# MASTERPIECE -

# Multidisciplinary Approaches and Software Technologies for Engagement, Recruitment and Participation in Innovative Energy Communities in Europe

# Deliverable 3.3

## TECHNIQUES FOR FINANCIAL AND SOCIAL PLANNING OF SUSTAINABLE ENERGY COMMUNITY PROJECTS

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# ● EXECUTIVE SUMMARY

This deliverable is part of MASTERPIECE project. MASTERPIECE aims to build up a digital coordination and cooperation arena that will facilitate the creation and operation of energy communities (ECs) throughout Europe. The project's objectives are: i) to develop technical and social innovations to empower energy consumers and to make them active agents of collaborative ECs, paving the way towards a new energy market paradigm; ii) to create user-centric solutions that are based on participatory approaches such as co-creation and accelerate citizens' involvement; iii) to propose new business strategies and incentive mechanisms; iv) to configure a standardised and sound cyber-security infrastructure so the active citizens are protected against cyberattacks, at the same time that privacy is defended in accordance with the EU regulation; and v) to demonstrate the applicability and replicability of methodological, technical and business innovations in a variety of real-life pilots in different geographical locations, with heterogeneous social and economic environments and different regulatory/administrative frameworks. MASTERPIECE will follow a staged implementation approach, utilizing use cases with different maturity and TRLs. To demonstrate and evaluate the proposed innovations, it will leverage four pilot cases in different geographical areas and within different operational/policy frameworks (France, Italy, Sweden and Turkey).

Considering regulatory frameworks and financing mechanisms at national and local levels with a focus on pilot cases (see MASTERPIECE D2.1, and D3.1), this deliverable aims to set up the theoretical base for supporting pilot cases and future Energy Communities (EC) in designing targeted Business Models (BM). The first step focuses on investigating and synthesising knowledge of EC BMs, intending to understand the driving dimensions that mostly affect ECs toward the definition of a new and replicable analytical framework. This new BM analytical framework will be used by MASTERPIECE partners and stakeholders in the BM co-design process and represents a crucial basis for the next research steps focusing on techniques for financial and social planning addressing ECs setup, implementation and long-term management. Financial planning is the practice of defining strategies for the setting up, implementation and management of initiatives and businesses, considering potential financial resources, revenues, and costs. Social planning is a process of assessing and addressing social needs and goals through the development of innovative techniques for designing social services that boost the participation of individuals, organizations, and government entities. The analytical framework will be used and applied in T6.3 as part of the multidimensional platforms developed in MASTERPIECE. In this deliverable it has been used to define EC BM archetypes which are intended as general and theoretical (abstract) models which are representative of a set of mechanisms that can describe the differences between EC initiatives in terms of how they work, generate and capture value. Archetypes are described and analysed to provide a commune knowledge base in terms of EC BMs. EC BM archetypes can be scale down according to different configurations. Those will be further identified and developed in the next steps in order to provide standardised set of options useful to support EC BM design process.

The deliverable is organised into four sections. The first session focuses on EC BMs analysis and categorisation in the literature. In the second session, the most recurring dimensions used in the literature to describe EC initiatives and their BMs are reported and explained. The third session is devoted to describing EC BM archetypes based on the recurring dimensions that emerged in the

literature. Finally, the fourth section states the next steps for Task 3.2, with a focus on developing supporting tools for BM co-design process.

# ENERGY COMMUNITY BUSINESS MODELS

## 1. Introduction

The Energy Community (EC) concept describes a broad spectrum of collaborative actions aimed at democratizing the energy system and encouraging citizens to participate in energy markets. Even though most scholars accept this large definition, the EC concept remains quite unclear (Walker et al., 2007; Bauwens et al., 2022). Beyond the EU definitions of Renewable Energy Community - REC (Directive 2018/2001 - RED II) and Citizen Energy Community - CEC (Directive 2019/942 - IEMD), doesn't exist a common and unique definition and understanding of the EC concept in the literature (Brummer, 2018). This is also due to the blurring term "community" which contains a diversity of meanings and interpretations (Walker et al., 2007). In general, ECs must be understood as collectively organized energy systems, characterized by the participation of citizens, local authorities and other small businesses who are willing to work collaboratively to reach common goals (Reis et al., 2021).

According to MASTERPIECE D2.1 (2023), we can define the EC as a legal entity where members collaborate to generate benefits for the members and the community. Revenues (if any) are used to increase the capacity to support and enhance the community through recycled investments for financing new RES plants and fighting energy poverty. Collaboration is made up of a local bond or a legal agreement that allows the interaction and full participation of members. Technologies are crucial to managing the interaction among members (monitoring, demand-response, flexibility, energy trade, etc.) and assuring energy efficiency (e.g., energy storage, Vehicle to Grid – V2G, etc.). The membership is voluntary and open to everyone. However, the participation can follow different models according to the legal form the community decide to set up. In other words, we consider ECs as a multidimensional concept, where legal, economic, social, and technological aspects match up with the aim to reinforce collaboration towards energy transition at the local level.

In the EU, citizens participating in energy initiatives, either involving a few stakeholders or the whole local community, have a long history. The first EC initiatives date back to the early 20th century when rural electrification cooperatives existed in countries such as Germany, Italy, and Spain. The first country to develop a collective investment model in renewable energy production was Denmark in 1970, followed by Germany in the early 1990s (Bauwens, Gotchev & Holstenkamp, 2016). The development of pioneer initiatives has been favoured by the energy crises in the 70s, the strong local energy activism (such as antinuclear protests), and the lack of grid connection (e.g., the case of the Alpine region in Italy). Most recently ECs in the EU have been boosted by the introduction of public incentives, the rise in relevance of global climate actions and the Russian gas crises. Figure 1 illustrates that many initiatives were founded during the past 30 years, particularly from 2010 to 2015, coinciding with the period when incentives were in place in many countries (Gorroño-Albizu et al., 2019; Schwanitz et al., 2023).

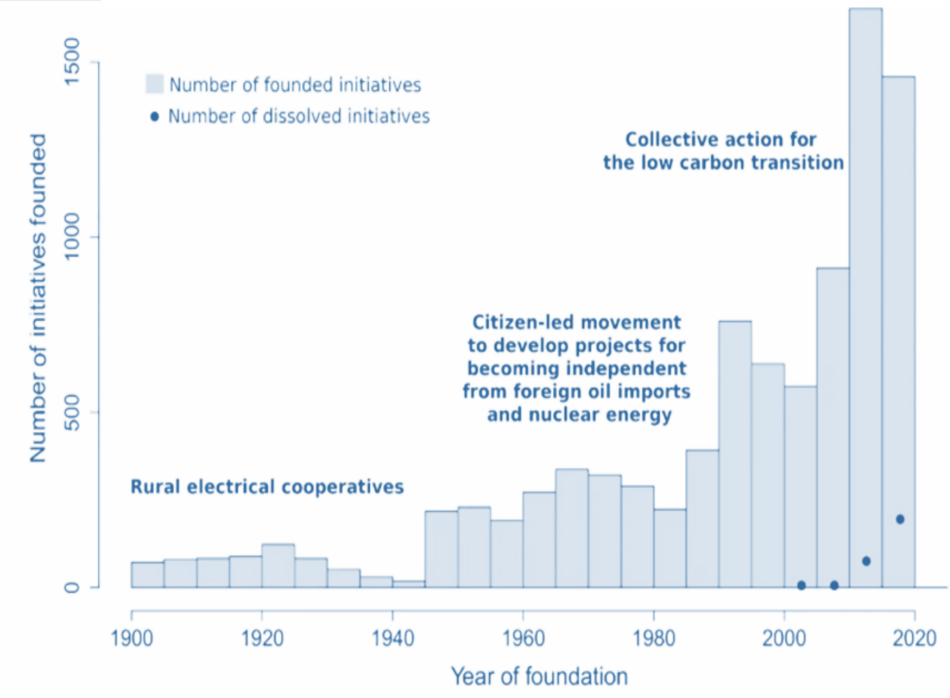


*Figure 1 Evolution of EC initiatives in the EU*

Despite there is not a clear and complete overview of existing ECs, the estimated number of citizen-led energy initiatives in the EU is 10.243, involving almost 2 million people. This list considers ECs that follow 3 criteria: 1. citizens-led, 2. involved in providing energy services (energy production, sharing, and management), and 3. intending to generate social and environmental benefits. Those EC initiatives entail finances invested of 6.2–11.3 billion EUR, and renewable capacities installed of 7.2–9.9 GW from 30 European countries. Compared to the population of Europe, the numbers of people involved in these initiatives are marginal and most of the investments are in higher GDP countries, describing a niche phenomenon that struggles to include low-income families and produce wider social and environmental benefits as foreseen by the EU Directives (Schwanitz et al., 2023).

ECs still represent experimental and sporadic initiatives which are facing several barriers (institutional, economic, technological and social, see MASTERPIECE D2.1, 2023) and difficulties in organising themselves, attracting new members and participating in the energy market. These difficulties entail also the lack of a clear definition of how EC works from a Business Model (BM) point of view. The BM describe how a firm does business and operates in a marketplace (Koop, et al., 2021). Osterwalder, Pigneur and Tucci (2005) define the BM as the rationale of how an organization creates, delivers, and captures value. Recently the raising of sustainability attention brought the introduction of a new dimension in BM studies. This refers to the "shared value" concept. It proposes to redefine the purpose of business as "creating economic value in a way that also creates value for society by addressing its needs and challenges" (Porter and Kramer, 2011). Through the generation of "shared value", a business entity enhances its competitiveness while simultaneously advancing the economic, environmental, and social conditions in the communities in which it operates (Bagaini et al., 2022). This is particularly relevant for entities that address sustainability, like ECs that aim at producing renewable energy, reducing energy poverty, increasing awareness, and supporting local economic growth. Indeed, we intend the EC as an innovative sustainable BM, since it aims to generate environmental and social benefits for members and the community as a whole (MASTERPIECE D2.1, 2023). Furthermore, ECs not only redefine the value proposition of their BMs but also provide a new organizational structure and new activities in the energy sector (Figure 2). ECs make end-customers protagonists of the energy transition, allowing citizens, administrations, and enterprises to collectively develop and manage energy projects or services, with a different model of governance.

