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# D2.3 | ENPOWER Business Sandbox

AUDENCIA

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# Energy Activated Citizens and Data-Driven Energy-Secure Communities for a Consumer-Centric Energy System

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| **Authors** | Georgia Giannakidou, Konstantinos Andriosopoulos (AUDENCIA) | | |
| **Quality Reviewer(s)** | Adam Hearn, Annika Sohre & Iljana Schubert (UNIBAS), Nektarios Matsagkos, Eleni Kanellou (NTUA), Andrea Gabaldon (CARTIF) | | |

# Copyright Message

# Preface

ENPOWER designs, develops, and demonstrates SSH-driven methodologies, interactive and closed-loop tools, and data-driven services for energy-activated citizens and energy-secure cross-sector communities towards a citizen-centric energy system. By combining leading-edge ICTs with social/behavioural dimensions and with sharing economy and value stacking business models the project aims to deploy: 1) a Social Science Framework for energy citizens activation and innovative multidimensional incentives for citizens' participation in energy markets; 2) AI-based consumers clustering and segmentation algorithms; 3) interactive tools and facilitation services for energy community planning; 4) Energy Data Space adaptation to support community-level data-driven activation and interoperable automated privacy and sovereignty-preserving Demand Response (DR); 5) P2P DLT/Blockchain digital marketplace for tokenised energy and non-energy assets reciprocal compensation; 6) data-driven services and apps for energy efficiency and activation performance management; 7) ICT services and Digital Twins for community-level energy optimisation and aggregated flexibility management to trade off local self-consumption against grid service provisioning, while boosting a beyond-energy community social welfare; 8) Edge monitoring hubs for automated DR; 9) Business Sandbox for novel sharing economy and social innovation-based business models; 10) methodologies for evaluating different energy community setups, upscaling and replication. ENPOWER framework will be validated along 4 Front Runners energy communities' pilots and further replicated in 2 Early Adopters, covering different levels of maturity of communities, to demonstrate increased RES local self-consumption and consumers participation to the energy markets, while nurturing increased local security of supply. ENPOWER Leadership Programme and blueprints will support EU-wide replication and advice regulatory bodies on communities-friendly enabling frameworks.

# Who we are.

| No | Participant Name | Short Name | Country | Role |
|---|---|---|---|---|
| 1 | National Technical University of Athens | NTUA | GR | Coordinator |
| 2 | Design Strategy Technology S.r.l | DST | IT | Technology providers |
| 3 | INESC TEC - Institute for Systems and Computer Engineering, Technology and Science | INESC TEC | PT | |
| 4 | Fundación CARTIF (CARTIF Technology Center) | CARTIF | ES | |
| 5 | COMSENSUS D.O.O. | COMS | SL | |
| 6 | European Dynamics Luxembourg SA | ED | LU | |
| 7 | Audencia Business School | AUDENCIA | FR | Business modelling |
| 8 | Regulatory Assistance Project | RAP | BE | Regulatory assistance |
| 9 | ICLEI Europasekretariat GmbH | ICLEI | DE | Policy & capacity |
| 10 | University of Basel *(associated partner)* | UNIBAS | CH | Social framework |
| 11 | Blueprint Energy Solutions GMBH | BLUEPRINT | AT | Pilot 1 - Austria (Front runners) |
| 12 | OurPower Energiegenossenschaft SCE | OurPower | AT | |
| 13 | Cooperativa de Desenvolvimento Sustentável, CRL | COOPERNICO | PT | Pilot 2 - Portugal (Front runners) |
| 14 | WATT-IS SA | WATT-IS | PT | |
| 15 | Cooperativa Eléctrica do Vale D'Este CRL | CEVE | PT | |
| 16 | EnC of Chalki‘Chalkion’ | ChalkiON | GR | Pilot 3 - Greece (Front runners) |
| 17 | Hellenic Association for Energy Economics | HAEE | GR | |
| 18 | Green Energy Aggregator Services SA | GEARS | GR | |
| 19 | Parity Platform P.C. | PARITY | GR | |
| 20 | Electric Power Research Institute Europe DAC | EEU | IE | Pilot 4 - Ireland (Front runners) |
| 21 | University College Cork (MaREI Centre for Energy, Climate and Marine, Environmental Research Institute) | UCC | IE | |
| 22 | DC Six Technologies Limited | DCSix | IE | |
| 23 | MOL TEIC - Dingle Hub | DINGLE HUB | IE | |
| 24 | ESB Innovation ROI Limited | ESB | IE | |
| 25 | Békéscsaba Energia ESCO Kft. | BCS | HU | Pilot 5 - Hungary (Early adopters) |
| 26 | Enasco Cleantech Alliance LLC. | ENASCO | HU | |

| | | | | |
|---|---|---|---|---|
| **27** | Montajes Eléctricos Cuerva SL | CUERVA | ES | Pilot 6 - Spain (Early adopters) |
| **28** | VERGY COMMUNITY S.L. *(affiliated partner)* | VER | ES | |

# Executive Summary

It is crucial to highlight the importance of active societal participation in the energy transition, which goes beyond public acceptance or lifestyle changes, and to emphasise the need for energy citizenship, which can promote ownership, democratisation, decentralisation, and community-based energy production. However, the current social practices, technologies, and business models are not yet mature enough to enable energy citizenship.

The main challenge is that the current business models, such as Energy Services Companies (ESCO) and supplier-based models, fail to value the active behaviour of individuals and communities. Energy communities in this report are understood as citizen –driven initiatives, legal entities based on voluntary and open participation. Natural persons, local authorities, municipalities, small and micro enterprises could potentially be members and shareholders. The last ones can participate in the whole spectrum of the supply chain from energy generation, distribution, consumption, aggregation, storage, and get involve in energy efficiency services, mobility services and energy services, depending on the scope of the Energy community (EnC).

To address the Business Models challenge, the ENPOWER project and especially Task 2.5 is proposing innovative cross-value chain and cross-energy carrier hybrid private/public sharing economy business models that can leverage on shared ownership and management of community-level assets. These models can capture and share financial, and non-financial benefits, such as carbon emission reduction, reduced energy costs, improved comfort, job creation and additional streams that occur from the use and exploitation of the digital platforms and adds from the customer-side perspective. Energy citizens have active participation in decision-making, are fully informed about the consumption patterns within the community, can act on their initiative, prioritizing not only the good of the community but also their interest (highlighting the dual identity of the energy citizens: members of an Energy Community (EnC), self-sustained individuals with personal interests).

Through the created business models, we designed and introduced new market roles in the business models to bring consumer participation to the centre stage. To reach the innovative business model concept, the role of energy citizens within the European transition era and in the Energy Communities (EnCs) must be defined first. Throughout the EU, governments are adopting a more bottom-up approach to the energy transition by gradually investing in citizen engagement across various energy projects. However, there are barriers to these attempts to increase energy democratisation related to the lack of opportunities for the public to interact with governmental actors, decreased public trust towards public authorities, energy literacy, and the use of technically limiting language that is beyond the knowhow of average citizens and limiting accessibility. The integration and utilisation of ENPOWER's innovative technologies as described in D2.1 "ENPOWER Gap analysis and use case capitalisation towards a consumer-centric energy system", boost active societal participation in the energy sector, promote transparency, accountability, and inclusivity in decision-making processes, foster innovation and creativity, empowering individuals to contribute to a more sustainable and resilient energy system (key insights are given in D2.2 "Active societal

participation, emergence and consolidation factors of energy activated citizens and data-driven energy-secure communities").

This Report has collected and identified each pilot Energy community (EnC)'s key resources, partners, activities, channels, cost structure, revenue sources and the involved stakeholders by using the Business Model Canvas (BMC) tool. Afterward, we used the theoretical framework for analysing and understanding energy communities' business models developed by Reis et al. (2021) which sets eight business model archetypes for energy communities. These archetypes were used as a useful framework and as sandboxes to develop best practices and new types of business models. Then, we matched our pilot cases with one or more of the aforementioned archetypes, and based on this pairing, we analysed the energy, money, and data flow. Finally, we added and designed the "citizens 'engagement flows" resulting from the use of the technical enablers (TEs) in each of the pilot communities and recorded the power these enablers give to the energy citizen during the decision-making process, the range of participation of the latter and finally the level of community interaction with the involved actors as it results from the use of the same technologies.

The differentiating factor and the innovation of ENPOWER's business models (BMs) is the new added value proposition that arises from the activity and the level of citizens' participation within the pilot Energy Communities (EnCs). The models foster a diverse and more inclusive ecosystem, involving a range of stakeholders but targeting the unique needs of individual energy consumers in the six (6) pilot cases.

In the last part of the Deliverable, the components of energy citizenship were scattered down, and a barometer of citizenship participation was created, depicting from more individualistic forms of participation to collective and fully representative forms of participation. Then Technical Enablers (TEs) were tested on how they match and feed on or more components of the barometer, based on the power and the freedom of choice and action they give to the energy citizens.

The ENPOWER business models, put forward in this deliverable, were developed through bilateral discussions with all six ENPOWER pilot case studies comprehending their needs, and perceptions. In addition, data collected through questionnaires provided further details of the pilot cases. In addition, we build on the analysis and results of Deliverable 2.1 "Gap analysis and use case capitalisation towards a consumer-centric energy system" in WP2 to ensure that the technical enablers (TEs) have been recruited and processed in the best possible way during their integration into the pilot's business model  Finally, and to capitalise on similar activities, we provide details of a literature review, consisting of scientific and grey literature to integrate and validate our findings.

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# List of acronyms

| | |
|---|---|
| **AI** | Artificial Intelligence (AI) |
| **BM** | Business Model |
| **BMC** | Business Model Canvas |
| **CEC** | Citizen Energy Communities |
| **DSO** | Distribution System Operator |
| **EC** | European Commission |
| **EnC** | Energy Community |
| **ESCO** | Energy Services Companies |
| **EV** | Electric Vehicle |
| **GA** | General Assembly |
| **ICT** | Information and Communication Technologies |
| **IoT** | Internet of Things |
| **LEM** | Local Energy Market |
| **MB** | Management Board |
| **MO** | Market Operator |
| **PV** | Photovoltaics |
| **PPA** | Powe Purchase Agreements |
| **P2P** | Peer-to-peer |
| **REC** | Renewable Energy Communities |
| **RES** | Renewable Energy Sources |
| **SM** | Scientific Manager |
| **TM** | Technical Manager |
| **TAB** | Transdisciplinary Advisory Board |
| **TC** | Technical Committee |
| **TE** | Technical Enablers |
| **TL** | Task Leader |
| **TSO** | Transmission System Operator |
| **DCS** | Dissemination and Communication Secretariat |
| **ToC** | Table of Contents |
| **V2G** | Vehicle-to-Grid |
| **WPL** | Work Package Leader |
| **WP** | Work Package |

# 1. Introduction

## 1.1 Overview

In 2019 the "Clean energy for all Europeans package" was introduced, to decarbonise the EU's energy system, by moving away from fossil fuels towards forms of clean energy (Clean energy for all Europeans package[1]) and finally achieving a carbon neutral (net-zero emissions) by 2050. The directive 2019/944 [2], created shared rules for aspects as generation, transmission, distribution, energy storage, and supply of electricity within the EU, aiming to create an integrated and consumer-centric and more sustainable electricity market, giving emphasis on customer rights and adaptation.

