 2020):

- Peak shaving
- Grid services - aggregation of small scale flexibilities
- Storage - minimise renewable curtailment or using parked cars rather than peak plants

4.2. PRELIMINARY 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 actions. While the ENBRO, DomX, HERON and ThermoVault pilots are collective 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: BUSINESS MODEL CANVAS for Thermovault

The initiatives of Thermovault could become 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.

The Tartu Regional Energy Agency 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 established 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 are implemented to analyze current consumption and state of comfort in buildings 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 associtations and the DSO.

[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)

Figure 3: BUSINESS MODEL CANVAS 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.

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.

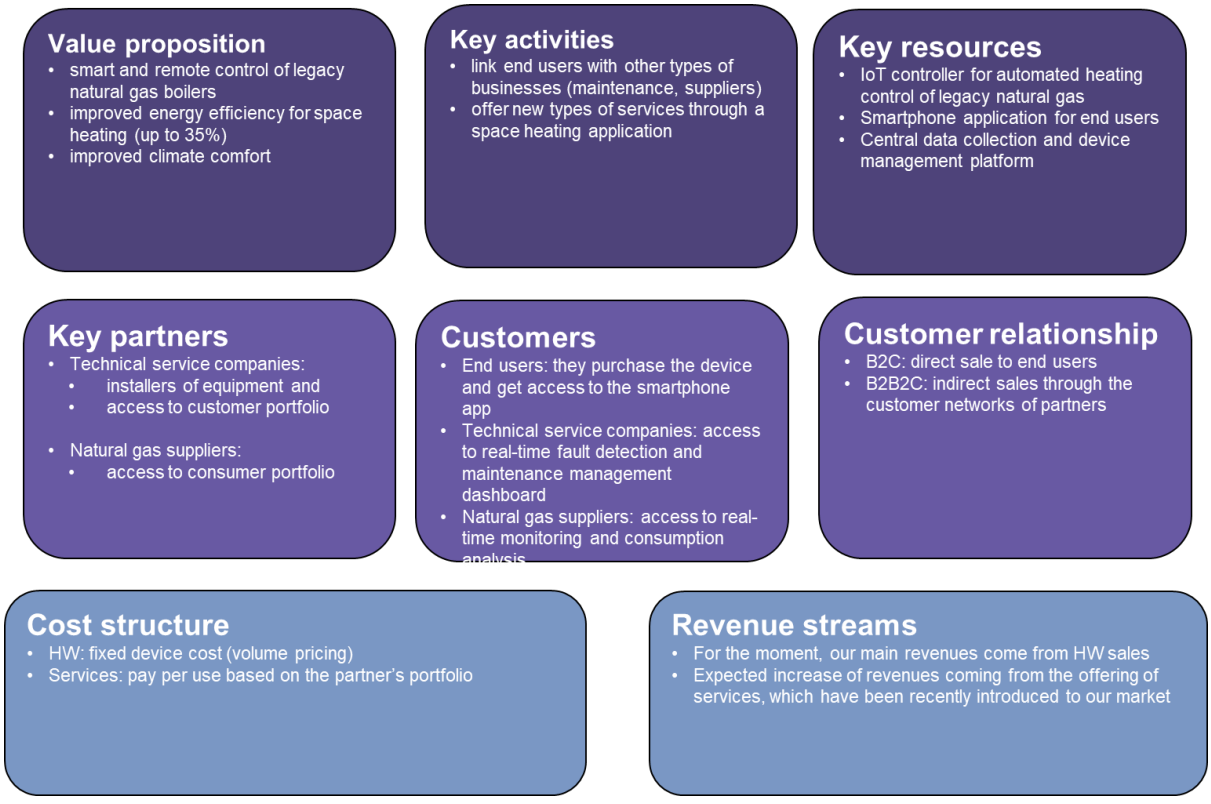


Figure 4: BUSINESS MODEL CANVAS for domX

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".

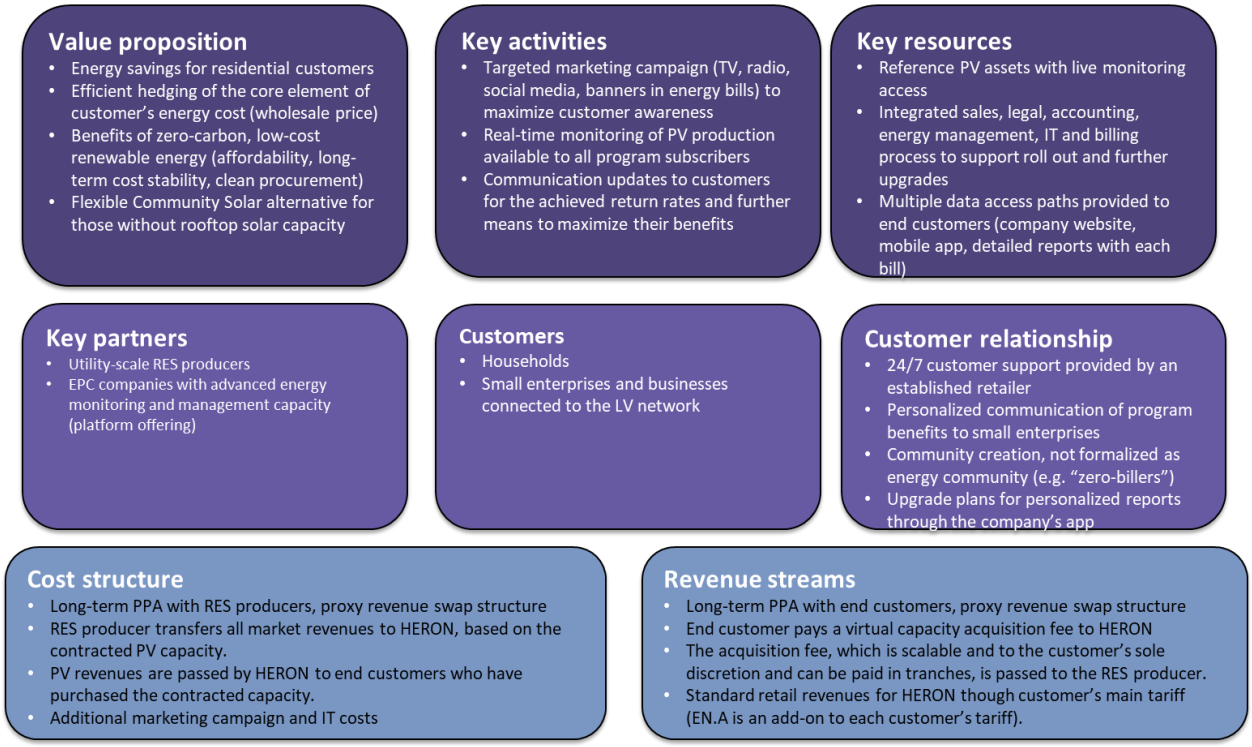


Figure 5: BUSINESS MODEL CANVAS for HERON

Hindelang - a community onwed energy system

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

Bad 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 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.