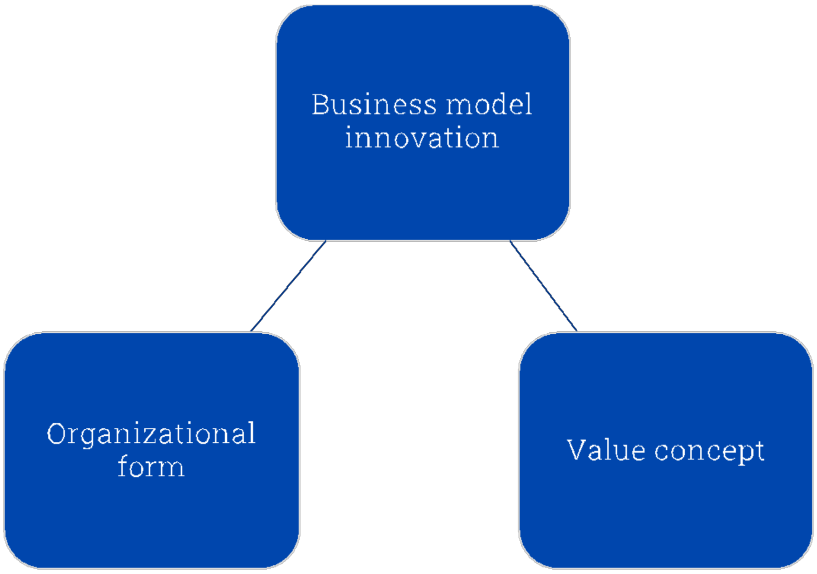


*Figure 2 EC BM innovation (Masterpiece D2.1)*

In the literature, there are many articles and reports addressing the EC BM, with the aim to describe how they generate and deliver value for members and stakeholders operating in the energy sector. As for the EC definition, studies addressing the EC BM are characterised by uncertainty and divergences also considering the analytical frameworks used to describe and assess them. Some authors use the Business Model Canvas (BMC) which has become one of the most used and cited BM analytical framework (Osterwalder, Pigneur, 2010). It counts 9 dimensions: Customer Segments, Value Proposition, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure. Other authors, considering the complexity and novelty of ECs, prefer to analyse EC BMs by looking at macro dimensions, i.e., the Value proposition, the Value capture and the Value delivery. Other publications try to analyse EC BMs by defining new analytical frameworks and considering different dimensions – compared to BMC – that better embody the ECs' peculiarities. Those look at different key features such as membership, technologies, financing mechanisms, etc. All those studies aim to clarify the EC concept and support players in understanding how different EC initiatives can work and operate in the market. Since the literature on EC BMs provides different analytical frameworks and different dimensions, the deliverable aims to identify and categorise all the dimensions considered in the literature to discover the most recurring ones and define a new analytical framework based on them. This process allows us to define EC BM archetypes intended as a general and theoretical (abstract) model which is representative of a set of mechanisms that can describe the differences of EC initiatives in terms of how they generate, deliver and capture value.

The deliverable final goals include: 1. supporting the EC BMs design process by providing a standardised analytical framework that is the expression of the peculiarities of EC initiatives and synthesis of the most prominent literature in the field; 2. providing a common base of knowledge on different theoretical EC BMs which can inspire and guide new stakeholder in defining their ECs paths.

# 2. State of art of Energy Communities Business model

## Methodology

A literature review was conducted to identify key dimensions taken into consideration in the literature to describe EC initiatives and EC BMs. First, we searched the Web of Science database using the following keywords (("Energy communit*" OR "Renewable Energy Communit*" OR "Citizen Energy Communit*" OR "Community Energy") AND ("Model*" OR " Archetypes" OR "Business Model*" OR "Cluster*" OR "Taxonom*" OR "Categor*")). For the aforementioned keywords, we do not utilize all subject fields, as we only search for "authors keywords". The variety of keywords is due to the lack of a single definition of ECs in the literature. Some papers have used the term "energy community", while other studies use the terms "community energy", "local energy community", "renewable energy community", etc. (Gruber, Wogrin, 2021). Therefore, we tried to include as many terms as possible to identify the most relevant works addressing how EC initiatives can work, with a focus on EC BM analysis and categorization. Indeed, we tried to find all possible configurations of keywords that are both related to the business model and more general terms such as typology, categories, archetypes, etc.

A total of 202 papers appeared, but we restricted the number using only the literature conducted in English. In addition, we excluded process papers and editorial material, leaving 166 papers. In addition, we included papers related only to economics, business, social sciences, sustainability science, and interdisciplinary studies and excluded other disciplines related to engineering, computer science, and natural sciences, since the scope of the literature review is to understand which dimensions affect ECs BMs.

In total, we retained 19 papers that were relevant to our study objective. In addition, we conduct a review of grey literature by searching on Google Scholar. The topic of EC has gained a lot of attention not only in academia but also in policy and administration sectors. Thus, considering reports outside of academia is relevant for having a wide understanding of the topic. Finally, we applied a snowball technique to find correlated research works included in the bibliographies and citations of our sample. In total 24 research works were used in our analysis, from which 19 were journals' papers, 4 reports, and 1 book chapter.

Figure 3 shows the research areas[1] of our literature sample. Most of the studies are related to energy, environmental science, and ecology fields of research, and only a few are related to business and economics.

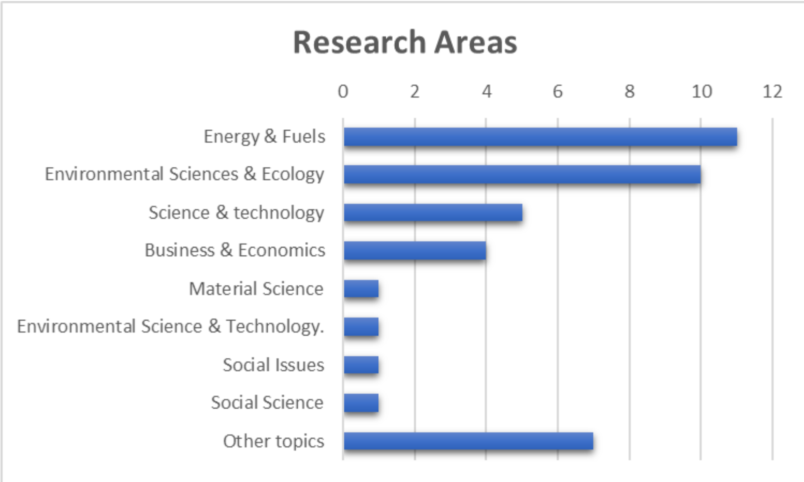


*Figure 3 n. of research works by fields of research*

20 out of 24 research works were published after 2018 (Figure 4). The increased interest in recent years is probably related to the adoption of EU directives aimed at supporting and boosting ECs, namely the Renewable Energy Directive (RED II) and the Internal Electricity Market Directive (IEMD) both published in 2019.

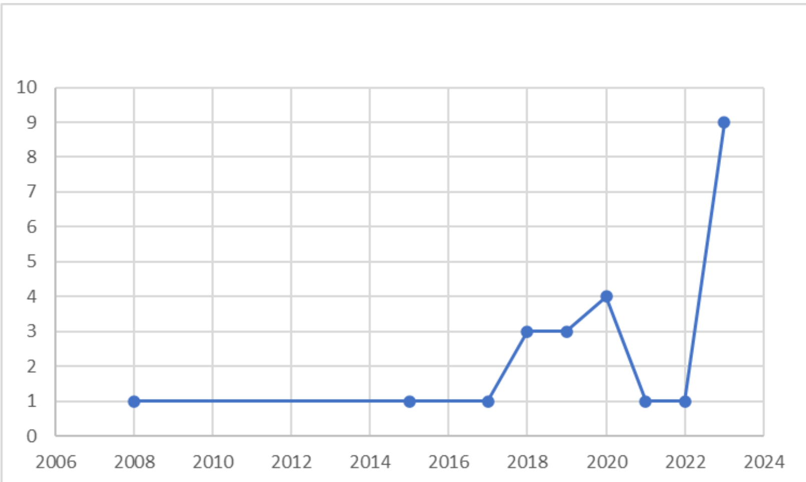


*Figure 4 n. of research works by year*

This is also supported by the geographical distribution of research works included in our sample as shown in Table 1. Most of the studies, in our dataset, have been conducted in European countries, except for two studies conducted from Australian Institutions. Italy is the country with more studies with 7 out of 20 papers. The UK follows with 5 articles. The concentration of studies in the EU is

[1] The figure shows only the journal papers (19 articles) and not the reports used in this analysis.

probably related to the rise in relevance of EC initiatives in achieving the EU climate goals set by the Clean Energy for all Europeans Package (2019) and reinforced by the Green Deal which increased the interest in studying this topic.

| Countries | Occurrences |
|---|---|
| Italy | 7 |
| UK | 5 |
| Germany | 3 |
| Australia | 2 |
| Netherlands | 2 |
| France | 2 |
| Spain | 2 |
| Portugal | 1 |
| Austria | 1 |
| Switzerland | 1 |
| Norway | 1 |
| Belgium | 1 |

*Table 1 n. of research works by countries*

# 3. Energy Community Business model analytical framework and key dimensions

In our study, we attempt to identify and analyse the key dimensions that have been used in the literature to categorise ECs, with a focus on EC BMs. The final goal is to define a new and tailor-made BM analytical framework which considers a set of dimensions to describe the peculiarities and innovation of these initiatives and support the design of innovative BMs.

In the literature, two main approaches have been used to analyse and categorise ECs and ECs BMs: deductive and inductive (Lambert, 2015; Lambert, Montemari, 2017). The first approach attempts to define *typologies* (Lambert, 2015) by using a limited number of parameters based on well-established theories or concepts. On the other hand, the second approach uses many parameters and starts from empirical observation to define *taxonomies* (Lambert, 2015; Koltunov, 2023). The two approaches have been applied by several authors and publications, leading to the thriving of different sets of ECs *typologies* and *taxonomies* based on a quite large number of dimensions used to categorize them. Our first goal is to identify, analyse and synthesise all those dimensions to find similarities or recurrent patterns that can be exploited in the definition of a new BM analytical framework for ECs.