An energy community (EnC), as defined by the European Commission, is a "Citizen-driven energy actions that contribute to the clean energy transition, advancing energy efficiency within local communities" (Energy Communities[3]). These communities, to support the clean energy transition, enable collective and citizen-driven energy actions. Such actions can contribute to increasing public acceptance of renewable energy projects and attract private investments for the clean energy transition (Roberto & Ferruzzi & Negro & Noussan, 2023).

Members of the EnCs can directly benefit from them by having lower energy bills, lower energy poverty, and being more energy efficient while also benefiting from job opportunities in the green energy sector (Roberto & Ferruzzi & Negro & Noussan, 2023). At the same time prosumers-active consumers of the EnC, can participate in all markets whether it is energy generation, consumption, energy sharing and selling energy, or even providing flexibility assets and services through DR, storage, and V2G solutions.

EnCs under the EU's laws can take the form of a legal entity, as an association, a cooperative, a partnership, a limited liability company and even a non-profit organisation (Energy Communities[4]). It is made easier for EnC's citizens, in cooperation with other market participants, to jointly invest in energy assets for decarbonisation, grid flexibility, etc. (General Information[5]).

**Table 1: Main impact categories of Energy Communities (EnCs) (Roberto & Ferruzzi & Negro & Noussan, 2023).**

| Social | Environmental | Economic |
|---|---|---|
| energy justice | resource consumption | reduced costs |
| energy democracy | GHGs emissions | local jobs |
| community and empowerment | pollutant/harmful emissions and impacts | revenues |
| social capital | local RES | opportunities for companies |

[1] https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019L0944
[3] https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en
[4] https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en
[5] https://energy-communities-repository.ec.europa.eu/energy-communities-repository-energy-communities/energy-communities-repository-general-information_en

| | | |
|---|---|---|
| social cohesion | resource efficiency | affordable energy costs |
| social wellbeing | responsible use of resources | invest in local generation |
| health and safety | environmental wellbeing | cost- effectiveness |

By legal definition, EnCs are split into two categories, Citizen Energy Communities (CEC) and Renewable Energy Communities (REC). A CEC is a legal entity based on voluntary and open participation, controlled by members and shareholders, they could be natural persons, local authorities, municipalities, small and micro enterprises. The primary drive of a CEC is to support environmental, economic, or social community benefits for its members. A CEC can be engaged in energy generation, distribution, supply, consumption, aggregation, storage, energy efficiency services, mobility services and energy services in general for its members and shareholders.

On the other hand, a REC is a legal entity, following the applicable national law. It is based on voluntary participation, autonomous, while it is controlled by members and /or shareholders that are located within the proximity of the renewable energy projects owned and developed by the legal entity. The members and shareholders can be natural persons, local authorities, municipalities or SMEs. A CEC and a REC share the same primary drive. A REC can engage in activities based on RES (energy generation included), supply, aggregation, energy efficiency, self-consumption, energy sharing, mobility services, and heating & cooling.

To be able to widespread energy communities, customised business models need to be developed and used. Current BMs for EnCs can capture multidimensional flows of energy and money between the involved actors and identify potential sources of benefits and revenues for the community. However, the majority of the BMs for EnCs cannot count the impact of the last ones on the socio-economic and technical environment/system where they operate, since they usually represent the way, the value is created and captured within the community, and how this value returns back and benefit the community itself (self-indulgent). What the existing BMs are missing is the added value, the value proposition that is occurring from the involved citizens not only as community members but as self-imposed individuals with separate needs, acting for their interest.

That is exactly the problem statement of D2.3: We believe that the citizen's involvement as a decision-maker within the EnCs and the identification of their level of participation is an untapped area. The current BMs, fail to value the active behaviour of individuals as unprompted actors and to quantify/count the added value that arises from their actions within the community framework.

Thus, in the Report, energy citizens are approached with a dual identity: both as a collective concept (community members), as well as individuals. Digital, innovative technologies can enable and facilitate the individual's transition from passive energy consumers to active energy citizens (participating in all energy processes), empowering in that way the concept of energy citizenship and energy democratisation.

When studying EnC challenges within the EU's legal and regulatory framework, it occurs that citizens' participation in community activities and the level of their engagement in new electricity market designs, examined in D2.1, are the main challenges to widespread EnCs. Addressing the citizen participation in the energy sector and making the members of the EnC rather involved in community activities and the optimisation of the locally produced energy consumption, storage, or any other flexibility and energy efficiency services would strengthen not only the concept of a collective energy

community but would elbow in the bloom of new value streams. To enable and facilitate citizen involvement activities in the setting of the ENPOWER project, eighteen (18) technical enablers are used, developed and applied in specific pilot sites.

**Table 2: List of Technical Enablers as analysed and presented in D2.1.**

| TE # | TE Description | Partner |
|---|---|---|
| **TE-1** | Interactive decision support tool for EnC planning | CARTIF, INESC TEC |
| **TE-2** | SITEC-Sizing tool for EnCs | INESC TEC |
| **TE-3** | CRP social engagement management platform | DCsix, EPRI |
| **TE-4** | Energy Data Space compliant tools for sovereign data management, sematic interoperability and exploitation | ED, DST |
| **TE-5** | DLT/Blockchain/smart contracts multi-purpose marketplace for increased Trust & Sovereignty and for P2P tokenised assets sharing and compensation | DST |
| **TE-6** | Digital Twins for consumer activation | INESC TEC, DST |
| **TE-7** | Consumers clustering and segmentation tools | NTUA, UNIBAS |
| **TE-8** | FATEC - Flexibility Assessment tool for EnCs | INESC TEC |
| **TE-9** | Self-consumption optimisation tool | NTUA, GEARS |
| **TE-10** | Closed-loop optimal load control and intelligent monitoring of electric appliances for residential users | NTUA, COMS |
| **TE-11** | V2G-based flexibility management platform for providing incentives to communities of EV drivers | PARITY |
| **TE-12** | OSTEC-Optimised Scheduling Tool for EnCs | INESC TEC |
| **TE-13** | AI-Powered Virtual Energy Manager (WIS4Households) | WATT-IS |
| **TE-14** | Nudging Apps for near real time closed loop consumers activation | OurPower, BLUEPRINT |
| **TE-15** | Blockchain-based hybrid coalition-based flexibility aggregation tool | DST, COMS |
| **TE-16** | P2P digital tools and platforms for consumer activation and social engagement | OurPower, BLUEPRINT |
| **TE-17** | P2P energy markets designs and algorithms | INESC TEC |
| **TE-18** | Privacy preserving tools for automated interoperable DR | EPRI, DCSix, MaREI, COMS |

To conclude, in Task 2.5 we developed easy-to-adopt innovative consumer-centric models, engaging different actors of the energy value chain with different characteristics, and new market concepts, and applying/evaluating them through practical application within the ENPOWER pilots. Different BBMs capture, propagate, illustrate and share the flows of energy, payments, flexibility services, system balancing and non-financial segments (e.g. environmental, social cohesion, job creation, improved efficiency of business activities), through the development of multi-component diagrams, showing the way that each pilot project works and facilitating the optimisation of BMs will be the interactive engagement of the energy citizens during the decision-making process of each BM through semi-structured questionnaires/ interviews to explore their emerging effect with the involved parties. The results of each case will be tested and disseminated to each pilot project energy community (EnC).

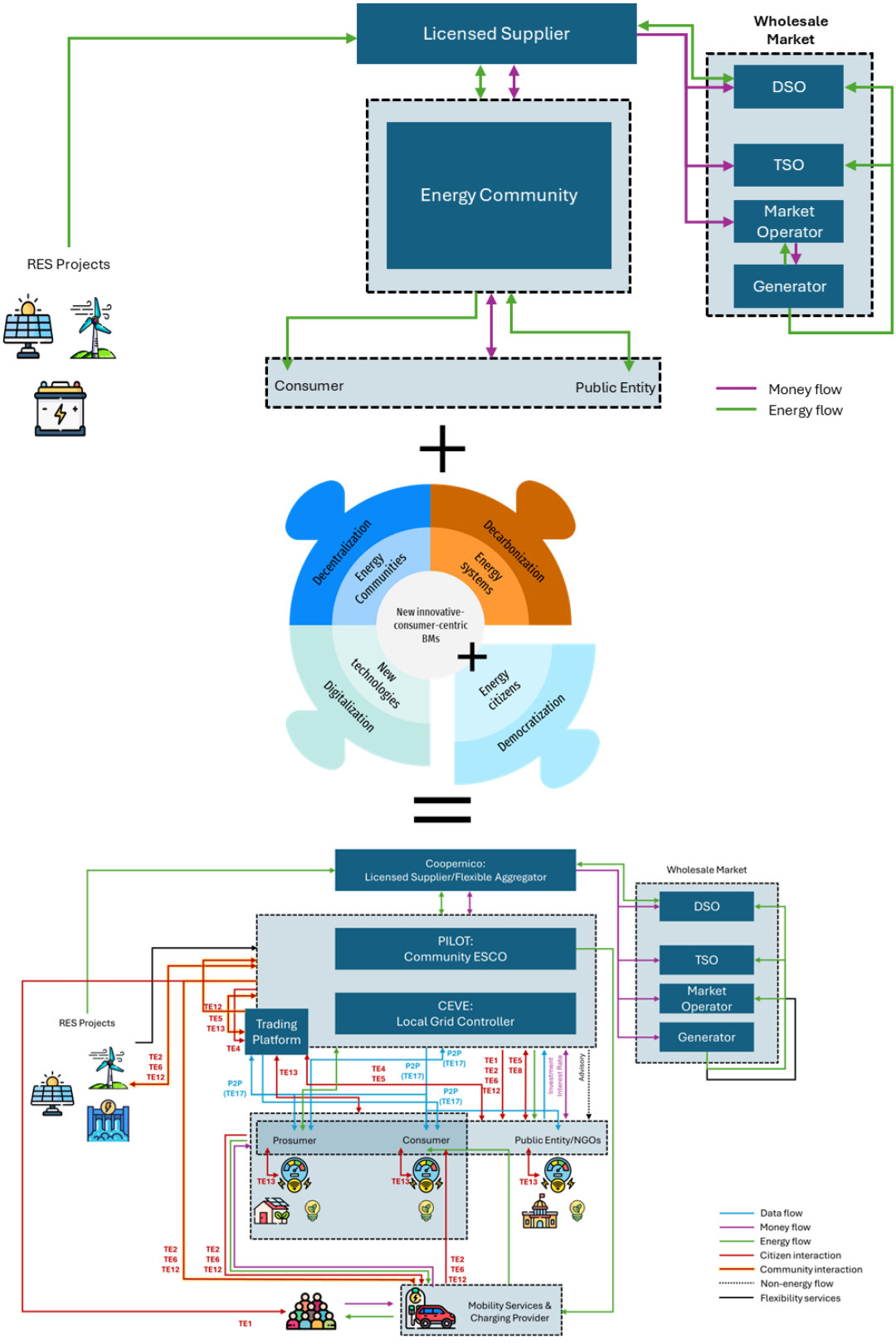


**Figure 1: Traditional BM combined with innovation of Democratisation.**

## 1.2 Role and Structure of the Document

The deliverable is based on a mixed-methods approach to develop BM for each of ENPOWER's six (6) pilot cases, with primary sources of information as follows:

- Extended discussions with partners involved in the development of each pilot case, to establish a baseline understanding of them, and explore stakeholders' vision and mission.
- Open-ended questionnaire filled by partners involved in the development of each pilot case (the most important primary data source).
- ENPOWER other documentation, and more specifically D2.1 "ENPOWER Gap analysis and use case capitalisation towards a consumer-centric energy system", which contributed to researchers' assumptions and helped them to reflect on and validate their results.

The research also benefited from exchanges between consortium partners, through WP2 meetings and regular discussions in the Plenary Meetings that strengthened our understanding and kept us updated on the pilot cases.

The data analysis was based on:

- Identification of main actors/entities, mapping of the leading-technology involvement and the resource flows of each pilot case.
- Application of the standard "BM Canvas" model to the pilot cases.
- Identification of value created and captured as depicted through the BMC.
- Narrative analysis of the pilot case communities to identify opportunities and restrictions and to understand actors' motivations and their specific roles.
- Systematic review of the concept of innovative EnCs BMs to clarify what they mean conceptually and practically and how they can be utilised.
- Identification of new flows of energy, money and knowledge between the involved in each case actors and design of new multidisciplinary relationships.
- Analysis of community participation in the emergence and operation of BMs to understand when and how community members and individual energy citizens may be involved in the different archetypes of ECs, within the wider context of energy democratisation.

This deliverable is structured as follows. Chapter 1 familiarises readers with the key concepts and key terms that set the ground to our research. The concept of energy citizens, their role within EnCs and the concept of democratisation, and the design and obsolete of BMs, BMC and diagram archetypes are presented in this chapter.
In chapter 2 different BMs for ENPOWER six pilot EnCs are being designed and developed with the use of BMC. Then the operation and the value propositions of the six BMs are analysed. The models are re-ordered and re-design by adding the flows and interconnections arising from energy citizens' involvement in the decision-making processes and the operational procedures within the community, as a result of the use of innovative technologies, which appear in ENPOWER as project's TEs. Finally, the type and the range of participation that TEs unlock is analyzed with the use of the "citizenship participatory barometer" (Figure 2).
Chapter 4 consists of our research conclusion, that identifies the key findings of Deliverable, identifies research gaps worth exploring deeper and presents an early outline of the next actions to follow under Task 2.5.

# 2. State-of-art business models in energy communities

## 2.1 The role of Energy Citizens in the European transition era

By now, it has become clear that the EU is working on raising the region's climate ambition, as well as energy security, through becoming energy independent. The proposed actions from the Green Deal [6] and REPowerEU [7] directives are expected to support the transformation of the current European energy system, through investments in practical and innovative technologies, as well as through community engagement. The concept of placing the community at the centre of the Energy Transition is also something that has been discussed, especially in the EU's Energy Union policy[8]. In such a scenario, citizens are encouraged to take ownership of the transition, whilst benefiting from the added value that they may receive via implementing new technologies. It is considered that this practice will especially support vulnerable energy consumers, who will be able to significantly reduce their energy expenses.

The ideas of prosumerism (i.e. energy producers and consumers) and ECs, are considered to be the next step in the energy transition plan, where citizens are essentially given a bigger role than before. The sense of ownership that citizens will develop is expected to drive changes in the energy system, which will alter the supply-demand dynamics of the EU energy landscape. However, mass adaptation of what translates to "energy citizenship" can be achieved only through gradual transitions that also take into consideration the social and political needs of the community (including behavioural nudging), and not simply the technological and financial aspects.

As such, we can conclude that the core of "energy citizenship" is the collective approach, where community members engage with energy transition from all different perspectives mentioned. According to Campos & Marín-González (2020), "energy citizenship can be broadly defined as "a view of the public that emphasises awareness of responsibility for climate change, equity and justice (...), and the potential for (collective) energy actions."

Of course, the definition of "energy citizenship" can be harmonious with a variety of market trends and behavioural patterns. Once again, the concept of prosumerism and the implementation of smart technologies in residents and businesses is one of these trends, followed by the evolution of mainstream lifestyle characteristics and the collective approach to the energy transition as a whole (e.g. the formation of ECs, co-operatives, etc.). Naturally, the political engagement of citizens also works as a catalyst for the accelerated adoption of the "energy citizen" mindset. Some of the ways citizens can influence policymakers, for example, are through policy co-design initiatives, public consultations, etc.

Reaching the European climate goals for 2050, requires immediate action, however it is imperative to mention that the development of energy modelling tools is essential for accurate analysis of the key drivers and barriers for the different milestones, related to decarbonization, cross-tech large-scale RES deployment and energy decentralization, among others. Thus, acquiring a deep

[6] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[7] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en
[8] https://www.europarl.europa.eu/factsheets/en/sheet/68/politica-energetica-principios-gerais

understanding of the behavioural impacts and implications due to the alteration of established market designs of the energy sector, across levels (Tsopelas & Stavrakas & Flamos, 2022).

## 2.2 The role of Energy Citizens within Energy Communities and the concept of Energy Democratisation

The need for more decentralized energy systems, and the shift away from passive energy consumers to active energy citizens participating in all energy processes (production, consumption, trading), led to the concept of energy democratization (Coy & Malekpour & Saeri & Dargaville, 2021).

Discussions about energy and energy policy emphasised the technical and economic parameters (Devine-Right, 2007), whereas democratic, fair and inclusive governance has not historically been discussed in depth. The integration of "energy democracy" and "energy citizenship" illustrates this exact shift (Palm, 2021).

Energy citizens are becoming actively involved in the energy transition and engaging politically, either as consumers and users by participating in protest and support movements, and as prosumers (Campos & Gonzalez, 2020). The concept of energy citizens can also be described as “people’s belief that they as individuals and as collectives have rights and responsibilities for a just and sustainable energy transition, and their motivation to act upon those rights and responsibilities” (Hamann et al., 2023). Citizen participation is often described in literature as a personal journey from passive consumption to engaging with energy more meaningfully in everyday life, through which energy literacy and individual consciousness should evolve (Massey & Verma & Khadem, 2018).

Moving a step forward of the individualistic perception of energy citizens, the last ones can be further perceived and defined within cooperatives to emphasise the dominance of their role as the link between individuals and collective/collegiate bodies, which overrides their individual will: “Energy citizens as active participants in the energy system, who can: feel positive and excited about new energy technologies rather than apathetic and disinterested; be aware rather than ignorant of the scale of its potential impacts on political institutions, the environment, and everyday lifestyles; and be willing to engage not just as individuals but as collectives in shaping technological change at local, regional, and national levels” (Devine-Wright, 2007).

According to Children and Longhurst (2016), EnC must be understood more constructively beyond deliberative-individualist or citizen-consumer dichotomies, including the complicated relationship between people and energy technologies as well as the different roles individuals can assimilate into themselves as energy producers, consumers, prosumers, supporters, and protesters. Under the broader umbrella of energy democracy, these relational roles also entail citizen positioning. Guided by this perspective, it is important to state that the term “consumer-centric” will not be used in this research in a sterile way in the sense of a passive observer and consumer of energy but instead will be used somewhat identically with the notion of an active energy citizen.

“Energy democracy refers to an emergent social movement that re-imagines energy consumers as ‘prosumers’ or innovators, designers, and analysts who are involved in decisions at every stage of this sector, from production through use” (Williams & Sovacool, 2020), while the term is also met in the literature as “a novel concept and emergent social movement that connects energy infrastructural change with the possibilities for deep political, economic and social change” (Rogers & Simmons & Convery & Weatherall, 2008).

Energy democracy definitions are distinctive for emphasising the institutionalization of more participatory forms of energy provision and governance structure, such as communal and civic ownership of power plants and grids (Becker & Naumann, 2017). Energy democracy is the goal of redistributing economic and decision-making power by empowering citizens to become recipients, stakeholders, and account holders across the entire energy industry (Pidgeon & Demskia & Butler & Parkhill & Spence, 2014).

Therefore, it is understandable that the "participation" in governmental procedures, its intensity and frequency by the citizens is the differentiating factor between the two concepts. These range from more intense and representative forms of participation to local cooperative ownership and consumer forms of participation.


**Figure 2: Different levels of citizen participation (Lennon & Herrejon & Dunphy, 2022).**

Citizens may decide or be encouraged to strengthen their participatory role in the energy transition, both as individuals but also as members of collective bodies. Thus, they could get involved in energy policy outcomes, supporting energy democracy procedures, by participating in decision-making initiatives through public consultation and energy design planning projects at local, regional and national levels. Another mechanism for citizens to play a greater role in shaping energy policy is the increased asset ownership within the communities, at the local level and the enhancement of "consumer's choice". Strengthening consumer choices means that consumers can have the ability to either increase their involvement in energy purchase and trading decisions, by taking control over t energy demand levels and deciding upon when and where they want to sell and store their self-produced electricity or participating as equals with other energy actors such as energy companies in the energy markets.

Energy citizenship and energy democracy contribute to the new conceptualisation of what these terms mean, how they can contribute to the era of the rapid, fair and inclusive energy transition and to what extent they can contribute to the formation of new innovative and consumer-centric BMs (Skjolsvold & Coenen, 2021). The two terms exist in parallel and often co-opt each other.