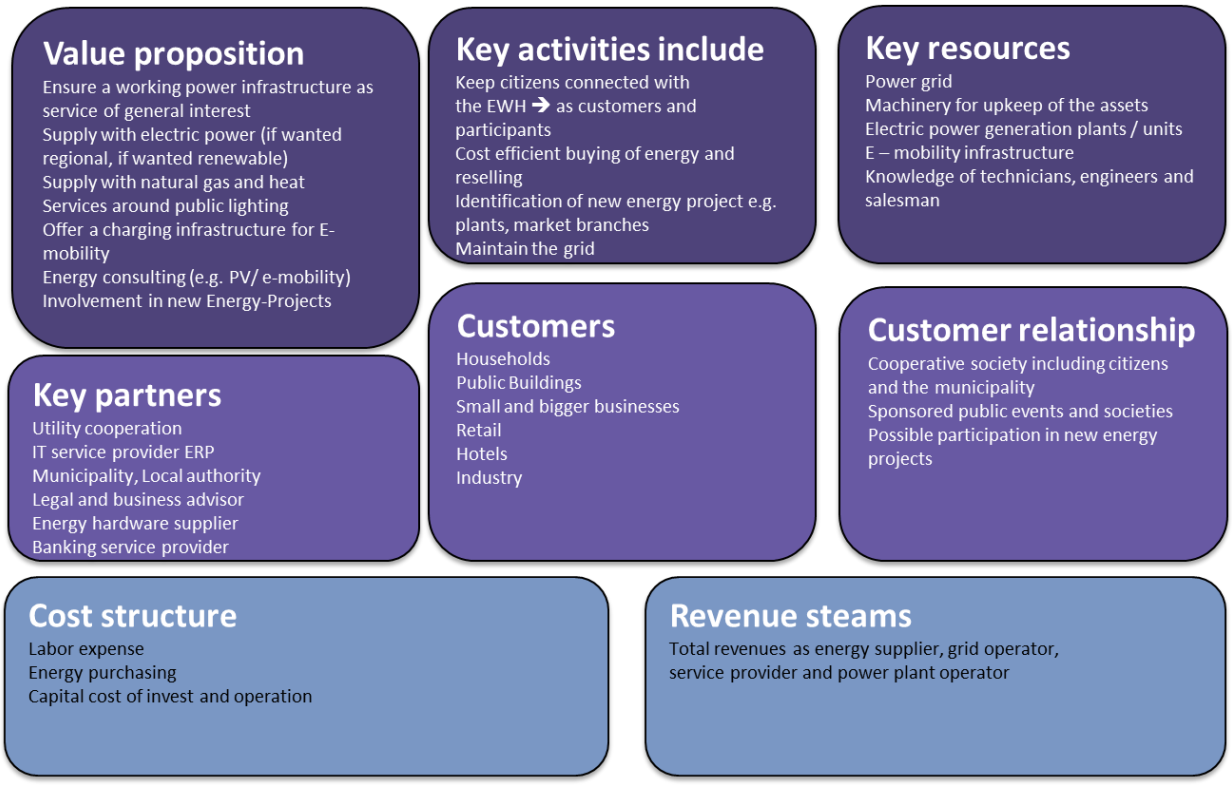


Figure 6: BUSINESS MODEL CANVAS for Hindelang

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

OurPower utilizes category 1 busines 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: BUSINESS MODEL CANVAS 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 and those that are collective actions regarding technical sets ups, but also revenue structures. The collective 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 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.

5. FACTORS IMPACTING BUSINESS MODELS FOR COLLECTIVE ENERGY ACTIONS

The success of the presented business models in providing benefits to energy communities and collective actions is dependent on multiple factors among which are the regulatory framework, the local socio-cultural and economic context and available financing and funding schemes. In this chapter, we discuss how these factors affect business models. In addition, we identify barriers to a successful implementation of business models for energy communities and collective 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 exemptions from the grid tariff surcharges for energy communities (see section 5.3), the spatial boundaries or energy allocation rules.

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:[4]

- *Typology of the public grid* (e.g. low voltage or medium voltage transformers as boundaries). This 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 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 planned by RECs. However, there is an ex-ante uncertainty if a REC will be approved,if the criteria are unclear.

[4] based on Frieden et. al. 2021

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 500 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 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, 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 the primary purpose 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 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 the minimum number of members (Frieden et. al., 2020).

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 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).

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 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 microloans.

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. Poland, for example, exempts energy communities from all grid-related surcharges. 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 EUrequirement to set cost-reflective tariffs (Frieden et al., 2021). 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 (Peeters et al., 2021).

Crowdfunding and microloans

Crowdfunding platforms address the lack of funding from traditional sources due to comparatively small project sizes and missing collateral or securities, widen the target group, especially if the local investor base is too small for projects to be realised and close the funding gap for more innovative business models, substituting or adding to public funding (Holstenkamp et. 2020). Crowdfunding can be organized in four different ways: donation-based, reward-based, lending-based, and equity-based (Compete4SECAP). 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 (Compete4SECAP). 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 actions, as we learned from the DECIDE pilots and DECIDERs, as well as via public workshops the DECIDE project held with other related projects and initiatives. Barriers identified for energy communities and collective 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.

Uncertainties related to ownership of installations

According to EU provisions, 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 (Frieden et. al, 2021). For instance, in Austria third parties can act as contractors and own the installation, while decisions on the operation of the installation are still with the community (Austrian Coordination office for Energy Communities, 2021). Also, in Portugal different options for "external" ownership, including contracting, are discussed: also here, 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 what shares of the installations are held (Frieden et. al, 2021). For collective actions there is no restriction in external ownership. Third parties can invest in as well as operate decentralized technologies for consumers.