We found 24 papers addressing our scope and we divided them into three groups, which represent three distinct methods to analyse and categorise ECs. The first group applies the deductive approach. The second group applies a mix of the deductive and inductive approaches, while the third one is characterised by the full application of the inductive approach. In detail, the first group includes research works that fully apply well-recognised BM analytical frameworks, e.g., the *Business Model Canvas (BMC)* developed by Osterwalder et al. (2005). In the second group, authors only apply some of those dimensions, such as the *Value proposition*, combined with new ones based on empirical observation of ECs, e.g., *Governance*. Finally, in the third group, the dimensions considered are not related to any well-recognized analytical framework. For instance, authors used dimensions such as *Membership* or *Network effects.*

Regarding the first categories, six papers explicitly use well-recognised BM analytical frameworks like the *BMC*. Reis, et al. (2021) define 8 archetypes of EC BMs combining the *BMC* and the *Lean Canvas Framework (LC)* as conceptual models to cluster EC BMs[2]. Similarly, Braunholtz-Speight et al. (2018) analysed the evolution of EC in the UK by using the nine-block of *BMC*. However, some other studies focused on analysing the EC BMs by using the four macro-dimensions of business model analysis, namely: *Value proposition, Value creation, Value delivery,* and *Value capture* (Mlinarič, et al., 2019; Vernay, et al., 2023; Brown, et al., 2019). Those four macro-dimensions have a similar focus to *BMC*, i.e., describing how an EC operates and generates value, but having a broader approach (Figure 5). The application of those 4 broader dimensions is linked with the innovative nature of ECs that do not follow the traditional idea of a business where products and services are generated and distributed to external customers. EC BMs' description can be favoured by looking at macro-dimensions that can better incorporate the peculiarities of those initiatives.

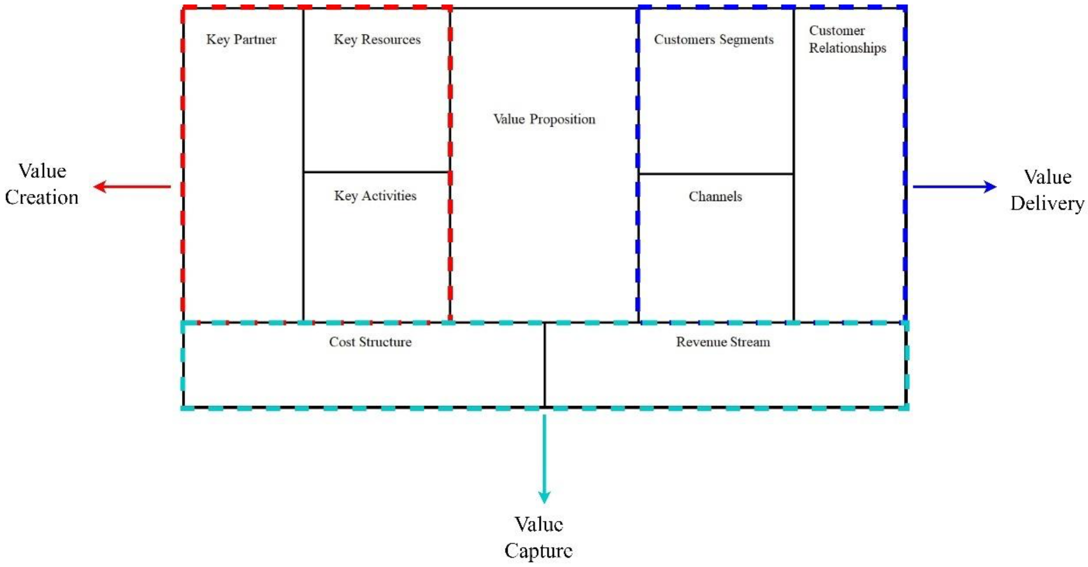


***Figure 5 Business Model Canvas and Macro-elements of Business Model Analysis***

Some other scholars have studied and categorised ECs by combining dimensions coming from BM analytical frameworks and new ones. Hansen et al. (2022) argue that the EC BMs do not operate in a vacuum, but they influence and are influenced by broader social and technical changes. Hence, apart from the *Value Proposition,* they consider *Actors* and *Technologies* as essential dimensions that affect EC BMs. The importance of different types of actors and their roles in ECs was also

[2] The eight archetypes defined by Reis et al. (2021) are the following: (i) Energy cooperatives (ii) Community prosumerism (iii) Local energy markets (iv) Community collective generation (v) Third-party-sponsored communities (vi) Community flexibility aggregation (vii) Community ESCO (viii) E-mobility cooperatives.

highlighted by Schwidtal, et al. (2023) who define nine "macro-actor" categories[3]. On the other hand, Bertolini & Morosinotto (2023) consider the *Type of energy markets* combined with the *Value Proposition, Value Capture, Value Delivery,* and *Value Creation*, to categorize the EC BMs. Nevertheless, other studies have taken into account only the *Revenue streams* as a crucial dimension for categorising EC BMs (Braunholtz-Speight, et al., 2020; Nolden et al., 2020). Finally, Roberto et al. (2023) takes into account the *Membership*, along with some dimensions belonging to *BMC*, as essential parts for the categorization of EC BMs.

The last category of research works includes studies that classify ECs without using any recognised BM analytical frameworks. Kubli & Puranik, (2023) followed an inductive approach, starting from the analysis of the unique characteristics of EC, at an empirical level, and constructed a tailored-made canvas framework that provides design options for business analysis. The authors define five characteristics of ECs that make them unique in terms of BM, namely (i) the *Outside-in perspective* meaning that EC compared to other types of business have strong social and environmental purpose and are not profit-oriented, (ii) the C*ommunity perspective* which refers to the diversity of actors and motivations (Kubli & Puranik 2023, p. 2); (iii) the *Co-benefits exploitation*, which refers to the fact that successful EC BMs exploit benefits by providing multiple services, (iv) the *Multisided platforms* which characterize businesses that operate in a two-way form rather than in a linear interaction where producers provide services to consumers who pay the corresponding economic price. In ECs, producers and consumers/prosumers interact continuously with each other, usually through an online platform. Finally, (v) the *Network effect* refers to the fact that the utility of EC members grows as the number of members or complementary services. Other scholars categorize ECs without directly addressing the scope of business analysis. Walker and Devine-Wright (2008) attempt to clarify the fluid meaning of the word "community" by considering two key dimensions that are essential for understanding all social arrangements of ECs, in particular, the *Process dimension* (who participates, manages and has influence on the EC) and the *Outcome dimension* (users and beneficiaries of the project). Dudka et al. (2023) define citizen-based ECs considering the *Social implications* and *Ownership structure*; while Moroni et al. (2019) taxonomize ECs based on the (i) *Geographical context*, as place-based and non-place-based EC, and (ii) the *Purpose of the community*, as single-purpose and multiple-purpose EC.

Based on the literature review, it is clear that there are multiple ways to categorise ECs from a BM perspective. In total, we found 33 distinct dimensions that have been used in academic literature to describe how ECs can differently work and operate. Those dimensions will be further analysed in WP6 to support the work of Task 6.3. However, not all scholars use the same terminology to refer to the same concept since they are anchored on different disciplinary backgrounds and ambitions. Thus, we found different words with the same or similar meanings, such as *Value proposition* and *Purpose of the community*. To overcome this overlapping, as well as to avoid the double counting of the same concepts, we grouped terminologies that explain the same concept under a unique dimension. In total 13 unique dimensions affecting the EC BM have been identified (Table 2).

[3] The nine categories provided by Schwidtal, et al. (2023) are the following: (i) Prosumer (ii) Pure consumer (iii) Pure generator (iv) Storage operator (v) Platform operator (vi) Aggregator (vii) Representative (viii) Retailer (ix) Grid operator.

| Dimensions | No. | Dimensions | No. |
|---|---|---|---|
| **Value proposition** | **18** | **Membership** | **12** |
| **Value capture** | **9** | Type of Market | 3 |
| Value creation | 3 | Geographical context | 5 |
| Value delivery | 4 | | |
| Business Model Canvas (BMC) | 4 | | |
| **Main Functions** | **9** | | |
| Financial characteristics | 3 | | |
| Network effects | 2 | | |
| **Governance** | **6** | | |
| Initiators | 2 | | |

*Table 2 Dimensions that have been used by different scholars to categorize EC BMs*

Regarding the *Value proposition*, we found different terms used in academic literature such as the *Purpose of the organization* (Caramizaru & Uihlein, 2020; International Renewable Energy Agency, 2020; Koltunov et al., 2023; Moroni et al., 2019), *Goals* (Gui & MacGill, 2018), *Generated benefits* (de Vidovich, et al., 2023) or *Unique value proposition* (F.G. Reis et al., 2021); yet all these terms describe what is the main objective of the EC and thus we group them under the dimension *Value proposition*. Based on Osterwalder, et al. (2005) we define the *Value proposition* as the advantages that members can have from the services provided and being part of the community. Moreover, we conceptualize *Value creation*, *Value capture* and *Value delivery* based on Osterwalder et al. (2015). Specifically, we define *Value creation* as how ECs create value and it includes activities, partners and resources to achieve it. *Value delivery* refers to the processes needed to deliver value to the members of the community. About this dimension, we add the study of Brown et al. (2019) who use the word *Customer interface* and Bertolini and Morosinotto (2023) who use the term *Partners and relations*. Finally, the *Value capture* refers to the cost structure of the EC and the revenue stream. Nonetheless, we include under this last category, papers that use different terminologies, namely, *Financial characteristics* (Bertolini, Morosinotto, 2023), *Financial model* (Brown et al., 2019; Nolden, 2020), *Energy value capture* (Kubli, Puranik, 2023), *Outcome* (Walkera, Devine-Wright, 2008) and *Value-sharing mechanism* (Kulmala et al., 2021) adopted by ECs to share the revenues among members as considered by Minuto and Lanzini (2022). We report Barabino et al. (2023) *Value-sharing mechanism* list in Table 3.

| Value sharing mechanism | Description |
|---|---|
| **Equal Distribution** | Regardless of their level of involvement or contribution, community members receive an equal share of the financial advantages. This mechanism promotes fairness and inclusivity, ensuring that everyone benefits from the initiative. |
| **Individual Contribution-Based** | Participants who generate more energy, invest in the infrastructure, or actively engage in energy-saving practices receive a proportionate share of the economic benefits. This mechanism rewards and incentivises active participation and contribution. |
| **Ownership-Based** | Participants who have invested in or maintained the infrastructure may receive a larger portion of the economic |

| | |
|---|---|
| | benefits. This mechanism acknowledges the financial commitment and responsibility of individual members. |
| **Community-Centric** | With this value-sharing mechanism, the revenues may be used to fund local initiatives, reduce energy bills for low-income households, or enhance the overall resilience of the EC's infrastructure. This benefits the EC as a whole, emphasising collective prosperity. |
| **Third-Party Reward** | In cases where third parties are involved, the value-sharing mechanism may extend to external stakeholders. They may receive a portion of the benefits in recognition of their support or investment in the community energy project. |