## 2.3 Key barriers to individual citizen engagement

Over the last few years, citizens' engagement has been a priority for governments while moving forward in the energy transition era. Citizens should be empowered to actively engage in more decentralized and multi-actor energy production systems by optimizing their energy behaviours in their daily lives, adopting zero or lower carbon transportation and heating options, participating in DR and energy trading activities (P2P trading), investing in energy-efficient and self-efficient technologies, and engaging in local energy initiatives. Some of the key barriers to citizen engagement in a sustainable energy transition have been identified as follows:

- Self-motivation is rarely a characteristic of citizens especially when they don't have specific perceptions or incentives to engage with societal energy decisions.
- There are no fora or opportunities for effective communication between governments and citizens (communication gap). Generally, people hesitate to take part in public/open discussions with local authorities or with local, regional, or national governments.
- Despite efforts to assimilate and adopt new and innovative technologies, there is a lack of public trust in them or in the platforms/apps through which they operate.
- Citizens engagement and their civic participation are rarely prioritized as a core policy by governments and other authorities or organizations with action in the public sphere.
- Energy illiteracy prevents citizens from getting involved in local, city or national-level discussions, particularly on technical topics, such as energy technology.
- There is no single path nor a set model or structure for citizens' or community engagement. Neither is there a platform for sharing experiences and success stories. Thus, individuals may believe that they are unable to engage or engage further due to a lack of preliminary information.
- There is usually a lot of technical information that stands in the way of the average citizen getting access to the information. Less emphasis is placed on social benefits, and they are not explained in a way that provides a clear and comprehensive understanding. This can lead to a lack of trust in the government's intentions.
- Community engagement is often not specifically funded by organizations. Energy-based projects are often not encouraged nor empowered by local government or other local organizations.
- Citizens are not sufficiently informed at the local level because there is not enough capacity building on energy behaviour patterns or the effective and efficient use of energy technologies (Massey & Verma & Khadem, 2018).

However, despite the bottom-up approach that is used in the Report, it is worth mentioning that according to PEN (Public Engagement Network) Strategy[9], four levels of engagement are necessary to achieve the "active and fully engaged energy citizen concept". The engagement concept is shown by four concentric circles (Figure 3). In the core of this structure, we find the individual energy citizens, who have autonomy of movements, thinking and the ability to act on their initiative. However, citizens themselves need to be involved in community engagement. EnCs are the exponent of the second circle. EnC is the legal entity that defends the energy rights of its participating citizens and acts as an intermediary between them and the market, the grid and central governments. In most cases and as it has also emerged from the empirical observation of the 6 ENPOWER pilots, local governments are active, core members of the communities. In the vision of citizen engagement, local governments need to take responsibility for organizing a strong group of representatives (Advisory Board of the community, General Assembly of the community) and develop a sense of collaboration with local NGOs, local institutions, private companies/businesses and individual energy citizens. A strong capacity-building effort at the local and individual levels is required to make passive consumers active citizens by informing them of the government's vision for citizen engagement and energy transition. Every citizen must understand why they should engage (what is the importance of energy transition for both individuals and society?), where and how to engage (what are the government's expectations of citizens?) (Massey & Verma & Khadem, 2018).

[9] https://ieeexplore.ieee.org/document/8617063

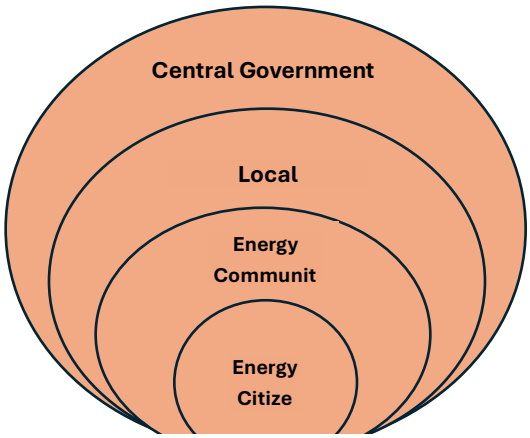


**Figure 3: Concentric circles for citizens' engagement.**

## 2.4 Definition and Business Model Canvas (BMC) Concept Idea

The concept of "Business Models", although practically used by businesses throughout modern history, was officially defined in the 20th century and was designed in a way that supports efficient market-defining and landscaping, providing critical information such as:

- Target and potential customers.
- Added value of the business to said customers.
- Profitability dynamics and opportunities for the business.
- Offering said value, at the right cost.

As the concept of BM gained popularity, many experts described them as a means for understanding the logic behind the operational aspects of a business, focusing on resource management for profit maximization. Eventually, the BM generation technique emerged, offering a useful visualisation framework, also known as a "BM Canvas" (BMC), introduced by Osterwalder and Pigneur (2010). The framework explores the different dimensions of a business and clearly defines how value is generated across each dimension. Consisting of nine building blocks, four of those (i.e. activities, resources, partners, and costs) are devoted to discussing the efficient creation of value, divided by the value proposition block (value from the customer's perspective). The remaining four blocks, on the other hand, seek to optimise the dynamics of value collection and distribution (Reis & Goncalves & Lopes & Antunes, 2021).

The BMC is a straightforward framework, where various components can be mapped, and companies can investigate which ones are evolving at the corporate utility and collective consumer levels. As discussed, the core of the term "value proposition," lies within the combination of delivered goods and services, and more importantly, the value created by the clients. Concerning the energy industry, value propositions are a complicated synthesis of the requirements of the electrical grid and the environmental and social objectives of prosumer collectives. New BMs and tailored consumer-centric environments are more likely to involve different value propositions in addition to alternative supply chains financial structures and customer interfaces, as well as new perspectives on policy and governance approaches.

Of course, like any other tool, the BMC offers many advantages and flexibility, however, limitations have been pointed out by many authors. For example, BMCs have been known to offer a poor depiction of the relationship dynamics between the different elements of the business, hindering the

visualization of strategic dimensions such as a business's competitive positioning in the market of interest. Furthermore, it has also been mentioned that the lack of detail in the structure template of BMCs may impact creativity, making it difficult to explore new business dimensions. Despite their noted weaknesses, BMCs show growing application across the business community and have achieved the status of one of the most used techniques (Reis & Goncalves & Lopes & Antunes, 2021).

Although the concept of BMs has gained popularity in the business world, academics are increasingly using it for analysis purposes, as they offer a prism through which to view how organizations function and impact socioeconomic development. Along the lines of value creation, the newly defined and introduced BM can be used as tools for understanding the creation and capture of value, whilst exploring their impact on socio-technical and even political systems. Resulting changes that occur, due to the symbiotic nature of the socioeconomic and political structures and BMs, may be economic (in terms of technological advancements becoming commercial), as well as institutional, such as in the case of the Fit-for-55 and the Clean Energy Package, enabling the creation of new environments where new BM can be formed.

To comprehend how BM could facilitate social, economic, political and technological transformation we broke down the components related to BMC for each pilot case. The aim of the application of the BM Canvas in our six pilot case communities was to capture, concentrate and analyse all critical segments of the projects and gain a better understanding of their scope, their vision and their mission. Operating within dynamic and newly transformed and continuously evolving energy markets instigates the need to record strategic partnerships, key activities, community main actions, channels, customer segments and relevant customer relations. Additionally, the BM Canvas allows us to spot and outline our revenue streams and, cost structure, while identifying the source of innovation and competitive advantage (value proposition). Capturing how value is created, captured and delivered within different EnCs way leads to the development of scalable and possibly replicable new BM ideas and structures for future EnCs, that originate from BMC archetype and progress to more complex and advanced forms. This knowledge gained from designing and observing BMC for each pilot community acts as a baseline that enables the comprehension of the potential outcomes and vision each respective BM seeks to serve.

# 3. Constructing an archetype of innovative consumer-centric BMs

## 3.1 EnCs as BM innovations

According to the EU Project TEPSIE social innovation can be described as the “new solutions in services, models, procedures etc.", that appear to match societal needs and lead to new or improved capabilities and relationships and/or better use of assets and resources” (The Young Foundation 2012: 18), while for Hoppe and de Vries (2019) social innovation can be defined as innovation that is social in its means and which contributes to the low carbon energy transition, civic empowerment and social goals. Thus, social innovation may occur through new partnerships, new interrelations between the actors, and the integration of unfamiliar digital tools that entail new opportunities for action.

According to De Vries et al. (2016), innovation dynamics in EnCs are deeply correlated with learning processes at the community level, in which technical identity is evolving and community-building activities serve as a framework for user innovation.

In that context, ENPOWER BMs incorporate a diversity of actors and parties at a local, regional, and national level, direct relationships between prosumers, consumers, the communities, networks and the market operators, and increased powers on the citizens’ side given mainly from the use of innovative and smart technologies. The newly developed BMs promote fully customized archetypes, to better meet the individual energy citizens’ needs, in a consumer-centric perspective within the broader context of the overall industry (Kubli & Puranik, 2023). In that context, consumers are not seen only as engaged members of a community, but as self-appointed individuals with separate needs, responsibilities and respective powers. The switch from a passive consumer to a fully engaged energy citizen involves the inclusion of prosumers and the consideration of the decision-making processes at the individual level. This swiftly affects the rest of the energy services provision, moving the point of interest from a large-scale to small-scale production, from centralized production to decentralized and local production, from to-down approaches to bottom-up perspectives, from single flows of energy, money and data to bidirectional or multidirectional flows and from placed-based infrastructures to virtual ones (Hall & Brown & Davis & Ehrtmann, 2019).

We propose new innovative BMs, which will include a change of scope, will re-order and re-design the existing flows of energy, money, data and most importantly the relationships between the involved actors to create a range of new value propositions. The new value propositions in each pilot case will mainly occur through the increased powers and freedom of choice and action of the energy citizens, given to them by the use and implementation of innovative technologies, interactive digital tools, engagement and management platforms, nudging apps and decision-making and support tools. However, in the newly developed BMs, the perspective is not only through an individualistic prism. Citizens have a dual identity: as independent and self-efficient entities but also as community members. For this reason, in Chapter 2, where ENPOWER BMs are extensively analysed we do not only record flows, single or multi-perspective relationships and interactions of energy, money and data. We observe and explain the impact and the potential of technological tools to enhance the power and influence of energy citizens, other individuals, the community itself, other involved actors, and the energy markets. Community interaction is also noted and examined.

In addition to the scope for citizen action, the innovation in the models of the Deliverable, stems from how the forces of the energy transition and their parameters interact with each other. Over the last few years, three main driving forces have been directing the energy transition, the so-called "three Ds": Decarbonization, Decentralization, and Digitalization. (Di Silvestre & Favuzza & Riva Sanseverino & Zizzo, 2018).