Multi-layer decision making and market power of incumbents

This includes complex rules for public tendering, housing regulations or specific national or regional energy regulations. While these barriers are not specific for collective actions and energy communities they can still delay project implementation. One example is Greece, where there is a large number of emerging energy communities, as the 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 actions.

Difficulties to get loans for citizen-driven initiatives

In several DECIDE partner countries difficulties to get bank loans were observed – in some cases no loans for small non-profit organisation are available, since they cannot offer any collateral. In general, only limited information is available about funding schemes for private and corporate actors.

Lack of knowledge, experience and awareness

Due to the fact that the targeted members in renewable energy communities and collective actions are citizens and companies that do not primarily work in the energy sector, there is often a 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 technologies and use of energy are also barriers. A change in existing energy culture patterns and technological knowledge will be needed. (DECIDE to ACT Workshop, 2021).

6. CONTRACTUAL CONDITIONS AND GOVERNANCE

The collaboration and interaction of members and shareholders within the energy communities or with customers within collective actions is often defined in specific regulations or contracts. Contractual conditions and governance are highly important for the functioning and growth of energy communities and collective actions and are further elaborated in this chapter.

6.1. LEGAL FORMS FOR ENERGY COMMUNITIES AND COLLECTIVE ACTIONS

While no legal form is specified for collective actions and collective self-consumption in the Clean Energy Package, the Clean Energy Package demands the creation of a legal entity for energy communities. The type of legal entity that is allowed 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 (Frieden et. al, 2021).

Overall, there is a tendency by Member States to define cooperatives as a preferred entity. Cooperatives are also often an organisational form for collective 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 (Frieden et. al, 2021). 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. 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 actions, may target housing associations for the same reason, such as done by the DECIDE pilot of ThermoVault, lowering administrative costs.

6.2. SHARING CONCEPTS

While basic sharing energy concepts are part of the national regulations, sharing concepts within energy communities are still discussed at a rather academic level. Aim of these concepts is to find out win-win situations for all members considering the heterogeneity of consumers, their needs and their preferences. Some authors focus on trying to optimize energy use across the consumers, others the wider benefits for consumers.

It is often proposed to use game theoretic approaches. Heendeniya (2021), for example, uses an agent-based modelling strategy following a two-step rule-based strategy to optimize energy use. In the first step, a building-integrated battery storage operation strategy based on a schedule improves the self-consumption on prosumer-level, while providing grid-friendly behavior. The next step involves an energy sharing strategy and an operating strategy for community-scale battery storage that maximizes the collective self-consumption. Another approach is based on an ex-post performance evaluation of peer-to-peer energy sharing models. The proposed methodology is able to identify the potential value, to estimate the energy bill and to finally provide the performance index value of P2P energy sharing models.

Hahnel et al. (2020) considers different groups in a community. He differentiates four target groups in his agent-based model:

- classic consumers (not interested in trading);
- price focused consumers;
- autarky focused consumers; and
- heuristic prosumers.

Fleischhacker (2019) examines to invest in joint generation and storages for electricity and heat provision. In this case, the members of the energy community form a coalition to share the benefits, e.g., economic benefits by the increase of self-consumption and economies-of-scale. The cooperative game designed in his work provides high benefits for ECs, as it

- encourages cooperation between the members,
- provides a mechanism for stabilizing the EC, and
- allows joint investments under the aspect of win-win situations.

6.3. ANALYSIS OF CONTRACTUAL AND GOVERNANCE ARRANGEMENTS

There are various ways in which energy communities and collective actions interact with their members (participants), shareholders and employees. These interactions should be managed effectively through clear contractual arrangements and data transparency. Here we aim to investigate whether the contractual obligations performed by the DECIDE pilots and DECIDERs:

- provide for the further development of existing energy communities and collective actions,

- offer an arrangement between all involved parties, and for society as a whole, that is reasonable and treats all the people involved equally,
- contribute to increased investments in renewable energy, and
- represent forms that are replicable to a broad socio-economic range or they create unjustified privileges.

To refine our understanding of these issues, we propose the following classification of the contractual obligations that the energy communities and collective actions have towards their members and employees.

Contractual obligations as enablers …	… for whom?...	Core Indicators
Fairness and democracy in governance and just transition, transparency in decision making	Towards members	• Open and democratic participation • Diverse participation • Participation rules • Quality and amount of interaction • Transparency in decision making
Incentives for additional investments in renewable energy	Towards members	• Financial benefits / incentives • Share of financial benefits • Capacity building / education / easier access to technology • Local development • Environmental impact • Economically viable business case
Replication in a broad social and economic range	Towards members and employees	• Replication potential • Voluntary/ paid work for the EC/CA
Easy to understand and communicate	Towards members	• Understanding of technical information for broader public • Understanding the contract/ structure • Information campaigns
Ethical behaviour	Towards members and employees	• Protecting data privacy • Paying fair taxes • Eliminating bribery and corruption • Responsible lobbying

The preliminary results presented in this chapter are compiled from a mixed-methods assessment combining quantitative and qualitative approaches. A quantitative survey has been distributed to seven DECIDE pilots representatives and three DECIDERs from September to November 2021. The survey used the above-mentioned categorisation of contractual obligations as a theoretical approach. Three DECIDE pilots and three DECIDERs completed the questionnaire. Missing or partially filled-out responses by pilots were supplemented by referring to qualitative documentation of focus meetings with the pilots and by conducting desktop research on the pilots' websites, informational materials and strategy documents. For the current stage in compiling the present deliverable, the following assessment results should be understood as a scoping exercise mapping the current status in the main processes and structures of the assessed initiatives. This scoping will be validated and expanded in an iterative discussion process with pilot representatives and stakeholders during the consecutive project stages. The contractual obligations survey will be further distributed among the DECIDE project participants and initiatives outside of the project as part of semi-structured interviews with initiatives across EU in order to better understand how different initiatives interact with their stakeholders.