***Table 3 Value-sharing mechanisms***

The *BMC* indicated in Table 1 refers to the nine dimensions included in the analytical framework defined by Osterwalder et al. (2005). The dimension *Main functions* has been used by different authors (Kubli, Puranik, 2023; Rossetto et al., 2022; Roberto et al., 2023) and refers to the main activities, technologies, and services provided and used by the ECs. With this dimension, we consider different terminologies because many authors used terms interchangeably to examine the same concept. Some use the term *Key function* (Kubli, Puranik, 2023; Roberto et al., 2023), while Rossetto et al. (2022) use the term *Main function*. All those terms highlight the relevance of ECs in terms of being engaged in multiple energy services and activities (Minuto, Lanzini, 2022), e.g., energy self-production and self-consumption, energy sharing, energy supply and retail, energy storage, energy management, smart grid management, flexibility provision and demand-response optimisation, e-mobility services provision, consultancy, information and awareness raising. Nevertheless, we add other studies that focus on technologies used by ECs (Hansen et al., 2022; Bertolini, Morosinotto, 2023; Koltunov et al., 2023) since they are essential to fulfilling ECs' purpose (Kubli, Puranik, 2023). *Financial characteristics* should not be confused with the *Revenue stream* included in the *BMC*, nor with the *Value Capture*. Under the *Financial characteristics* dimension, we group papers that consider the types of funding sources used by the EC to cover the upfront costs (González et al., 2023), and studies that categorise ECs based on their total financial capital[4] (Yildiz et al., 2015). Regarding the *Network effect* we use the definition provided by Kubli and Puranik, (2023), i.e., the utility for the user depends on the number of other users or complementary products (Kubli, Puranik, 2023, p. 2-3). Concerning the concept of *Governance*, we conceptualize this dimension considering how an organization is managed and controlled (Evans, 2012), and how the participants interact with each other, also from a legal point of view. Under this term, we grouped different studies and terminologies. Caramizaru and Uihlein (2020) categorise ECs based on the extent of the EC's "autonomy" and "effective control" of strategic assets (e.g., energy generation assets). "Autonomy" refers to the capability of ECs to remain autonomous from the individual members or market actors that participate in the community. "Effective control" means that ECs can be controlled by different types of actors, citizens and small/medium-sized enterprises participating in the EC. de Vidovich et al. (2023) use the term *Recruitment and participation process* and distinguish them as "top-down" and "bottom-up" processes to understand the level of local citizen involvement in EC initiatives. Moreover, we add under the *Governance*

[4] The term capital refers to the sum of equity capital and debt capital of a company.

dimension the reports and papers that take into account the *ECs' legal forms* since it is strictly related to the governance structure. For example, ECs operating as cooperatives are usually based on the principle of "one member, one vote" while other legal forms, such as partnership, operate based on other principles like quotas/shares, and employ different types of governance. Following the categorization proposed by Caramizaru and Uihlein (2020), ECs can be set up according to different legal forms, listed and described in the following Table 4.

| Legal form | Description |
|---|---|
| **Energy cooperatives** | A cooperative is an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise. |
| **Limited partnerships** | A partnership is made up of two or more partners. The general partner oversees and runs the business while limited partners do not participate in managing the business. Thus, it does not mean one partner/member is equal to one vote. |
| **Community trusts and foundations** | It aims at enhancing high social benefits and local growth rather than focusing on revenues and member profits. Community trusts and foundations are designed to pool funds together to help fund projects in a community. Members do not need to invest in the projects directly. |
| **Housing associations** | A housing association is an organization which owns houses, and provides affordable homes and supports local communities. Usually, it is a non-profit organisation. When involved in ECs it focuses on tackling energy poverty. |
| **Non-profit customer-owned enterprises** | Non-profit customer-owned enterprises are legal structures used by communities that deal with the management of independent grid networks. |
| **Public-private partnerships** | Public-private partnerships involve collaboration between a government agency and a private-sector company that can be used to finance, build, and operate projects. In ECs, local authorities can participate in the decision-making process with citizens. |
| **Public utility company** | These utility companies are mainly run by municipalities, managing investment and services. In ECs, public utilities can work as aggregators of prosumers/consumers and energy suppliers managing energy flows and the participation of citizens. |

***Table 4 Type of EC's legal forms and description***

Whitin the *Membership* dimensions, we include the type of actors involved and the role of those actors. Nonetheless, not all scholars use the same terminology. Caramizaru and Uihlein, (2020) use the term *Participants* and refer to all types of actors, public or private; while Dudka et al. (2023) differentiate the type of actors, i.e., SMEs, municipalities, citizens, and local associations, etc. who participate in ECs and analyse the level of citizen engagement in different EC BMs.

Based on the study carried out by Pellerin et al. (2019)[5], the type of actors that can participate and collaborate with an EC can vary as reported in Table 5.

| Type | Goal |
|---|---|
| **National and sub-national public bodies** | Achieving climate objectives<br>Reducing dependency on fossil fuels<br>Increasing energy system reliability<br>Promoting the use of renewable energy<br>Awareness raising |
| **Municipalities** | Achieving climate objectives<br>Ensuring access to reliable energy services<br>Promoting local development<br>Promoting the use of renewable energy<br>Reducing dependency on fossil fuels<br>Awareness raising and citizen engagement |
| **Environmental / Energy organisations** | Gain insights into the environmental impact of energy activities/services |
| **Aggregator** | Increasing portfolio size<br>Increasing services to DSO and grid operators (es. flexibility)<br>Reducing portfolio deviations |
| **DSOs** | High-resolution grid monitoring<br>Improving grid management<br>Increasing grid reliability<br>Delaying infrastructure investment |
| **TSOs** | Improving grid management and reliability<br>Receiving balancing services at a lower cost |
| **District Heat (DH) provider/operator** | Increasing services provided by the DH network |
| **Energy supplier/retailer** | Provide the best price of energy to their customers<br>Increasing market opportunity<br>Increasing portfolio size |
| **Consumers** | Improving reliable access to energy<br>Lowering the cost of energy<br>Increasing integration of energy consumption and production at the local level<br>Economic benefits from providing energy services to the grid (demand response)<br>Increasing the involvement in creation of sustainable solutions<br>Successful and lasting adoption of new technology<br>Awareness raising |

5

| | |
|---|---|
| **Prosumers** | Increasing the integration of distributed energy<br>Increasing the P2P share of energy production at the local level and its efficiency<br>Increasing storage efficiency<br>Increasing the involvement in creation of sustainable solutions<br>Successful and lasting adoption of new technology<br>Extending battery storage lifetime |
| **ESCOs** | Increasing market opportunity<br>Increasing portfolio size<br>Increasing customer interest<br>Exploring new service-based business models<br>Better optimization tools |
| **ICT, technology and software providers** | Increasing market opportunities for technology<br>Improving investment decisions<br>Increasing the presence of new technologies for the management of local energy systems |
| **EV charging infrastructure operators** | Reducing the cost of charging for end users<br>Promoting the sale of renewable energy to end users<br>Avoiding/dealing with investment in grid upgrades |
| **EV manufacturers** | Increasing market opportunities<br>Increasing portfolio size<br>Exploring new service-based business models |
| **EV owners** | Charging vehicles at lower cost<br>Reducing time<br>Increasing the availability of charging stations |
| **Facility and house manager/operator** | Ensuring reliable energy supply to tenants<br>Promoting the use of renewable energy<br>Avoiding/dealing with investment in grid upgrades |
| **Flexibility Market Operator** | Increasing market opportunities<br>Increasing portfolio size<br>Increasing local market interactions |
| **Microgrid operator** | Increasing the share of demand covered by local renewable generation<br>Ensuring reliable energy supply to end users<br>Decreasing reliance on external electric grid<br>Reducing the cost of electricity to end users |

*Table 5 Type of actors and goals in participating or collaborating with an EC*

However, some other studies focus on the role of actors rather than the type of actors, such as Schwidtal et al. (2023), who categorize actors not based on whether they are natural persons or not but concerning their role in the energy market. Thus, the authors distinguish actors into "prosumers", "pure consumers", "storage operators", etc. (Schwidtal et al., 2023, p. 5). It should be stressed that *Membership* does not include the initiators of the EC, which are considered as a separate dimension. *Initiators* refer to different types of actors, public or private, who initiate ECs and are considered a key element in the creation and development of ECs (Ghorbani et al., 2020). The last two dimensions are the *Type of market* and the *Geographical context*. The *Type of market* has been used by different authors but does not refer to the same thing. Bertolini and Morosinotto (2023) consider three types of electric markets, namely (i) day-ahead spot market, (ii) intra-day market and (iii) balancing market. On the other hand, Schwidtal et al. (2023) refer to the local energy market and distinguish them, as a peer-to-peer market, collective or community self-consumption, and transactive energy concepts. Finally, Gonzalez et al. (2023) focus on thermal ECs and consider the demand profile, which can be residential or industrial or for productive uses. Finally, the *Geographical context* has been considered by different studies; for example, Caramizaru and Uihlein (2020) analyse EC based on the EU definition of REC and CEC in terms of geographical context. Similarly, Moroni et al., (2019) categorize EC as place-based and non-place-based.

However, not all dimensions described earlier, appear equally often in the literature. The most frequently occurring dimensions are the *Value proposition* and the *Value capture* which appear 18 times and 9 times respectively. *Membership, Key functions,* and *Governance* appear 12 times, 9 times, and 6 times, followed by *Geographical context*, which appears only 5 times.