The current BMs for EnCs capture a. the decarbonized energy systems, since the main activities of the EnCs are based on RES and low-carbon technologies, b. decentralized energy systems since energy production facilities are located closer to where energy consumption takes place, c. digitalization that comes with the use and implementation of cutting-edge technologies and what is missing is the concept of the value of democratization.

Emphasis is given to how the fourth force, Democratization, is shaped.

- What is the degree of participation of the energy citizen in each pilot case?
- Are we referring to the consumer form of participation, direct forms of participation, or representative forms of participation?
- How does the energy citizen manage their rights within the EnCs?
- How do the technical enablers applied to each pilot case empower the energy citizen's capabilities or enhance its role in decision-making within the EnCs?
- How do these internal upheavals act on the other forces of the energy transition?

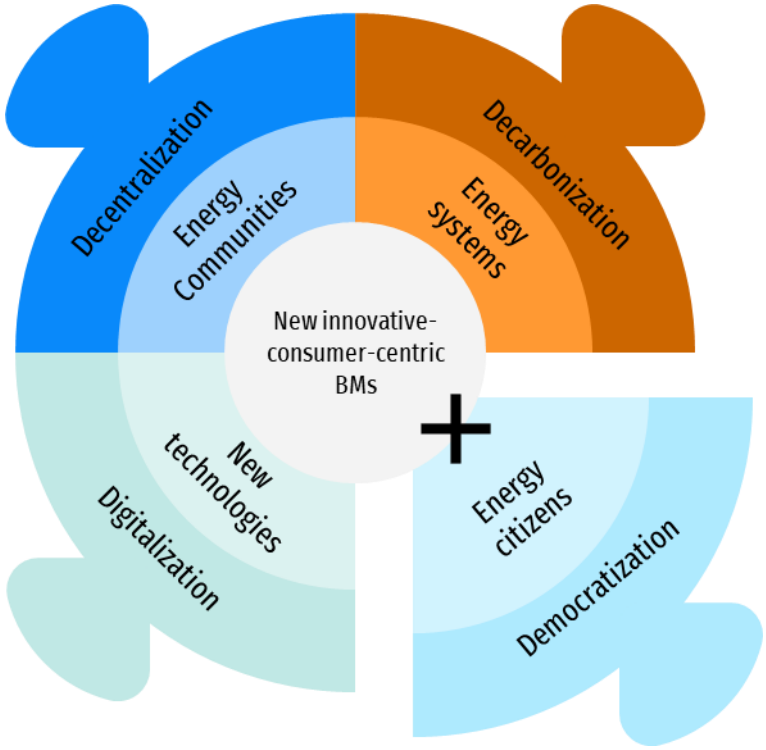


**Figure 4: Visualisation of the concept of ENPOWER BM with the use of "4Ds model".**

## 3.2 Types of emerging and innovative consumer-centric BMs, based and applied on ENPOWER six (6) pilot cases

BM research is significantly centred on the energy sector, while various energy-related BMs have been developed each with a different targeting and approach. Richter (2012) focused on the BM innovations concerning utility companies, while Palmié et al (2021). collected and compared the BM patterns applied by incumbents and start-ups while moving forward with the energy transition. (Hamwi & Lizarralde, 2017; Provance & Donnelly & Carayiannis, 2011; Strupeit & Palm, 2016) Given the need for decentralized and dispersed energy systems, there has been a dissemination of PV and battery storage BMs, while the focus has been given to the local management of these technologies, and their integration into the grid, through a community or a prosumer-centric perspective. (Gui & Diesendorf & MacGill, 2017; Mourik & Breukers & Summeren & Wieczorek, 2020; Huijben & Verbong, 2012; Strang & Wiesner, 2014) BMs targeting the digitalization of systems and processes, as a means of flexibility provision have also particularly attracted attention in BM research. (EU BAC ESCO, 2010; Yildiz, 2014; Cai & Huang & Bompard & Cao & Li, 2017) Additionally, e-mobility has catalysed new BMs that refer to the electrification of transport and smart charging technologies (Cao & Bu & Wang & Yang & Jiang & Li, 2019; Tounquet, 2019).

Innovative BMs for EnCs can combine some or many characteristics and benefit from the aforementioned studies, depending on the key activities and the value proposition of each community. Reis et al. and identified and analysed eight business model archetypes for energy communities based on the academic literature review of a sample of European energy communities. These archetypes are as follows: energy cooperatives, community prosumerism, local energy markets, community collective generation, third-party-sponsored communities, community flexibility aggregation, community energy service companies, and E-mobility cooperatives (Reis & Goncalves & Lopes & Antunes, 2021). These archetypes are reconfigured and differentiated according to the different regulations and energy policies applied, different citizens' preferences and various technologies and the use-cases that prevail as the main source of action and revenues within the EnCs. These archetypes serve as a useful framework and as sandboxes to develop best practices and new types of business models.

Given the unique characteristics of ENPOWERs six EnCs, we decided to develop a tailored approach for each pilot case, since each of them is applied in a different country with various demographic characteristics, regulatory frameworks, multiple stakeholders which take active control and applied technologies. Moreover, the business model innovation process is not only initiated by one main entity (firm, municipality etc.) but rather by various actors who may be loosely or strictly coordinated.

To begin with, we first applied the BMC framework in each pilot to capture the key activities, the mode of operation, and the main actors, to understand the rationale of the EnCs and identify the strengths and the barriers to EnC development. Then we tried to match our cases with one or more of the aforementioned archetypes, and based on this pairing, we analysed the energy, money, and data flow. Finally, we designed the flows resulting from the use of the technical enablers in each of the pilot communities and recorded the power these enablers give to the energy citizen during the decision-making process, the range of participation of the latter and finally the level of community interaction with the involved actors as it results from the use of the same technologies.

To ensure active involvement, we engaged in bilateral discussions to understand stakeholders' needs and perceptions. These discussions were supplemented with questionnaires to explore the details of the pilot cases. Our research also incorporated the analysis and results from previous tasks in WP2

and a comprehensive literature review of peer-reviewed articles and EU-funded projects. This thorough approach has enabled us to design robust, innovative business models that place energy citizens at the heart of the socio-energy transition.

In the final section of the deliverable, the elements of energy citizenship were outlined, while a participation barometer was developed. This barometer illustrates a spectrum ranging from individualistic forms of participation to collective and fully representative forms. Subsequently, TEs for each pilot were evaluated to determine how well they align with various gears of the barometer, considering the power and freedom of choice and action they provide to energy citizens.

It is worth mentioning that in the pilot cases of Spain and Hungary this tactic was not implemented, as those two countries are early adopters. During the course of the ENPOWER project we expect those EnCs to evolve even further.

### 3.2.1 Austria – Local Energy Market Community with P2P trading archetype

**Key Partners**

-Residents
-SMEs
-Farmers
-OurPower SCE
-DSO (preparing energy data via smart meter and IT system)
-Balancing Group/Energy Supplier
-Energiebezirk Freistadt (Communication Partner)
-Technology Provider/IT Service Provider

**Key Activities**

-Energy Generation
-Management of Energy Trading
-Management of energy use
-Local Grid Controller
-E-mobility Services
-Community Engagement

**Key Resources**

-Wind Farm
-PVs
-Small hydro
-Agro biogas
-Heat pumps
-Small scale energy storages
-P2P marketplace (digital processes like onboarding, settlement etc.)
-Employees/staff members

**Value**

-Settle energy supply and energy communities
-Stable prices for energy producers and energy consumers (regional value creation)
-Integrate energy communities as aggregated energy producers/consumers in the P2P marketplace

**Customer Relationship**

-Contracts and participation agreements
-Trust and transparency in energy transactions through digital platforms and IT services
-Community engagement

**Channels**

-Community organized as an Association
-Website, Newsletter, Blog
-Digital platforms for energy trading and associated apps ("Serve-U", "License to activate", License to operate")
-Partnerships
-Data Aggregation services
-Direct community involvement events and educational activities
-Energiebezirk Freistadt (Communication Partner)
-Energy producers (Word of Mouth)

**Customer Segments**

-Local producers and consumers of energy

**Cost Structure**

•P2P market place
-Energy consumers pay/ Energy producers earn
-IT service fee
-Labour costs
-Energy consumers pay for service provider
•Energy community
-Energy consumers pay/ Energy producers earn

**Revenue**

•P2P marketplace (P2P contracts)
-Fee for energy producers
-Marketplace contribution for energy consumers
•Energy community
-Financial reserve
OurPower pays the energy producers a stable price for the energy consumed via the P2P marketplace and a flexible price (electricity market) for the energy not sold via the P2P marketplace.

**Figure 5: BMC application in Pilot 1-Austria.**

The EnC (Energiegemeinschaft-Regional Energy Community Dreißgen-SpörbichI-REC DS) in the case of the Austrian Pilot, is a sub-community of OurPower Association operating in the Mühlvierte region located in Upper Austria. The key goals of the Austrian Pilot are the promotion of renewable local energy generation, the guarantee of Stable prices for energy producers and energy consumers, which entails regional value creation and the integration of the EnC and its participants as aggregated energy producers/consumers in the P2P marketplace. OurPower, as the umbrella organization will facilitate the community's integration in the marketplace and will mediate as a stability factor for the P2P contracts, providing settlement services and undertaking initiatives to leverage citizens' power to enhance community involvement.

The Austrian pilot EnC includes a diverse array of strategic partners, each undertaking an important role in the project's success. Individuals, SMEs and farmers are the backbone of the Community, participating actively as energy prosumers and consumers. OurPower SCE, functions as the Community Aggregator, managing and coordinating the energy generation and digital activities, including trading. IT and technology providers are responsible for digital infrastructures, and they prepare and manage the energy data through the relevant smart meters and IT systems, and digital apps securing the successful upshot of the data flows. The balancing group and energy supplier. Energiebezirk Freistadt acts as the communication and dissemination partner, fostering engagement of information in the Community, and externally.

The analysis of the Austrian pilot is based on the Local Energy Market (LEM) archetype, combined with P2P trading. LEM based on P2P trading are people-driven and prosumer-centered communities, they aim to work in collaboration to maximize self-sufficiency and bring down the volumes of traded power with entities from the external market. In communities that follow this archetype both prosumers and consumers have the freedom of choosing the type of their interaction with other participants or entities (to whom they sell or from whom they buy). Also worth mentioning, participants have access to information on the source of the traded energy. Revenues in such markets are distributed between the prosumers and consumers that benefit from the difference between tariffs in the local and outside markets. OurPower sells the energy of the participating energy producers which are community members of the electricity market. Energy consumers choose their energy producers in the P2P marketplace and pay a stable price for the energy they consume. OurPower pays the energy producers a stable price for the energy consumed via the P2P marketplace and a flexible price (electricity market) for the energy not sold via the P2P marketplace. In the Austrian case, the trading platform itself will be an implementation of OurPower's P2P marketplace, while the management will be conducted by the market participants, for the system reliability agreements should be signed with the DSO and energy retailers.