Fairness and democracy in governance and just transition, transparency in decision making

According to Roberts et al. (2019) „energy communities can be understood as a way to 'organise' collective energy actions around open, democratic participation and governance and the provision of benefits for the members or the local community". Both energy communities' and collective actions' aim is to foster citizen participation across the energy system and to ensure a just transition to a sustainable and climate-neutral economy.

To evaluate whether these elements were taken into account by the DECIDE pilots and DECIDERs, the assessment addressed the following questions (some with possibility of multiple selection):

1) How can one become a member of the initiative?
2) Do you take any specific action to assure diverse member participation?
3) How can a member leave the initiative?
4) How is the interaction of members and decision-making bodies in the initiative organized?
5) How often do members interact with the decision makers in the initiative?
6) Which subjects among the members have voting rights?

Open participation

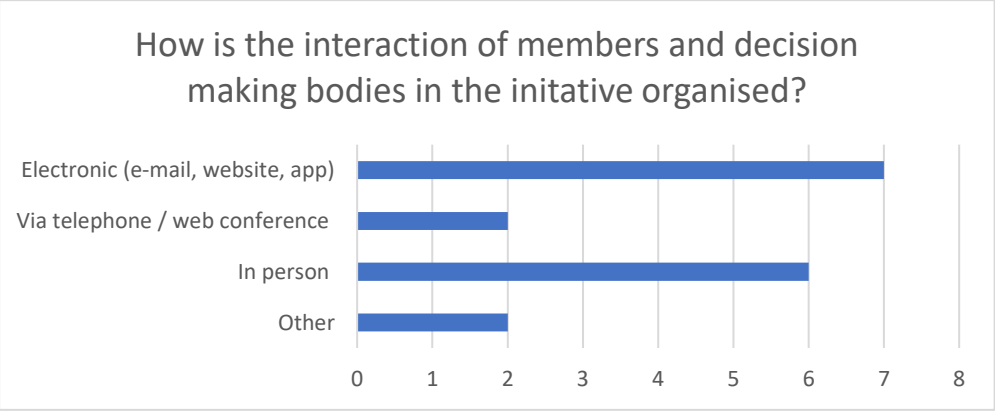
"Living in a specific area" is the most popular motivation for joining an initiative. Several initiatives allow for "other" ways of joining their initiatives, e.g., be a part of social housing that decides to use services of the initiative, be a member of a social housing association, become a member of the platform or start using a specific solution.

Only a single initiative explicitly mentions the possibility of joining the initiative “for free”. There is one initiative that does not accept new members.

Diverse participation

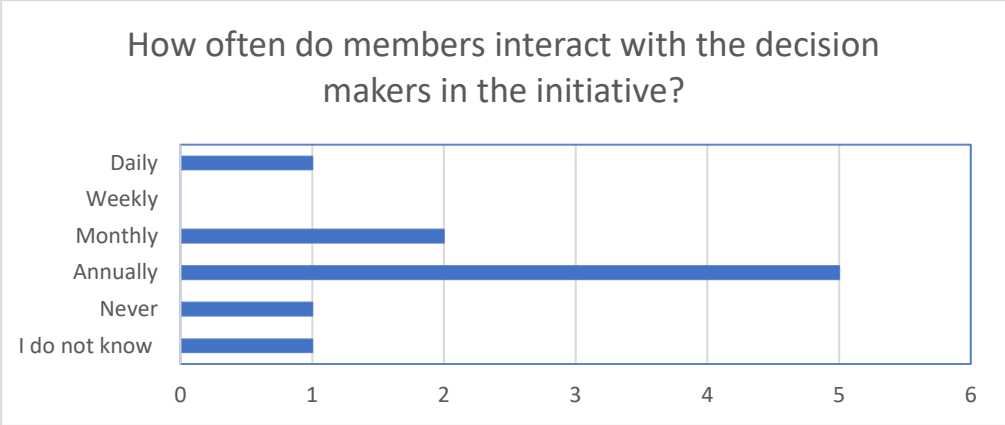
Most of the initiatives use targeted communication. Only two of them are organising targeted events. Two initiatives are currently working on the specific measures under design, e.g., reporting on savings. On the other hand, four initiatives currently do not take any specific action to assure diverse member participation.

Quality of interaction



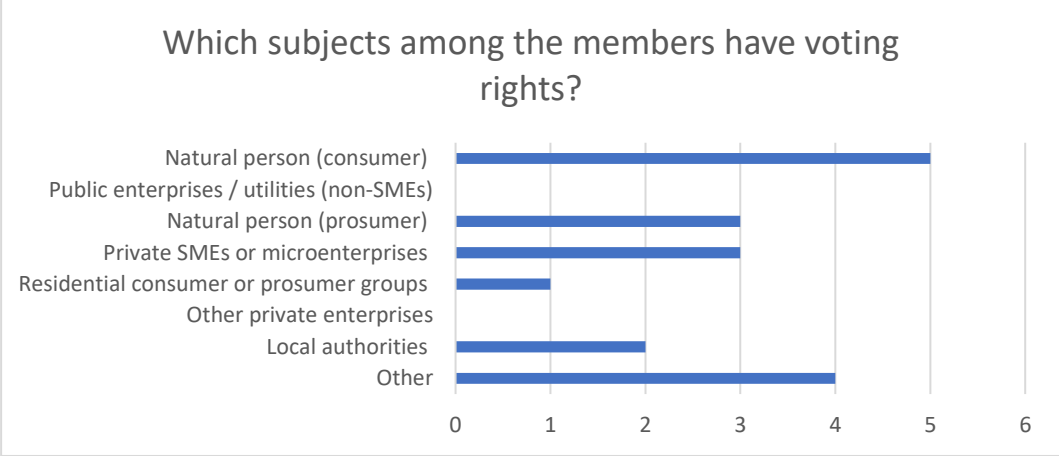
Members of the initiatives predominantly liaise with the decision-making bodies using mainly electronic means of communication, such as e-mail, app or web conference; this may stem from restrictions in coping with the Covid-19 pandemic. Six initiatives have a preference for “face-to-face meetings”. In two initiatives interaction occurs through housing associations (indicated as “other” on the graph).