# 4. Energy Communities Business model archetypes

According to the literature review results, we identify 5 key dimensions (table 6) that have emerged in the literature as the most used to describe how ECs can operate from a BM perspective.

| Key dimension | Description |
|---|---|
| **Value proposition** | It expresses the main objective of the community |
| **Membership** | It describes the different types and roles of EC members |
| **Main function** | It describes the key activities and services that an EC performs in order to fulfil its aims |
| **Governance** | It describes how an organization is managed and controlled, and how the participants interact with each other, also from a legal point of view. |
| **Value capture** | Refers to the value that the EC captures after providing its services to its clients/members |

***Table 6 BM analytical framework key dimensions***

These 5 dimensions constitute our BM analytical framework for defining EC BM archetypes. A BM archetype is intended as a general and theoretical (abstract) model which is representative of a set of mechanisms that can describe the differences between EC initiatives in terms of how they work, generate and capture value. Using this BM analytical framework, we can identify 4 EC BM archetypes (Figure 6). Each EC BM archetype presents a theoretical EC initiative that strongly differs from the others in all 5 dimensions considered. However, within the *Governance* dimension, we do not include the legal form since it strongly depends on national regulations that vary among countries. Thus, it is not feasible to make abstractions or standardizations on this aspect. In the dimension of *Main functions*, we also consider the type of users addressed by the EC services, i.e., external users (when the EC sells services outside the community), and EC members (Zia et al., 2020). In the Value capture dimension, we also include consideration of the Value sharing mechanism applied in each EC BM archetype according to Barabino et al. (2023) and Minuto, Lanzini (2022).

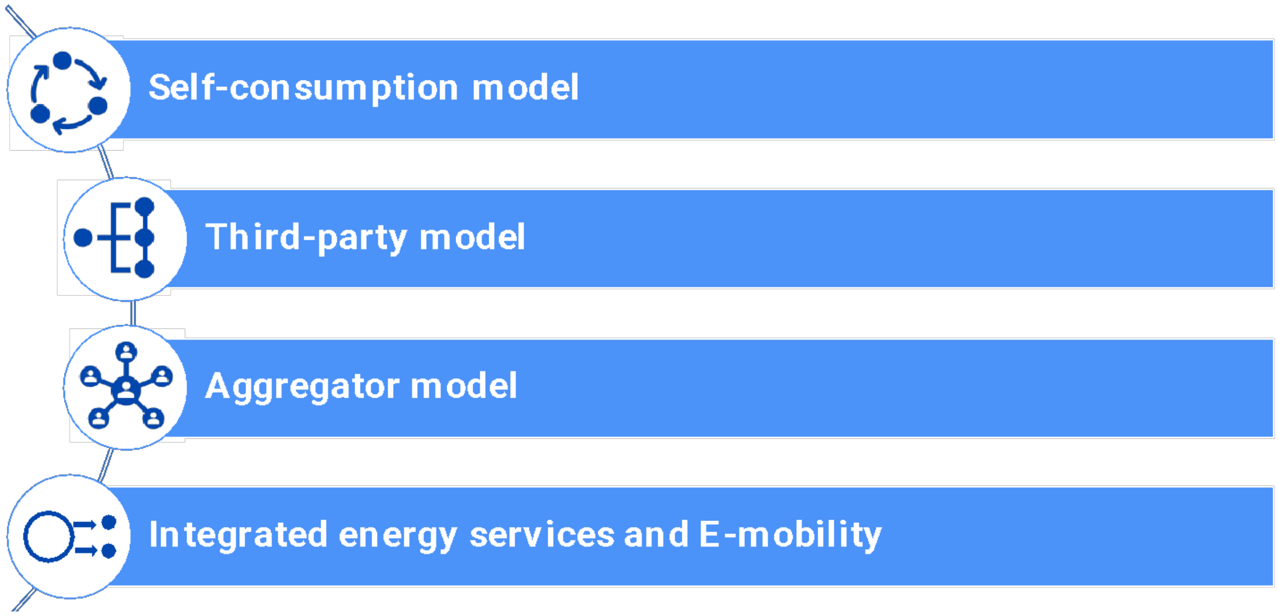


***Figure 6 Energy Community archetypes***

For each EC BM archetype, we describe how it works by considering the 5 dimensions identified in the literature. We also provide examples of case studies to better describe how the theoretical model can be applied in real cases.

## Self-consumption model

| Key dimension | Description |
|---|---|
| **Value proposition** | ● Increasing energy self-consumption by generating and consuming their energy in a collective way<br>● Reducing energy bills |
| **Membership** | *Type of EC members:* households, SMEs, local public authority<br>*Role of EC members:* collective prosumers |
| **Main function** | ● Energy generation for self-consumption (exceed energy can be fed into the grid)<br>● Grid operation (when a smart grid/District Heating-District Cooling is available)<br>● EC management<br>Services address only EC members |
| **Governance** | EC members finance, own and control the energy assets (land and generation plants, smart grids, etc.), and manage and maintain them collectively. Decisions are made by EC members (equally or based on individual quotas/shares). The EC directly interacts with the energy |

| | |
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| | supplier and grid operators (DSO/TSO) and issues the invoice/bill to members. |
| **Value capture** | ● Opt-in and opt-out fees<br>● Energy assets quotas/shares<br>● Revenues from internal energy services (EC members pay for the EC management and assets maintenance, allowing the community to compensate for its costs).<br>● Incentives for the RES fed into the grid (if available for RES production)<br>*Value sharing mechanism:* Equal Distribution or Ownership-Based when EC members differently finance and own assets |

The self-consumption EC BM is a widespread model across Europe. Although there may be different configurations under this archetype, the main goal is to reduce energy costs by increasing energy self-consumption in a collective manner. The energy community self-consumption BM strives to become as energy self-sufficient as possible in electricity or heating. This allows the EC to become more resilient to energy price fluctuation and empower members through local ownership of energy generation assets. Usually, the self-consumption BM is a citizen-led initiative, where end-users collectively create, finance, own, control and manage collectively the EC (including generation assets, the land/place where power plants are located, the local grids if available) which can take the form of a cooperative. Different types of actors, such as SMEs or local authorities, may be involved. The main functions are related to energy generation, grid operation and EC management. All services address exclusively the EC members. This model can work based on a geographical bond (members are located in proximity to the power plant) or virtually by setting an energy agreement with licenced suppliers or the DSO. This means that the place of production and the place of consumption are not connected. The decisions are made collectively by the members based on an equal mode or on individual quotas/shares (e.g., the shares of PV panels owned by each member, that usually are linked to the energy consumption need). Generally, the EC, as an entity, owns and manages the generation assets, and the funds come from the EC members (equity or debt capital) or public grants. This implies that when an EC member decides to leave the community, the generation plant remains available to the other members. However, members can also directly own the generation assets through the acquisition of individual shares. Thus, when an EC member decides to leave, its shares are sold to other members or new members (Minuto, Lanzini, 2022). The size of energy community self-consumption BM could vary, and usually consists of few members, between 50 to 200. Figure 7 depicts the main function elements of this model.

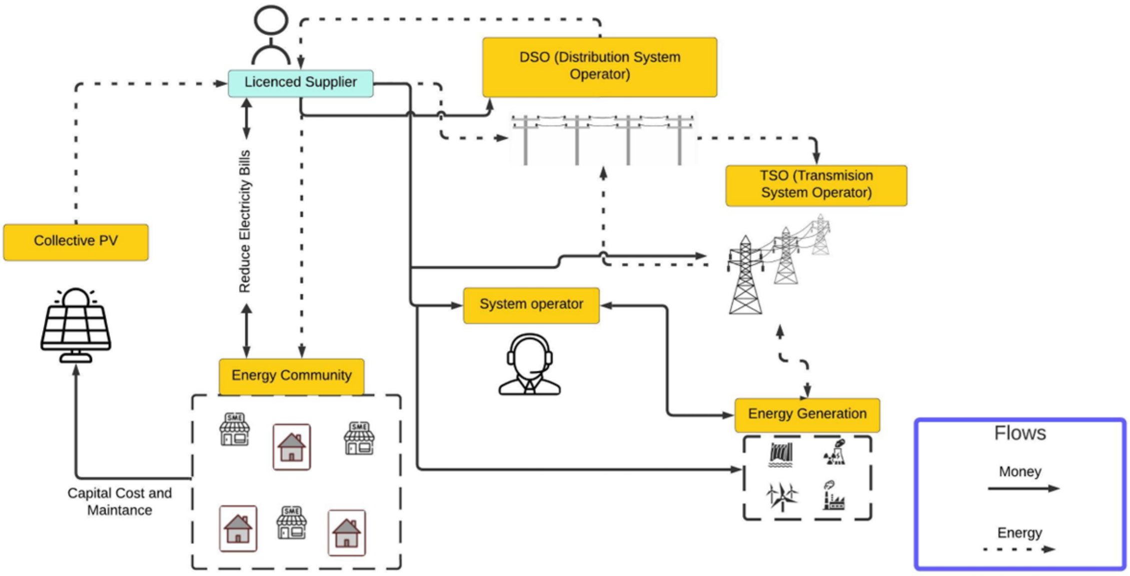


*Figure 7 Energy Community self-consumption model*

Regarding the energy value capture, this model relies on opt-in and opt-out fees, as well as monthly fees from members to cover costs such as maintenance or labour costs. However, this type of EC does not usually have paid staff and most of the time is based on volunteers, so the operational costs are low. Members benefit from the reduction in the energy bill. This model can also benefit from public incentives for the excess energy that is fed into the grid. According to De La Hoz et al. (2020), those incentives can refer to the *Feed-in-tariff (FiT)*, i.e., a fixed price, often above the market price, that is set by the national authority to incentivize the energy fed into the grid; *Feed-in-premium (FiP)*, i.e., a fixed price paid for all the generated energy instead of just the energy fed into the grid as the FiT; *Net purchase and sale*, i.e., a mechanism by which the utilities or grid companies buy the energy fed into the grid at a set price. Unlike FiT, the price is close to the average whole market price. Finally, to incentivise self-consumption, national authorities can apply a *Virtual self-consumption incentive*. Through this mechanism, the withdrawn energy is paid on a retail basis, while the self-consumed energy is incentivized at a price that is set by the national authorities, usually higher than the retail one.