When members of the LEM share common interests, they can establish prosumer-community groups or use storage systems virtual power plants (although this is still difficult due to regulation in most EU countries). In order to ensure the smooth operation of the P2P trading platform, TE-5 will take place in the Austrian pilot, implementing Blockchain technologies, smart contracts etc. According to Reis. et al. (2021) members of this archetype community can share common interests but be physically apart, joining virtually to create community virtual power plants. (A 31) The technology, based on blockchain, has been identified as a powerful ledger scheme to keep track of the transactions in this archetype and indeed the Austrian pilot will leverage this capability through TE5 and TE15.

The key elements of this archetype, which also apply to the Austrian pilot community, include communal infrastructure for energy generation—specifically, photovoltaic (PV) and wind turbines—

shared responsibility for energy management, and democratic decision-making procedures. These elements ensure democratic participation and fair distribution of benefits among citizens.

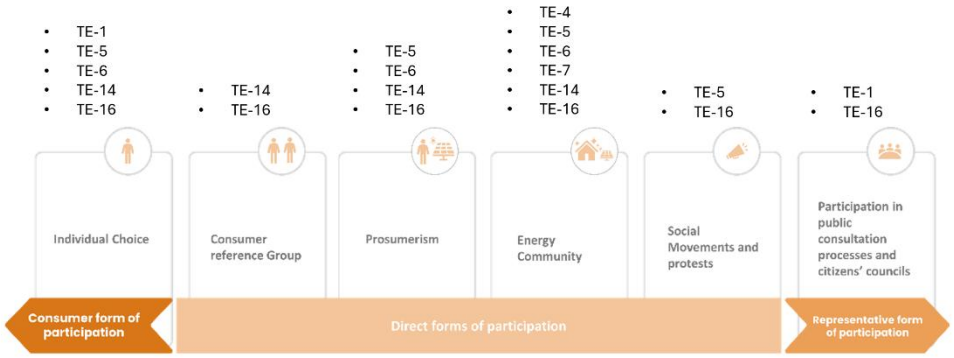


**Figure 6: Different levels of citizen participation activated by TEs within the Austrian Pilot.**

The Austrian pilot is intended to implement various Technical Enablers (TEs), which in return will affect the correlations between energy citizens and the community itself. More specifically, TE-1 will give consumers or external citizens access to the economic, social, and environmental benefits of becoming a community member or a prosumer, enabling them to take the leap and make the decision to actively participate in energy activities (consumer-form of participation). In that way, citizens' participation in public/civic life will be enhanced and they will be given an increased opportunity to express their opinion and their insights in public consultations and community meetings, regarding the operation and the profits of the energy community, as they will have direct access to any related knowledge and information (representative-form of participation). TE-4 will support community engagement and strengthen its powers since it will be used as an energy data space-compliant tool, that ensures efficient data management and allows connectivity between all digital platforms. TE-5 will enable increased end-user participation in personal energy data sharing either individually or within the framework of Data Cooperative. This specific TE will protect data transfer and data security and will increase the participatory level of citizens in the procedures (assets, services exchanges and reciprocal compensation), since it will act as a safety net against GDPR violations, supporting trust and sovereignty. TE-6 will apply different business and social dimensions from different pilots to the specific pilot, on individual, community and aggregation levels. This will allow to gain an accurate representation of how different techniques, technologies, business and social aspects will affect the specific pilot. TE-7 will only affect and strengthen the engagement of the community, since it refers to a customer clustering and segmentation tool that is used to bundle behaviors and interpret socioeconomic characteristics of the segments involved in the community. TE-14 will strengthen the direct forms of participation of the energy citizens since it will provide recent and forecast values of generation and consumption to users and offer advice to change the use of energy (individual choice-consumer form of participation). Additionally, it can be used as a communication channel between the participants and the community as it will also include community dialogs/online event notifications for feedback. TE-14 will further amplify the engagement of the community itself in the democratic decision-making procedures since it will assist in the optimization of the community energy use, balance, economy, or other KPIs. TE-16 is one of the most powerful enablers in energy democracy terms since it will give citizens full market access and unlock direct, bilateral relations and interactions between the participants. Engagement

components for power sellers and increased incentives towards enhancing social participation and increasing awareness are among them.

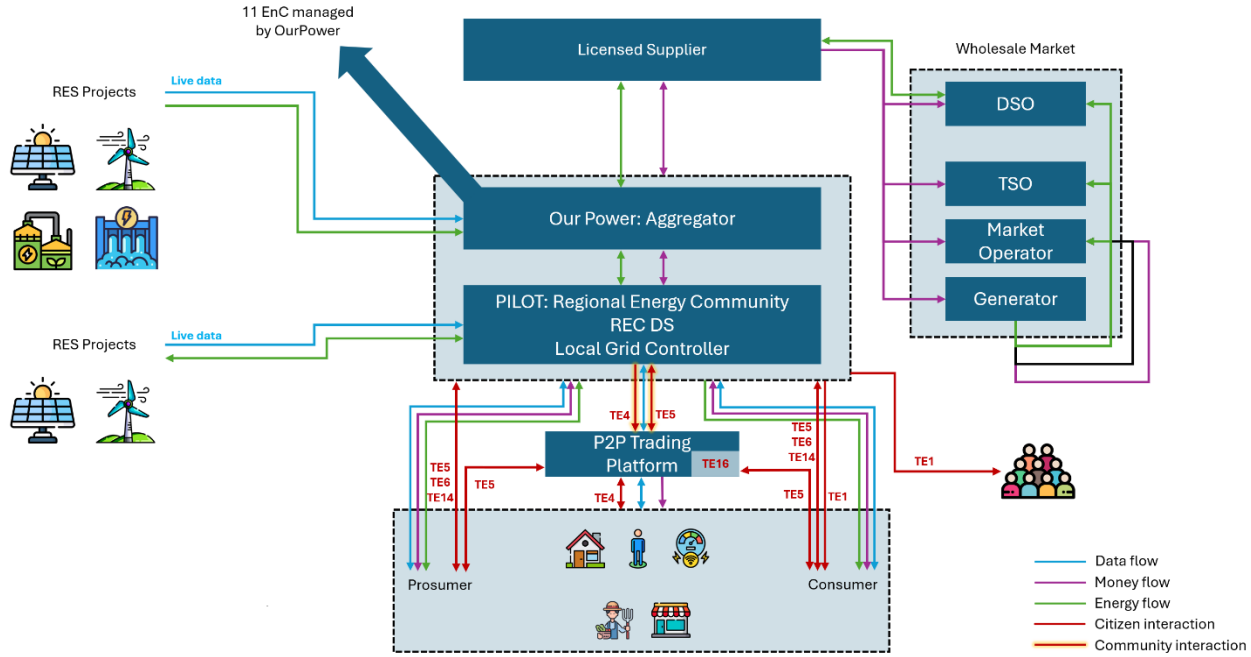


**Figure 7: Innovative consumer-centric BM – Austria.**

### 3.2.2 Portugal – Combination of the community ESCO BM archetype with Local Energy Markets BM and E-mobility Cooperative BM