Amount of interaction



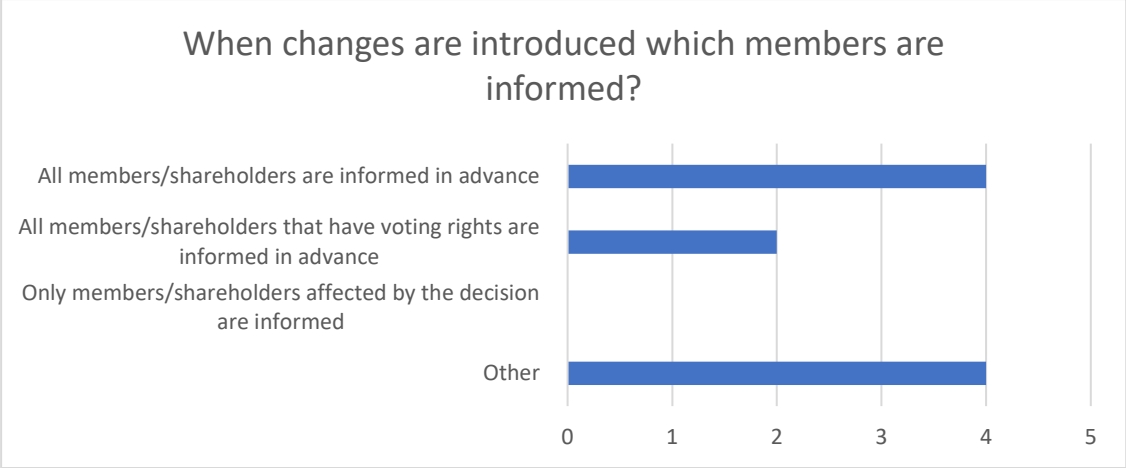
In most cases, the members interact with the decision makers of their initiatives only once per year. Only three initiatives indicated that they allow a more frequent interaction, on a monthly (2) or daily basis (1).

Transparency in decision making



Typically, voting rights are held by natural persons, either being consumers or prosumers. But also, private SMEs or microenterprises are important members with voting rights. In two initiatives the local authorities have the right to vote. Three initiatives clarified that there are no voting rights in their initiatives[5], as they are rather collective actions pursuing voluntary engagement than formalized energy communities. One initiative gives voting rights to groups of persons, e.g., housing associations and residential consumer or prosumer groups.

[5] Indicated under "other".



About half of the initiatives (4 initiatives) inform all the members/ shareholders about planned changes in advance. Two initiatives inform only the members/ shareholders that 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.

Incentives for additional investments in renewable energy

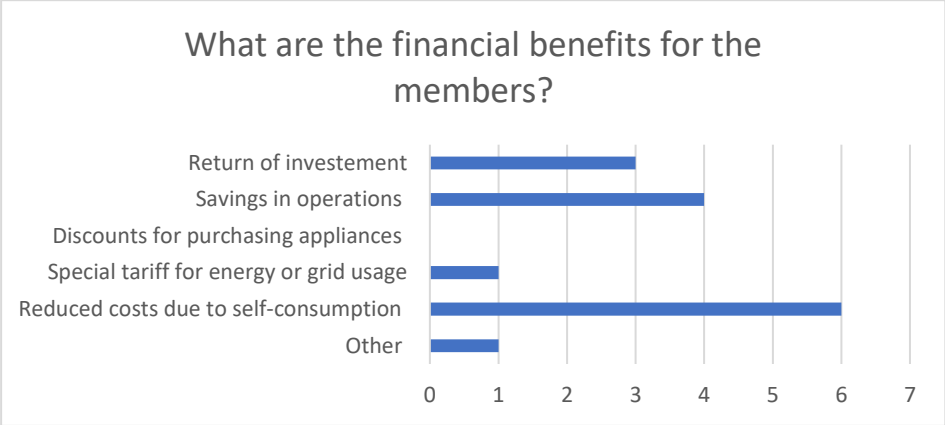
When participating in an energy community or a collective action, members may (but do not have to) benefit from financial gains in relation to energy costs. These potential financial benefits include: reduction in the energy bill, lower network tariffs due to aggregation effects and a better local supply (Caramizaru and Uihlein, 2020).

While in certain cases the financial outcome of an energy community or collective action is the main concern, other initiatives focus more on the non-financial benefits, e.g., capacity building, education, easier access to technology (Bauwens, 2016). These aspects of energy communities and collective actions will be addressed in the next report.

To evaluate whether these elements were taken into account by the DECIDE pilots, the assessment addressed the following questions:

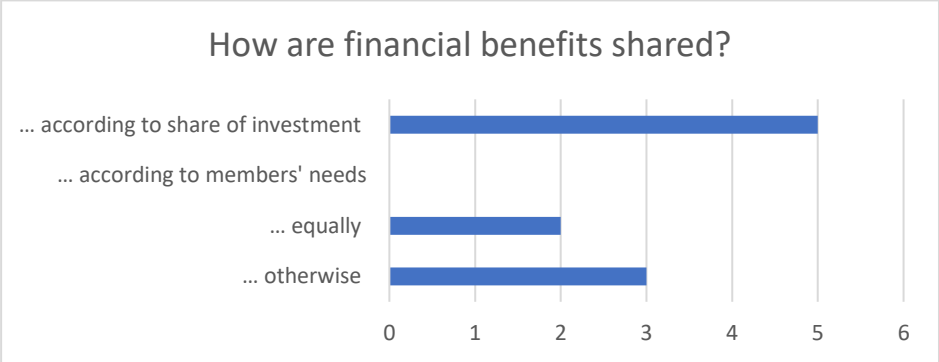
1) What are the financial benefits for the members?
2) How are financial benefits shared?

Financial benefits



Note that different financial benefits are not mutually exclusive, but that multiple benefits may apply within a specific initiative. Most initiatives (six) offer reduced costs due to self-consumption. Four initiatives offer savings in energy costs to their members due to operation of their devices or their services. Members of three initiatives benefit from receiving a return on investment. Only in one initiative a special tariff for energy or grid usage is applied.

Share of financial benefits



In about half of the initiatives the financial benefits are shared according to the share of investment. Only two 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.