A typical example of this model is the Hyperion Energy Community in Greece (Hyperion Energy Community, 2024). This EC is based on PV power plants that are not located close to the EC members. The geographical boundary is the administrative region where the EC members live and produce energy. The energy generated is injected into the grid and EC members withdraw energy from the national grid by applying a *Virtual net-metering mechanism*. This is a mechanism by which the withdrawn energy cost is reduced by the amount of energy produced and fed into the grid within a certain time frame (De La Hoz et al. 2020; Yamamoto, 2012). Each member has a specific share of the collective PV power plant based on its energy consumption pattern and pays for the energy consumed to the authorised supplier that issues the energy bill and controls and verifies the mechanism. Indeed, the energy bill can be issued by EC itself only if it is authorised and appointed as the licensed energy supplier. Figure 8 explains how a member of Hyperion EC, i.e., a household, can benefit from the self-consumption BM. The energy consumed by the household is offset against the production from the collective PV system. Therefore, the amount of energy provided by the collective PV system will be deducted from the final electricity bill. According to the Hyperion energy community, each member can reduce the energy bill by up to 70% since there are costs in electricity bills that are not related to the electricity consumption, such as cost for the grid usage, i.e., local network charges and tariffs, that are used to sustain the operational and maintenance-related costs covered by the TSO and the DSO. However, an EC that self-generates and self-consumes at the same voltage level cabin could lower the network charges (Minuto, Lanzini, 2022; European Commission, 2023).

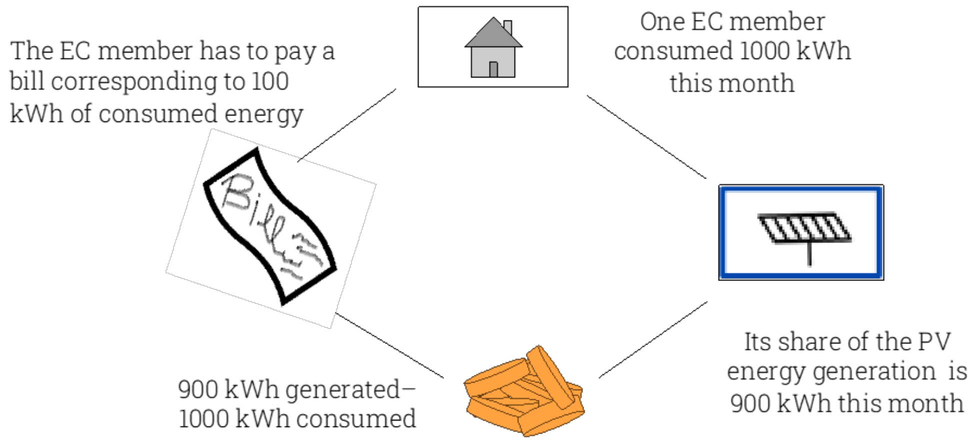


*Figure 8 Hyperion Energy Community Business Model*

## Third-party model

| Key dimension | Description |
|---|---|
| **Value proposition** | • Reducing energy costs by collectively purchasing renewable energy/leasing or renting energy generation plants provided by third parties<br>• Reducing energy consumption by implementing energy efficiency solutions (optional) |
| **Membership** | *Type of EC members*: households, local SMEs, local associations and NGOs, local public authority, facility and house manager<br>*Type of stakeholders*: Energy suppliers/retailers, Energy service company (ESCO)<br>*Role of EC members*: consumers, owners of places to locate power plants<br>*Role of stakeholders*: providers/managers of energy services and/or assets |
| **Main function** | • Optimize the purchase of energy (Energy Buying Group)<br>• Energy generation<br>• Energy efficiency solutions<br>Services address only EC members |
| **Governance** | Members do not or partially own and control the energy assets. Those can be leased or rented. Members participate in decision-making (usually |

| | |
|---|---|
| | based on an equal model). The third party is responsible for energy management, issuing energy bills and interacting with the grid operators – DSO/TSO. |
| **Value capture** | *For EC members*: Supply-side energy cost reduction (cheap energy); Energy savings from energy efficiency solutions; Reduced financial risks and responsibilities for non-technical EC members.<br>*For stakeholders*: rent/lease of energy assets; energy management fee (included in the bills); revenues from selling energy to the EC and incentives (if available for RES production quotas).<br>*Value sharing mechanism:* Equal Distribution for EC members and Third-Party Reward |

Several third parties operating in the energy sector, such as utilities, energy retailers/suppliers, or energy service companies (ESCOs), have recognized the importance and potential of ECs to enlarge their businesses. In the third-party EC BM, external stakeholders can be the promoter and the facilitator of the EC setup by providing efficiency services, energy supply, technologies (power plants, energy management tool), technical and managerial advice and competencies, financial support, or even the full financing of a project. The main value proposition of this archetype is to reduce energy costs for EC members by either collectively purchasing renewable energy (at a cheaper price), or leasing/renting energy generation assets provided by third parties. When the provision of energy and/or the rent/lease of energy generation assets is combined with energy efficiency solutions, EC members can also take advantage of reduced energy consumption. Usually, this model involves a few members and is located close to the power plants, such as households living in large building blocks, also in social housing, small municipalities, etc. EC members are all consumers, eventually owning the areas where the power plants are installed, like in the case of public authorities, local associations and NGOs or facility and house managers. The main functions of this model are related to energy purchase through the creation of an EC that acts as an Energy Buying Group; and energy generation when the EC leases or rents the energy generation assets. In this BM archetype, third parties can either maintain the ownership of the generation asset, be responsible for the project governance, or rent/lease the assets to the EC (totally or partially, based on the EC energy consumption profile). Thus, EC members do not or partially own and control the energy generation assets. Third parties cooperate with the communities in order to create tailor-made services that meet the needs of the community. Figure 9 depicts the main function elements of this model.

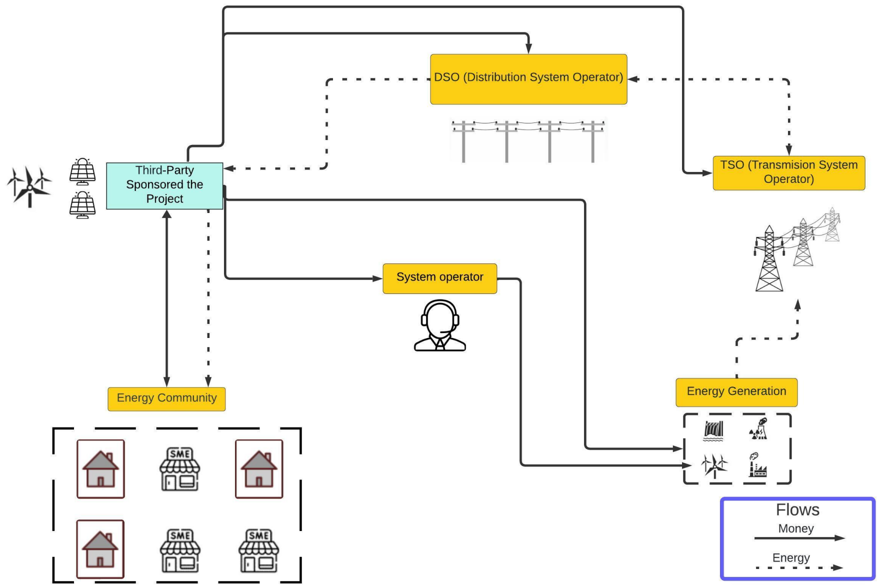


*Figure 9 Third-party EC model*

Regarding the energy value capture, it is important to distinguish the revenues/benefits for the third party and EC members. For EC members, the benefit is mainly twofold: a reduction in energy costs and energy consumption (when energy efficiency solutions are provided) and a reduction in financial risk and responsibilities for maintaining and managing the energy project. According to Minuto and Lanzini (2022), EC members can set up agreements with third parties according to three contracts. The first and most common one relies on buying energy from an energy utility at a fixed price or with time-of-use (ToU) tariffs. The second type of contract entails signing a collective purchase group contract that achieves volume discounts from the energy utility. This type is aimed at bargaining a volume discount contract with the utilities. The third type is based on a power purchase agreement (PPA). PPAs are long-term contracts (10-12 years) between energy buyers and sellers who agree to buy and sell an amount of energy which is or will be generated by a renewable asset. Third parties benefit from assuring new clients and selling them a fixed amount of energy, renting or leasing energy generation assets, providing technical and managerial advice and competencies, etc. Many times, when third parties provide integrated services, the investors/companies are remunerated through Energy Performance Contracts signed with EC members.

Several ECs in the EU fall under this BM archetype. An example is Chase Community Solar Limited, located in the UK (Chase Community Solar, 2024). In this case (Figure 10), a third party, Chase Community Solar Limited (CCS), is responsible for installing and managing PV panels, energy storage systems, and smart metering systems on the roof-tops of social residential houses owned and managed by a non-profit social housing association. Tenants, along with the social housing association and the local public authority, are the EC members. The third party, an ESCO, owns and controls all the energy assets and technologies. The smart metering systems alternate the customers' electricity supply between PV panel generation, battery storage, and the grid. EC members consume the energy generated for free since they grant freely the use of roof-tops and other shared spaces to install the PV panels and the other infrastructures (a 20-year contract between the ESCO and social housing association and the local public authority). The main goal is to assure free-of-charge RES energy to low-income families and fight energy poverty, as well as reduce upfront costs and investment risk for members. The excess energy is fed into the grid and paid back through the FiT by the supplier. Additional revenue for the ESCO comes from the provision of flexibility services to the grid operator. More information regarding Chase Community Solar can be found at the following link: HTTP://CHASESOLAR.ORG.UK/