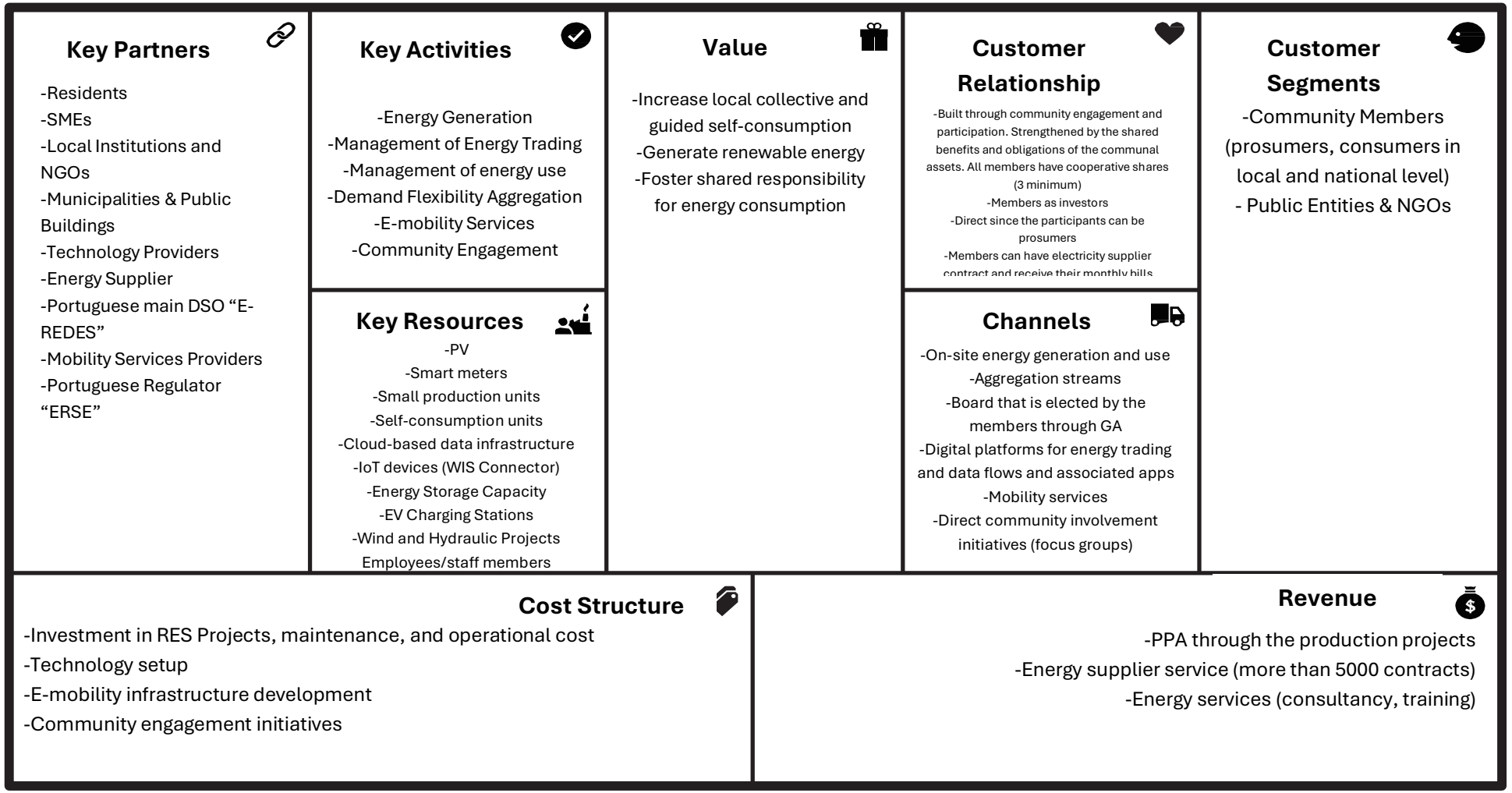


**Figure 8: BMC application in Pilot 2 - Portugal.**

Two entities, COOPERNICO and CEVE, have joined forces and established partnerships to create and operate the Portuguese pilot EnC, which combines the archetypes of community ESCO BM, Collective self-consumption BM and E-mobility Cooperative BM, to increase local collective and guided self-consumption, generate renewable energy and foster shared responsibility for energy consumption, by leveraging dynamic energy sharing and data exchanges. This combined BM could be defined as a community of place and interest, where the members share ownership and collectively own and operate PVs, wind turbines, hydraulic projects and other renewable generation systems and collectively take control over the energy management within the community. The ESCO remuneration scheme, applicable in this case is the pre-defined, guaranteed savings between the community, its members and potential customers, from the PPAs through the production projects and from energy supplier services. Besides that, the ESCO provides traditional consulting and technology training to the members and the community itself. In the Portuguese Pilot, CEVE will act as the local DSO, by developing and executing the energy management of the community, while COOPERNICO will uptake the energy aggregation role, to manage energy from RES surplus coming from prosumers, allocate it among all energy participants and possibly sell it to electricity markets.

The application of the LEM BM archetype in this case is adjacent to the main scope of the pilot EC to maximize its self-sufficiency and decrease the energy traded with entities /markets outside the community (A35,63,81). The main characteristics of this model are the clean, affordable, decentralization of energy production, the optimization of local energy flows and the enhancement of energy efficiency. Digitalization is a key aspect of securing the successful operation of energy, data exchange, or even monetary transactions. It also provides transparency in all processes, empowering citizens' engagement and strengthening their decision-making role over their energy production and consumption. To maintain a track of all energy, information, and financial transactions, sophisticated ICT, net-metering infrastructures, and software-based trading platforms are needed. (A91) A cloud-based data infrastructure with IoT devices (WIS-connector) connected to Portuguese smart meters and energy production installations will give access to power injected and exported, monitoring production and access consumption behaviours, and efficiency patterns.

LEM-related BMs are intertwined with P2P trading, that allows community members to negotiate either directly or via intermediaries, to solve local energy imbalances and find the best matches for the most affordable prices. In that way, using, processing and sharing demand and generation data from metering becomes a part of the community's key activities.

E-mobility BMs encourage the incorporation of clean mobility solutions and exploit additional sources of flexibility and alternative value streams. E-mobility cooperatives are formed by bringing together a variety of shareholders (households, SMEs, local authorities, mobility providers, etc.). These cooperatives can also utilize their assets EVs, electric buses and their batteries as flexibility resources (storage) (A35, 52A), and exploit V2X modes which can result in the reduction of energy bills. Aggregators can leverage these characteristics and deliver grid ancillary services by procuring energy during off-peak periods and provide flexibility services. As an added benefit, battery storage can also contribute to increased self-reliance and self-consumption when the community is also involved in power generation. Participants in these BMs are able to get involved as shareholders, decision-makers, and mobility customers mainly via partnerships.

The Portuguese Pilot community will incorporate E-mobility services with energy generated and delivered by community members (prosumers). In this setting, instead of selling their generation surplus externally, community members (prosumers) will have the right to decide and sell their energy upon payment, to E-mobility services providers. Additionally, the pilot community will own

charging stations, and make them available not only for the community members but also for external customers, so as to increase its profits stream. The promotion of green transportation and E-mobility solutions through shared and multilateral decision-making processes is an additional characteristic of this versatile model, that mainly strengthens community engagement and encourages the citizens' engagement.

The Portuguese pilot is intended to implement various Technical Enablers, which in return will affect the correlations between energy citizens and the community itself. More specifically, TE-1 will give consumers or external citizens access to the economic, social, and environmental benefits of becoming a community member or a prosumer, enabling them to take the leap and make the individual decision to actively participate in energy activities (consumer-form of participation). In that way, citizens' participation in public/civic life will be enhanced and they will be given an increased opportunity to express their opinion and their insights in public consultations, regarding the operation and the profits of the energy community, as they will have direct access to any related knowledge and information (representative-form of participation). TE-2 will bring knowledge to the EnC, about new technologies and how valuable they will be for the community to invest in them, new BMs for the EnC and its members, and possible outcomes of investing in shared assets and the benefits of sharing mechanisms. TE-4 will support community engagement and strengthen its powers since it will be used as an energy data space-compliant tool, that ensures efficient data management and allows connectivity between all digital platforms. TE-5 will enable increased end-user participation in personal energy data sharing either individually or within the framework of Data Cooperative. This specific TE will protect data transfer and data security and will increase the participatory level of citizens in the procedures (assets, services exchanges, and reciprocal compensation), since it will act as a safety net against GDPR violations, supporting trust and sovereignty. TE-7 will only affect and strengthen the engagement of the community, since it refers to a customer clustering and segmentation tool that is used to bundle behaviours and interpret socioeconomic characteristics of the segments involved in the community. TE-8 will evaluate aggregation levels and the effectiveness of aggregation flexibility among the pilots of ENPOWER project. Based on the elasticity profiles within the community, each consumer is given a tailored DR strategy, and extra decision-making power. According to TE-12 the energy citizens and flexibility assets of the EnC will be provided with optimal operating schedules, based on the maximization of different objectives, such as economic revenue, self-consumption, community trading, etc. From this significantly increased responsibility might further affect EnC's members' behaviour and new BMs with shared assets might arise when the schedules are provided (direct forms of participation). With the use of TE-13 members of the EnC using the AI-powered Virtual Energy Manager platform will be given their own energy consumption patterns, benchmarks similar to their peers, recommendations regarding energy efficiency and optimal solutions for becoming a prosumer, information the participant regarding energy sharing, empowering not only their individualistic identity but also their dynamic integration in alliances and sub-groups within EnC. TE-17 will highlight the involvement of the EnC as a collective entity, since the local energy and flexibility market designs will be explored through it based on the corresponding regulatory alternatives for self-consumption, flexibility provision, agents' relationship, and balancing responsibilities.