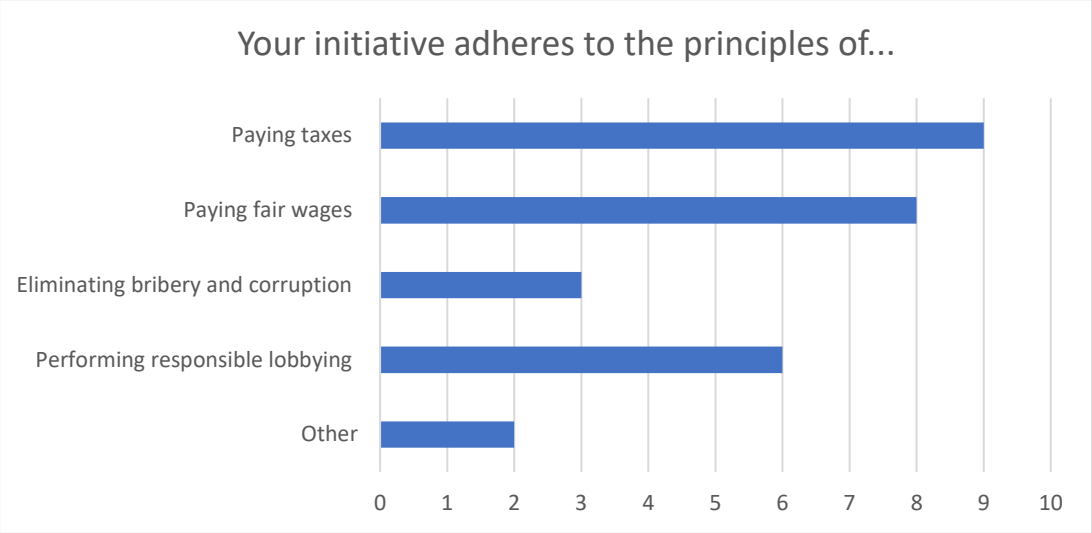
Ethical behaviour

Identifying and addressing ethics and data protection by the energy communities and collective actions is the remaining key element in the proposed classification. Protection of data privacy, informed consent, ensuring confidentiality and anonymity for the initiatives’ members, paying fair taxes, eliminating bribery and corruption and responsible lobbying should be rigorously applied by the initiatives.

To assess whether the pilots and DECIDERs are aware of and respect the principles of ethical behaviour and data protection, the assessment addressed the following questions:

1) Do you have defined procedures/forms for asking consent for the collection and use of personal data? Are you aware of GDPR rules?
2) Your initiative adheres to the principles: paying fair wages, paying taxes, eliminating bribery and corruption, performing responsible lobbying, other, none?

Other principles of ethical behaviour



A range of ethical principles are advocated across all assessed initiatives. Almost all initiatives pay taxes. A large majority of initiatives claim to pay fair wages to their employees. More than half of initiatives perform responsible lobbying activities.

Communication structures

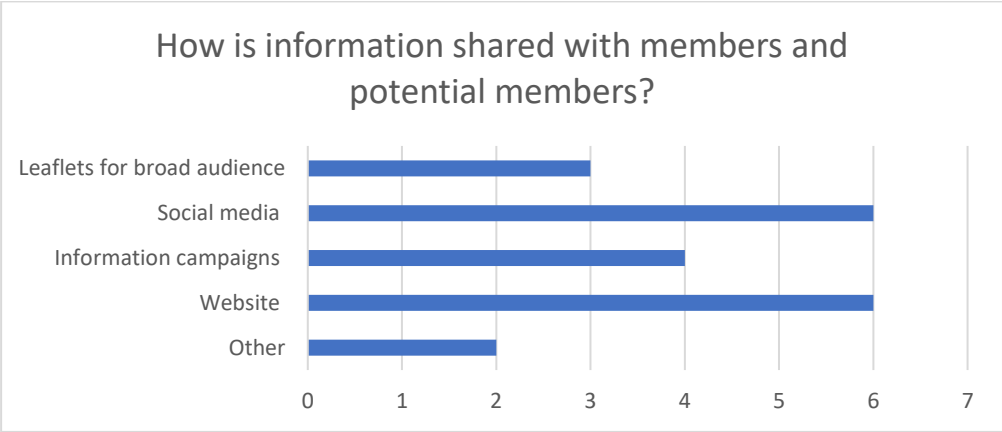
Information sharing and communication are vital elements of the proposed classification. One area where energy communities and collective actions need to be very attentive is communicating technical information to non-technical audience, e.g., members of the energy community or participants in a collective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

Further, 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.

To assess whether the pilots and DECIDERs invest their time and resources in making complex technical concepts easy to understand for the member in their initiatives, the assessment addressed the following questions:

1) How is information shared with members and potential members?
2) How was your organization established?

Information sharing



The most popular media and means of communication / information sharing are websites and social media; each of these information channels is leveraged by six initiatives. Four initiatives organise information campaigns. Only three initiatives distribute leaflets for broader audience. However, none of the assessed initiatives organises capacity building events, co-creates events or produces leaflets for experts.

Replication potential in a broad social and economic range

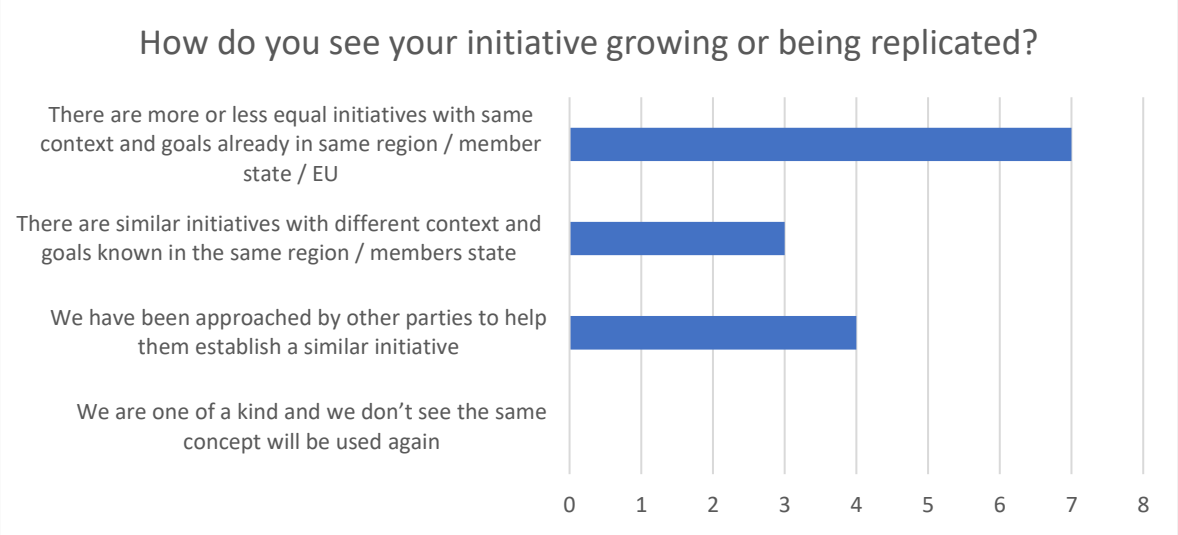
Replication potential played a central role in the classification of the contractual obligations analysed in this chapter. In the literature, replication is defined as an "experiment" that aims to "demonstrate that the same findings can be obtained in any other place by any other researcher (…). It is proof that the experiment reflects knowledge that can be separated from the specific circumstances (such as time, place, or persons) under which it was gained" (Schmidt, 2009). By reviewing the inputs of the project participants, we hypothesise that a successful initiative should be applying a socio-economic model that could be replicated in different contexts and ultimately lead to an increase in renewable energy investments.