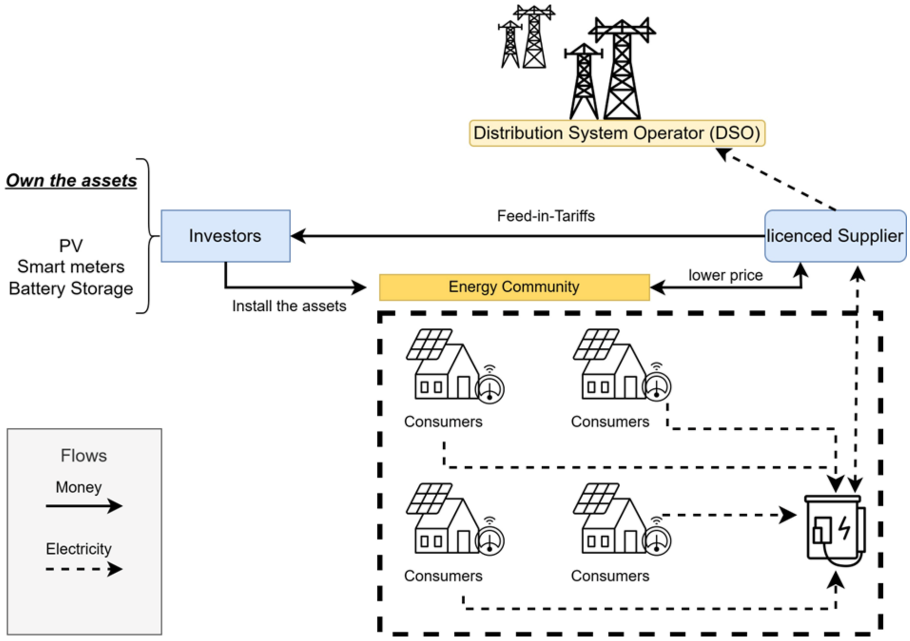


*Figure 10 Chase Community Solar Limited Business Model*

## Aggregator model

| Key dimension | Description |
|---|---|
| **Value proposition** | ● Aggregating energy production/demand and facilitating the share of self-produced energy<br>● Providing services to the grid (flexibility, balancing, etc.) |
| **Membership** | *Type of EC members*: households, SMEs, local public authorities, energy suppliers/retailers, energy managers, flexibility market operators<br>*Role of EC members*: Small and large prosumers; Consumers; Aggregator |
| **Main function** | ● Energy self-production (prosumers) and energy sharing among EC members<br>● Consumption-related services (demand-side management)<br>● Service to the grid (energy fed into the grid, flexibility)<br>Services address EC members, energy suppliers and grid operators - DSO/TSO |

| | |
|---|---|
| **Governance** | Prosumers finance, own and control the energy generation assets (power plants). Prosumers and consumers (EC members) participate in decision-making (based on individual quotas/shares) and demand-side/flexibility service provisions. The aggregator facilitates/promotes the EC and manages it, interacting with the supplier and grid operators - DSO/TSO |
| **Value capture** | ● Opt-in and opt-out fees<br>● Revenue from energy sharing (incentives, if available, for the energy shared among EC members)<br>● Revenue from service to the grid (incentives for RES production and injection into the grid, flexibility)<br>● Demand-side energy management (reducing peak consumption or shifting demand to low-tariff times)<br>*Value sharing mechanism:* Individual Contribution-Based. The revenues are shared according to the production capacity and services provided (e.g., flexibility, balancing, etc.) |

The aggregator model is based on central coordination aimed at bundling energy services (generation, share, flexibility, demand response) to a larger pool that can be managed and valorised more effectively because of its scale. The aggregated supply and demand are then pooled together in a community, where small and large prosumers provide energy to consumers, and both are involved in providing services for external actors, such as grid operators. Different services can be provided to the energy system from this model, such as energy generation, flexibility, and auxiliary services both on the supply and demand side. Usually, the aggregator provides a platform that allows coordination between various EC members on a day-to-day basis. The platform can manage energy sharing, optimise the demand-side management and facilitate the interaction between members and the TSO/DSO. The access to the flexibility market for small consumers is limited, considering the high costs and the difficulties in meeting the compulsory volume required. By pooling the available flexibility provided by multiple users, the aggregator model can achieve the volumes required to make offers in balancing, reserve and ancillary markets, thus enabling the participation of small end-users in this market. Dispatchable and non-dispatchable demand-side management programs can be implemented to exploit customers' flexibility. In dispatchable programs, members voluntarily accept that the aggregator controls their appliances during peak periods through direct load control. In non-dispatchable or price-based programs, members are exposed to dynamic pricing signals to influence their demand profile (D'Ettorre et al., 2022).
Due to the characteristics and activities performed, this model is generally made up of members who share the same interest in sharing energy and participating in the flexibility market and can be started by an aggregator which manages the EC, as confirmed by the study conducted by Plaum et al. (2022). This model can be based either on a geographical bond (members are located in proximity or connected to the same voltage level cabin) or virtual. Usually, this model exploits one or more generation plants individually owned by some EC members (prosumers). In such a case, whenever an EC prosumer member leaves the community, the EC loses the availability of power generation (Minuto, Lanzini, 2022). The aggregator or all EC members finance, own and install the storage systems and the technologies needed to monitor and optimise the energy sharing, consumption and the provision of flexibility services. The revenues come from opt-in and opt-out fees (entry-fee or annual fees), incentives for the energy shared among EC members, and energy

services provided to external actors. EC members also benefit from demand-side energy savings. Prosumers receive revenue from the energy they share with consumers and/or inject into the grid. The aggregator issues the energy bill and interacts with the supplier and grid operators - DSO/TSO. The energy bill issued considers network charges and the fee for maintaining the EC. Revenues are shared according to the member roles (consumers/prosumers), the scale of the energy production and the extra services provided.

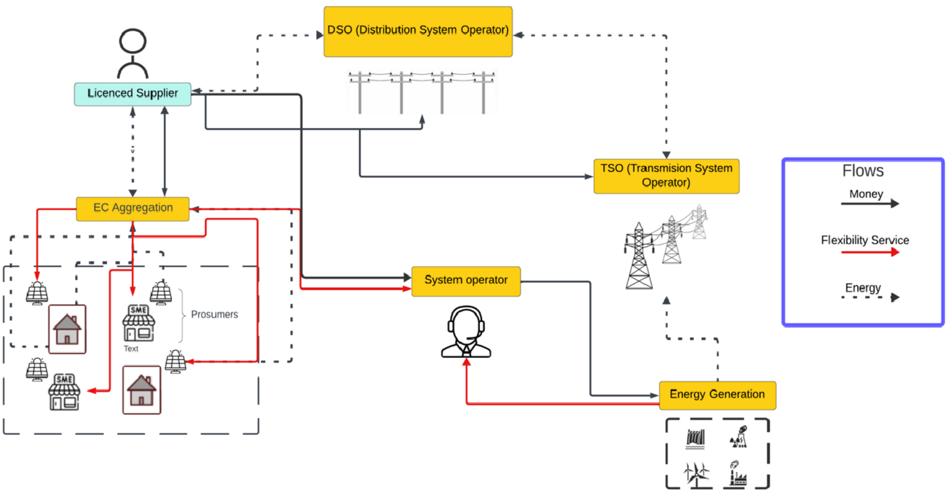


*Figure 11 Aggregator EC model*

Among the EC initiatives existing in the EU, the Unser Strom Landeck case, located in Austria, applies the aggregator BM archetype. Placed in a rural area, this case involves citizens (both consumers and prosumers) living in 4 Municipalities (Landeck, Zams, Stanz, Grins, and Pians) and connected to the same primary electricity substation (around 300 members). Prosumers (mostly local SMEs) own the PV panels and in a few cases the storage systems. The aggregator manages the EC allowing the share of energy among members, and directly interacts with energy suppliers and grid operators to inform them about energy generated, injected into the grid and shared (net-metering) among members. The aggregator provides members with all the necessary contractual arrangements to be legally part of the EC. Members receive an invoice from the aggregator every six months for the electricity they have bought and sold. In addition, members can check their consumption at any time via a web portal. For prosumers, the revenues come from the energy bills paid by consumers. The remuneration depends on the installed output of the PV system, along with a fixed price for maintenance. Through this model, smaller PV systems receive slightly higher compensation than larger PV systems (considering the higher maintenance costs they have to cover). Consumers benefit from a cheaper energy price for the energy they buy from prosumers participating in the EC. This cheaper price is also assured by a reduced network fee applied for ECs in Austria. More information is available here: HTTPS://UNSERSTROMLANDECK.AT/

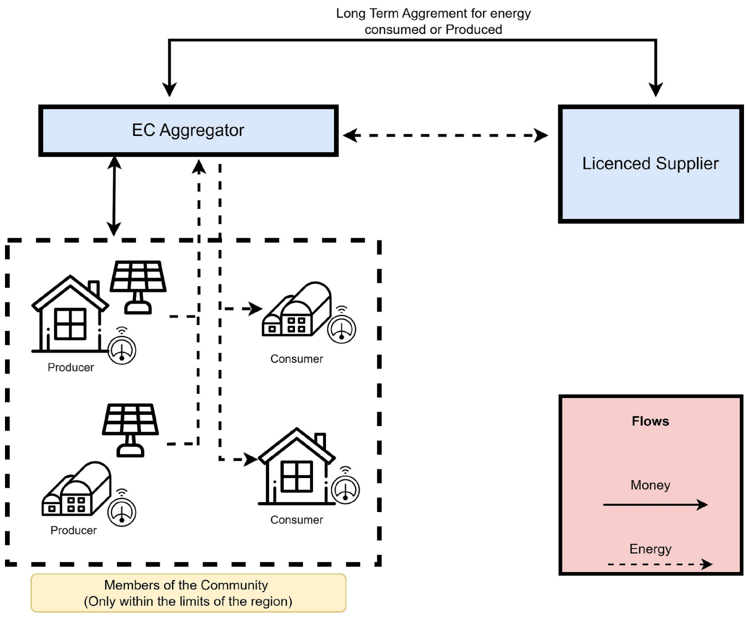


*Figure 12 Unser Strom Landeck Business Model*

## Integrated energy services and e-mobility

| Key dimension | Description |
|---|---|
| **Value proposition** | Boosting low-carbon solutions by providing integrated energy services to EC members and external customers in collaboration with external partners |
| **Membership** | *Type of EC members*: households, SMEs, local public authorities, energy managers, facility and house managers, flexibility market operators<br>*Type of partners*: Car-sharing service operators, EV charging infrastructure operators, EV manufacturers<br>*Role of EC members*: Small and large prosumers, Consumers, EV owners |
| **Main function** | *Service to members:* energy generation and sharing, demand-side management, energy storage, EV charging, car sharing<br>*Service to the grid:* energy injected into the grid, flexibility services<br>*Service to external customers*: EV charging, car-sharing, etc.<br>Services address EC members and external customers |
| **Governance** | Prosumers finance, own and control the energy generation assets (power plants). EC members finance, own and control smart grids (if any), and EV charging stations, share and lease e-vehicles (if any), and participate in decision-making (based on individual quotas/shares) and in demand-side/flexibility service provisions. The EC manages directly the services and interacts with the supplier and grid operators - DSO/TSO. The EC set long-term contracts with market operators for the provision of additional services (e.g., car-sharing platform and service management) |
| **Value capture** | • Opt-in and opt-out fees/Shares; |

| | |
|---|---|
| | ● Revenue from energy sharing (incentives, if available, for the energy shared among EC members)<br>● Revenue from service to the grid (energy fed into the grid, flexibility);<br>● Revenue from external services (EV charging, car-sharing);<br>● Demand-side energy management (reducing peak consumption or shifting demand to low-tariff times)<br>*Value sharing mechanism:* Individual Contribution-Based. The revenues are shared according to the production capacity, services provided (e.g., flexibility, balancing, car sharing provision, etc.) and shares owned by EC members. Extra revenues are reinvested in the community with a community (Centric value-sharing mechanism). |