One of the DECIDE project goals is to support a replication potential of successful approaches identified in the project.

After an extensive selection of project replicants, eleven DECIDERs have been selected up to now, providing a diverse geographical and topical distribution, e.g., energy management in buildings, sustainable mobility, collective self-consumption, sustainable heating system, and power farming[6]. With this action, the project looks forward to applying pilots' knowledge to replicant initiatives to help them grow their energy communities and collective actions.

To assess whether the pilots and DECIDERs feature replication potential, the assessment addressed the following questions:

1) How do you see your initiative growing or being replicated?
2) Individuals active in the organizational structure of the initiative are: voluntarily active members of the initiative, paid members of the initiative, paid employees or volunteers?



The majority of 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 have already been approached by other parties to help them establish a similar initiative. None of the initiatives consider that their model cannot be replicated.

[6] https://decide4energy.eu/deciders

Understanding the structure

Most initiatives were established on a basis of a pre-existing structure, e.g., by a municipality or other public body (four), by a for-profit organization (two), or on the basis of a pre-existing organization related to the energy field (one). Three initiatives were established by individuals.

Voluntary/ paid work for an energy community or collective action

Core personnel holding central roles in the initiatives' organization are predominantly paid employees; in two initiatives, these are members of the initiative who receive a dedicated salary for their management activities. However, four initiatives rely on crucial support by voluntarily active members.

6.4. 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 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. 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 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.

The research on contractual and governance arrangements will be further pursued by the DECIDE project. The goal of this study is to provide a starting point from research-based evidence and advice to all initiatives, in particular, regarding the understanding, assessment and tools for tackling the matters of diverse participation, transparency in decision making and communication and other aspects that are crucial for further development of energy communities and collective actions.

7. CONCLUSIONS

This report provided a comprehensive mapping of existing and emerging business models that can be used by energy communities and collective actions. Different emerging types of business models in different stages of maturity are presented. While in some EU countries collective actions already existed for several years, energy communities, according to the CEP, open up new regulatory opportunities and revenue streams.

The Clean Energy Package defines legal entities of CECs and RECs 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.

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 actions outside the Clean Energy Package 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 building or mobility sectors collective actions therefore may be of high relevance.

The report shows the broad range of factors that can influence business models for energy communities and collective 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 viable business case. Socio-cultural and economic factors are equally important for energy communities and collective actions. Finally, contractual conditions and the governance structure are very important to enable a fair distribution of benefits. An assessment among DECIDE pilots and DECIDERs showed that most of the initiatives allocate voting rights to consumers, prosumers, private SMEs and microenterprises, which is fundamental for transparency and equality in decision making. However, there is scope to improve the diversity of members as well as the communication among members. For both, business models and contractual provisions, DECIDE will provide further analysis and insights in an update of this report.

8. REFERENCES

Austrian Coordination office for Energy Communities, 2021. FAQs https://energiegemeinschaften.gv.at/faq/

Bauwens, T. (2016). Explaining the diversity of motivations behind community renewable energy. *Energy Policy*, 2016, p.278-290.

Bonhage, A. (2021). A financing guide for Citizen-led renovation. https://www.stefanscheuer.eu/wp-content/uploads/2021/10/20211018_CLR_financing-guide.pdf

Borges, T. (2020): Jointly providing flexibility and grid services while charging EVs. Presentation. Tereza Borges, International Business Development.

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

Caramizaru, A., Uihlein, A. (2020). Energy communities: an overview of energy and social innovation. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC119433/energy_communities_report_final.pdf

Compete4SECAP (2021): The Compete4SECAP project (C4S). https://compete4secap.eu/home/.

Davis, M., Cartwright, L. (2019): Financing for Society: Assessing the Suitability of Crowdfunding for the Public Sector. UK Government Report: DCMS. DOI: 10.5518/100/7

DECIDE2ACT Workshop (2021): https://decide4energy.eu/news?c=search&uid=Gk2VE1Sr.

Dilger, M.G., Konter, M., Voigt, K.-I. (2016). Introducing a co-operative-specific business model: The poles of profit and community and their impact on organizational models of energy co-operatives. University of Erlangen-Nuremberg, Germany

European Parliament (2018). Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

Fleischhacker, A., Corinaldesi, C., Lettner, G., Botterud, A. (2019): "Energy Sharing Concepts In Energy Communities". Vortrag, 11. Internationale Energiewirtschaftstagung IEWT, Wien; In: "Freiheit, Gleichheit, Demokratie: Segen oder Chaos für Energiemärkte?", (2019). URL: https://publik.tuwien.ac.at/files/publik_282375.pdf.

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

Frieden, D., Tuerk, A., Neumann, C., d'Herbemont, S., Roberts J. (2020). Collective self-consumption and energy communities: Trends and challenges in the transposition of the EU framework. COMPILE Working paper.

Hahnel, U.J.J., Herberz, M., Pena-Bello, A., Parra, D., Brosch, T. (2020): Becoming prosumer: Revealing trading preferences and decision-making strategies in peer-to-peer energy communities. *Energy Policy*, 137 (2020) 111098. https://doi.org/10.1016/j.enpol.2019.111098

Hannon, M.J., Bolton, R. (2015): UK Local Authority engagement with the Energy Service Company (ESCo) model: Key characteristics, benefits, limitations and considerations. Energy Policy, 2015, vol. 78, issue C, 198-212. DOI: 10.1016/j.enpol.2014.11.016.

Heendeniya, C.B. (2021): Agent-based modeling of a rule-based community energy sharing concept. E3S Web of Conferences 239, 00001 (2021) ICREN 2020. https://doi.org/10.1051/e3sconf/202123900001

Horstink, L., Julia M. Wittmayer, J.M., Ng, K., Pontes Luz, G., Marín-González, E., Gährs, S., Campos, I., Holstenkamp, L., Oxenaar, S., Donal Brown, D. (2020): Collective Renewable Energy Prosumers and the Promises of the Energy Union: Taking Stock. Energies, 13(2):421. DOI: 10.3390/en13020421

Holstenkamp L., T. Becker, A. Beigang, M. Ehrtmann, M. Davis, D. Brown, S. Hall (2020). Prosumers for the Energy Union: mainstreaming active participation of citizens in the energy transition. Stakeholder Report on Financial Innovation for Prosumer Expansion

Irish Government (2020): Terms and Conditions for the first competition under the renewable electricity support scheme – RESS1:2020. https://www.dccae.gov.ie/documents/RESS_1_Terms_and_Conditions.pdf

Ivask, N. (2021). Introduction to the COMETS Project Study; COMETS: Torino, Italy.

Müller, S., Welpe, I. (2018). Sharing electricity storage at the community level: An empirical analysis of potential business models and barriers. *Energy Policy*, 188, p. 492-503.

Portuguese Government (2021): Plano de Recuperação e Resiliência: recuperar Portugal construindo o future. https://www.portugal.gov.pt/pt/gc22/comunicacao/noticia?i=planode-recuperacao-e-resiliencia-recuperar-portugal-construindo-o-futuro.

Reis, I., Gonçalves, I., Lopes, M., Antunes, C. (2021). Business models for energy communities: A review of key issues and trends. *Renewable and Sustainable Energy Reviews*, 144.

RESCOOP, 2021: Energy Communities under the Clean Energy Package. Transposition Guidance, 2021

Roberts, J., Frieden, D., Gubina, A. (2019). 'Energy Community Definitions', Compile Project: Integrating Community Power in Energy Islands. https://www.compile-project.eu/wp-content/uploads/Explanatory-note-on-energy-community-definitions.pdf

Roby H., Dibb, S. (2019). Future pathways to mainstreaming community energy. *Energy Policy*, 135.
Horstink, L., Julia M. Wittmayer, J.M., Ng, K., Pontes Luz, G., Marín-González, E., Gährs, S., Campos, I., Holstenkamp, L., Oxenaar, S., Donal Brown, D. (2020): Collective Renewable Energy Prosumers and the Promises of the Energy Union: Taking Stock. Energies, 13(2):421. DOI: 10.3390/en13020421

Ruggiero, S., Isakovic, A., Busch, H., Auvinen, K., Faller, F. (2019): Developing a Joint Perspective on Community Energy: Best Practices and Challenges in the Baltic Sea Region. http://co2mmunity.eu/wp-content/uploads/2019/03/Co2mmunity-working-paper-2.3.pdf.

Schmidt, S. (2009). Shall We Really Do It Again? The Powerful Concept of Replication Is Neglected in the Social Sciences. *Review of General Psychology*. 13. 90-100.

SmartEn (2020). Smart Energy Prosumers. https://smarten.eu/wp-content/uploads/2020/05/Smart_Energy_Prosumers_2020.pdf

Sorrell, S., (2007): The economics of energy service contracts. Energy Policy 35(1):507-521. DOI: 10.1016/j.enpol.2005.12.009.

State Environmental Fund ČR (2020=: About the Modernisation Fund. https://www.sfzp.cz/en/about-the-modernisation-fund/

Steinberger, J., van Niel, J., Bourg, D. (2009): Profiting from negawatts: Reducing absolute consumption and emissions through a performance-based energy economy. Energy Policy 37(1):361-370. DOI: 10.1016/j.enpol.2008.08.030

Tuerk, A., Frieden, D., Neumann, C., Latanis, K., Tsitsanis A., Kousouris, S., Llorente Joldi, J., Heimonen, I., Reda, F., Ala-Juusela, M., Allaerts, K., Caerts, C., Schwarzl, T., Ulbrich, M., Stosch, A., Ramschak, T. (2021). Integrating plus energy buildings and districts with the energy community framework: regulatory opportunities and technological solutions. *Buildings*, *11*, https://doi.org/10.3390/buildings11100468

Tuerk, A., Neumann, C., Rakocevic, L. (2021). DECIDE Energy Community Monitor.

Verbong, G., Beemsterboer, S., Sengers, F. (2013): Smart grids or smart users? Involving users in developing a low carbon electricity economy. Energy Policy 52:117–125. DOI: 10.1016/j.enpol.2012.05.003.

Webb, J., Tingey, M., Hawkey, D., (2017). What We Know about Local Authority Engagement in UK Energy Systems - Ambitions, Activities, Business Structures & Ways Forward. https://d2e1qxpsswcpgz.cloudfront.net/uploads/2020/03/ukerc_eti_report_local_authority_engagement_in-uk_energy_systems.pdf

decide4energy.eu

PARTNERS

THINK-E

JOANNEUM RESEARCH LIFE

B.A.U.M.

prospex institute

ThermoVault

ENBRO

Tartu Regiooni Energiaagentuur
Tartu Regional Energy Agency

our power
DIE ENERGIE COOPERATIVE

HERON

domX

UNIVERSITÄT MANNHEIM
Fakultät für Betriebswirtschaftslehre

I·C·L·E·I
Local Governments for Sustainability

EWIH
ENERGIE & SERVICE

Privatuniversität
SCHLOSS SEEBURG

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 894255. The sole responsibility for the content of this document lies with the DECIDE project and does not necessarily reflect the opinion of the European Union.