ECs belonging to this archetype are characterised by the capacity to provide a wide range of services both to members and external customers. These types of services vary and can be related to energy production, demand-side management, e-mobility charging stations, flexibility and auxiliary services to the grid, car-pooling and car/bike-sharing services. This type of EC, due to the diversity of integrated services, usually has a variety of stakeholders, such as citizens, local public authorities, market players, and SMEs. In addition, the heterogeneity of members can be observed in terms of their roles, for example, some members may be consumers, prosumers, electrical vehicle owners, etc. Furthermore, different types of partners might also participate and be involved in this BM archetype to provide support (e.g., a digital platform for managing car-sharing). The aim is to integrate and optimise resources and services. The EC works as a company where members are shareholders and investors, service producers and consumers, while external partners provide resources in fulfilling the value proposition. EC assets are both individually owned and shared. As in the aggregator model, prosumers may own and control the energy generation assets (power plants). The energy generated is shared among EC members and used also for e-charging stations. E-cars, bikes or e-motorbikes owned by members, or acquired in leasing by the EC itself, are shared among members to allow the provision of mobility-sharing services. E-vehicles and energy storage systems are crucial to assure grid balancing and energy availability over time. EC members participate in decision-making based on individual quotas/shares. The EC manages directly the services and interacts with the supplier and grid operators - DSO/TSO and external partners by setting long-term contracts for the provision of additional services (e.g., car sharing platform and service management). Hence, a variety of possible agreements might exist in this type of EC. Some services are also provided to external customers. The energy value captured in this type of EC is related to the type and openness of services provided. Apart from the opt-in and opt-out fees and the incentives that are common to almost all ECs, possible revenues might be derived from the services provided to the grid and external customers, such as e-vehicle charging fees. Revenue and additional energy savings could be generated by energy efficiency services provided to the members by the EC. Indeed, often the profits are re-invested in the community itself to improve the energy performance of buildings, provide new services or enlarge existing ones, and fight energy poverty by allowing low-income members to access services for free.

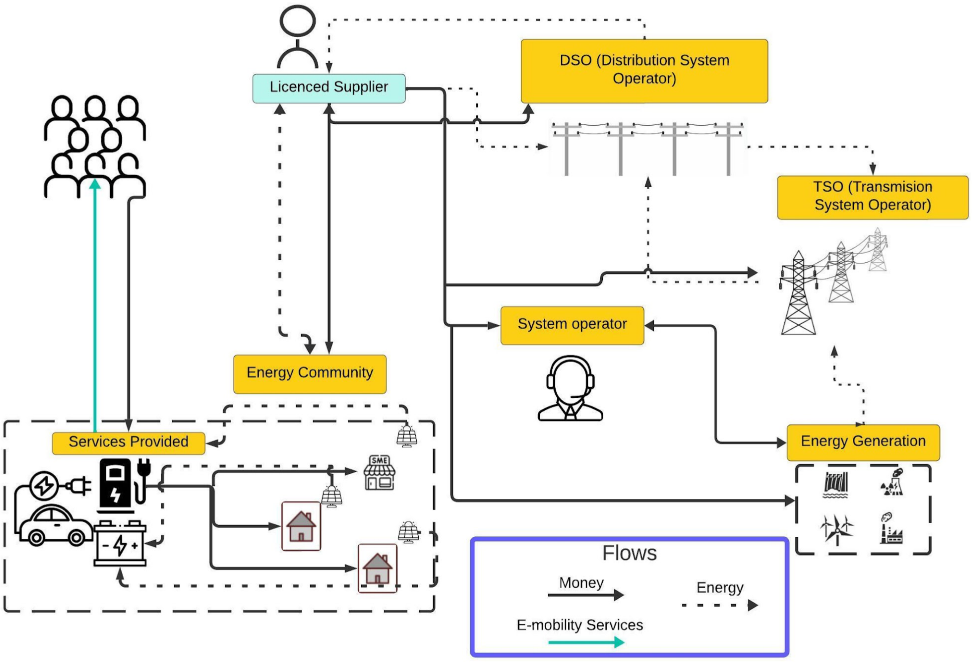


*Figure 13 Integrated energy services and E-mobility model*

An example of EC that falls under this archetype is the Neo Balenya (Balenya Sostenible Sccl) in Catalonia, Spain which is a non-profit EC with the aim to provide a variety of services such as energy production and sharing, as well as e-vehicle services in their region. Figure 14 provides the main partners and services provided by this EC as well as the interaction among the partners. Nel Balenya EC provides services both to members and external customers. The community collaborate with the municipality who provides the roof-tops for the installation of the PV systems. In addition, the EC provides e-mobility services to non-members. More information about this EC business model can be found at the following link: HTTPS://WWW.BALENYASOSTENIBLE.CAT/.

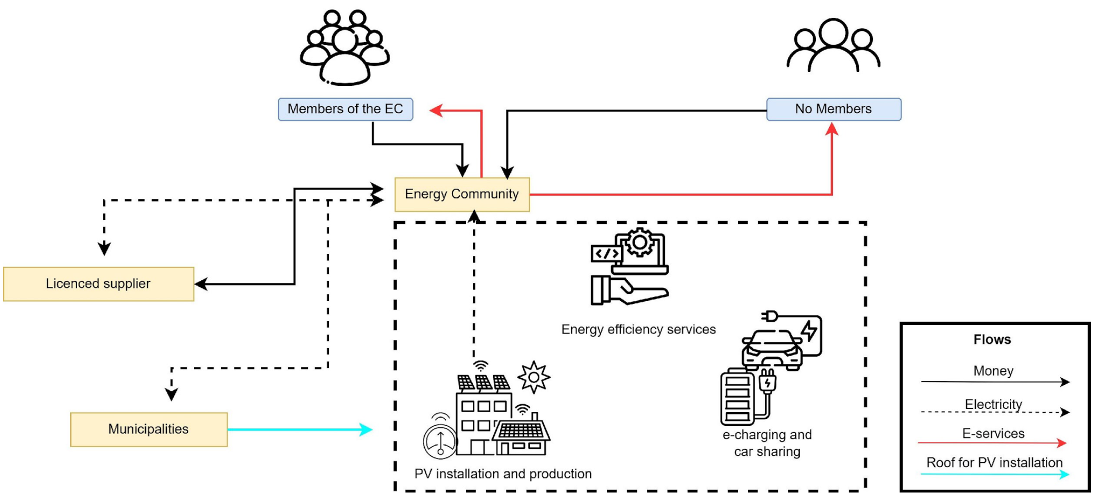


*Figure 14 Neo Balenya (Balenya Sostenible Sccl) Business Model*

# ● CONCLUSION AND NEXT RESEARCH STEPS

The BM archetypes illustrated in the previous sections represent theoretical models that EC initiatives can embody to some extent. Indeed, BM archetypes can imply many sub-categories and configurations that differ from the theoretical model in some details. However, the BM archetypes analysis is relevant to explain how ECs can work and operate in a marketplace, exploring their possibilities in terms of services provision, value capture, EC members' characteristics and engagement in the decision making and assets ownership.

The BM archetypes are defined by applying the BM analytical framework based on 5 key dimensions emerging from the literature review. It can support in better understanding different paths an EC initiative can follow. This BM analytical framework will provide a good starting point in supporting MASETRPIECE pilots and other ECs in designing or redefining their BMs. Dimensions will be further analysed and used in WP6 as part of the final multidimensional platform developed within the project. Furthermore, the BM analytical framework and the 4 archetypes constitute the main outcomes for helping pilot cases and future ECs, especially at the setting up stage or during the refinancing phase. They also might contribute to explaining the concept behind the EC and attract new members, investors and partners.

In the next research step, the BM analytical framework will be further investigated to define standardised replicable options for each driving dimension that emerged from the literature. Those replicable options will consist of building blocks that can be combined to design a complete BM providing a supporting tool to ECs. In the next step, we will use it to further analyse BM archetypes looking at sub-categories and different internal configurations. This will be applied in Task 6.3. This work will support MASTERPIECE pilot cases in BM definition/re-definition/upgrading according to their needs, maturity and ambitions. The BM analytical framework and replicable options will be applied during co-creation sections with pilot cases to define better strategies for the operation and financial phase. Pilots can select among those options to define or redefine their BMs. Both bottom-up and top-down financial strategies (from T2.1 and T3.1) will be considered with a medium and long-term horizon. Special attention will be given to social services, value-sharing mechanisms, and community engagement actions.

Those are crucial to support social planning. Social planning is the practice of strategic planning applied to addressing identified social objectives. Social planning is based on the analysis of community needs and aim at designing strategies to enhance benefits for the community. Recognised elements of social well-being include reducing energy poverty, ensuring equity in access to services and enhancing quality of life. Core areas of social planning practice include consultation and engagement with communities, and planning for community services (Miller, Richter, 2014).

Social planning relies on a set of well-recognised tools and techniques that help in designing social strategies, actions and/or services and businesses. Among those tools and techniques, there is the social needs assessment intended to figure out what people in a community need; stakeholder engagement process; SWOT analysis to look at the strengths, weaknesses, opportunities, and threats; and cost-benefit analysis to understand the costs and benefits of a proposed initiative. This helps them make decisions about where to allocate resources. Finally, the monitoring and evaluation aimed at collecting data to assess the success of a strategy, initiative, service or business.

In the next research phase, those tools and techniques will be explored and tested with pilots' managers to provide insights for better defining the EC BM and social services, analyse the impacts of their strategies and business on social aspects and increase the engagement of EC members. These actions will take advantage of outcomes produced by project partners within WP2 and WP3, especially T2.5, T3.1, T3.3 and T3.5. The next deliverable of T3.2 reporting the advanced findings on EC BM design and techniques for financial and social planning will be submitted at M30.

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