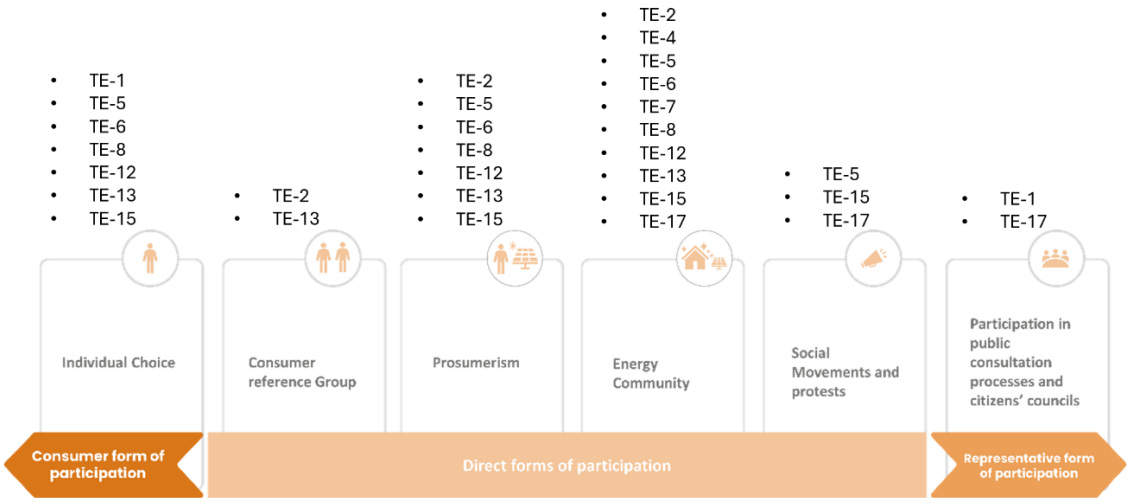


**Figure 9: Different levels of citizen participation activated by TEs within the Portuguese Pilot.**

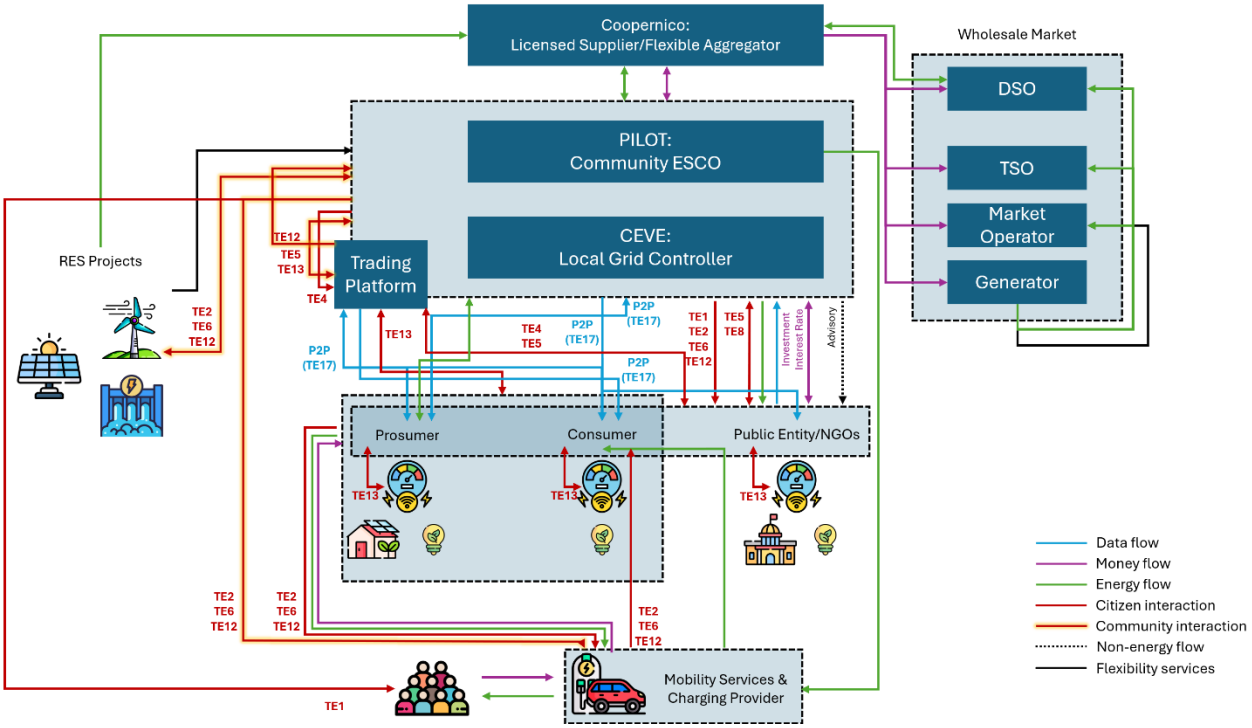


**Figure 10: Innovative consumer-centric BM - Portugal.**

### 3.2.3 Greece – Combination of Community Aggregation BM with E-mobility Cooperative BM

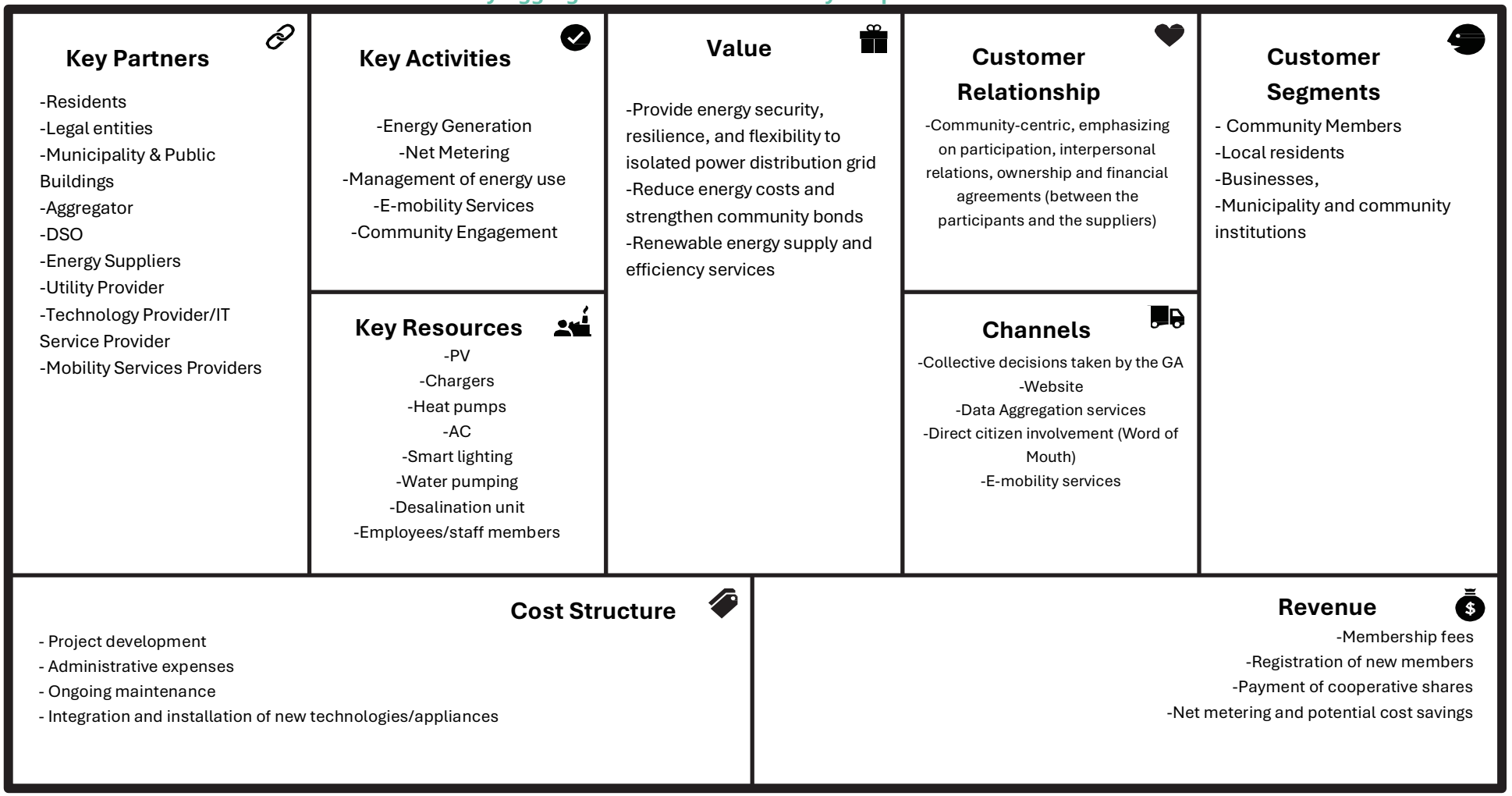


**Figure 11: BMC application in Pilot 3 - Greece.**

As for the Greek Pilot, the EnC was formed by ChalkiON Enc, with the aspiration to make the island produce completely green energy and stop dependence on the conventional electricity imported from the neighbouring island of Rhodes. Additionally, a further goal in the latter step, was to convert all consumers into prosumers. Members of the EnC are residents of both the islands Chalki and Rhodes, the Municipality of Chalki and business owners.

The BM that is established is a combination of Community Aggregation and E-Mobility Cooperative, to increase local self-consumption and provide optimal load control. For optimal load control, E-mobility services will contribute to a latter step when V2G will be established. That will be rather valuable, especially during the summer months during peak tourism season for the island. This combined BM could be classified as a community of interest while developing clean mobility solutions with alternative value stream exploitation, where all customers are looking for the benefits of reducing their energy bills through production of the solar PV panels, exploitation of water pumping and EVs as batteries for vehicle-to-grid and grid-to-vehicle acting as flexibility services for further reduction of energy bills. Furthermore, the revenue from trading the excess energy is expected to be used also for non-energy assets, such as social services and/or assets, further reduced electricity bills for vulnerable people and social services, such as care services for elderly people. The EnC remuneration scheme applied at the moment, engages the community members in demand-side management strategies, through selling the surplus produced energy to the outside market, providing demand flexibility to the grid operator via aggregation services, provided by GEARS. This scheme will be further enhanced with the introduction of V2G services. Another key goal of the Greek pilot is to turn all consumers who are part of the EnC into prosumers, allowing for an even higher energy generation.

The application of the community Aggregation BM archetype in this case is adjusted to the main scope of the Greek Pilot. To enhance flexibility management and increase the traded volumes of locally produced energy, the island's flexible assets, including air-conditioning and heat-pumps from residential households and tourist apartments, the water network via the later introduction of water pumping and flexible use of the desalination unit will be exploited. To further improve self-consumption and self-sufficiency, additional smart meters will be installed in residential households, tourist apartments, the water desalination unit and two businesses that are large consumers of the EnC. Through the introduction of smart meters, combined with the PV's production and consumption patterns, will be analysed, and mapped to find the optimal time frame for energy consumption. After mapping in collaboration with the water network operator, an improvement in the water desalination management is expected while also using the unit as pumped hydro storage. With the help of the aggregator GEARS, a hybrid data-driven VPP will be set up and operated.

To enhance the previous techniques, the E-mobility Cooperative BM archetype will be implemented via the E-mobility sector, exploiting EVs and E-Boats. The Greek pilot will introduce vehicle-to-grid as storage. Smart charging schemes could also be designed and included. E-chargers have already been introduced in the EnC, which are accessible to both members of the EnC and external customers, contributing to additional profit for the pilot. The turn from fossil fuels to E-mobility solutions, not only shows the versatility of the model, but also contributes to citizen engagement, as citizens take action by directly contributing to the grid based on the load's needs.

This hybrid BM is expected to combine the above-described techniques. A load schedule operation to maximize off-peak high demand periods when local energy generation is available will be achieved, thus optimizing local resources and minimizing dependency on conventional generation from the outside market. An important role will be held by the members of the EnC, as flexibility assessment (TE8 and TE10), and self-consumption (TE9) sizing (TE2) tools will be

constructed. These tools will allow the members to change the EnC's load patterns, thus flattening any harsh demand peaks and taking advantage of the low-demand hours.

The implementation of these two BMs in the case of Greece will allow for load flexibility and optimization in self-consumption. The stakeholders, in this case, are the prosumers of the community, both individuals that have full ownership of rooftop PVs (which is planned for the future, during the course of ENPOWER), the municipality that manages the PV plant, but also consumers with a financial contribution in the PV farm.

The Greek pilot intends to implement various Technical Enablers, which in return will affect the correlations between energy citizens and the community itself. More specifically, TE-1 will give consumers or external citizens access to the economic, social, and environmental benefits of becoming a community member or a prosumer, enabling them to take the leap and make the individual decision to actively participate in energy activities (consumer-form of participation). In this way, citizens' participation in public/civic life will be enhanced and they will be given an increased opportunity to express opinions and insights in public consultations, regarding the operation and the profits of the energy community, as they will have direct access to any related knowledge and information (representative-form of participation). TE-2 will bring knowledge to the EnC about new technologies and how valuable they will be for the community to invest in them, new BMs for the EnC and its members, and possible outcomes of investing in shared assets and the benefits of sharing mechanisms. TE-4 will support community engagement and strengthen its powers since it will be used as an energy data space-compliant tool, that ensures efficient data management and allows connectivity between all digital platforms. TE-5 will enable increased end-user participation in personal energy data sharing, either individually or within the framework of Data Cooperative. This specific TE will protect data transfer and data security and will increase the participatory level of citizens in procedures (assets, services exchanges and reciprocal compensation), since it will act as a safety net against GDPR violations, supporting trust and sovereignty. TE-7 will only affect and strengthen the engagement of the community, since it refers to a customer clustering and segmentation tool that is used to bundle behaviours and interpret socioeconomic characteristics of the segments involved in the community. In TE-9 NTUA and GEARS will take real production of different RES plants data and compare them to the real production of those RES plants, allowing for the accuracy of the different models used to increase. For different stakeholders of the EnC this will bring valuable information, drawing meaningful connections between events and near real-time situational awareness. The ability to optimise self-consumption will bring added value to energy citizens' behaviours and decisions and will draw meaningful connections between real-life situations/events and their response to them (direct form of participation). By implementing TE-10, users of this application will be capable of monitoring smart household appliances, inspecting consumption patterns in different periods and receiving tailor-made recommendations of how to keep a high quality of life, while limiting their consumption in the low RES-based production time periods. Lastly, TE-11 will provide real-time data related to charging stations and provide future reservations on the publicly accessible charging station, implementing a smart charging module that also shows load management patterns. V2G transactions will also be available, incentivizing users to shift their EV charging/discharging schedule to support the grid.

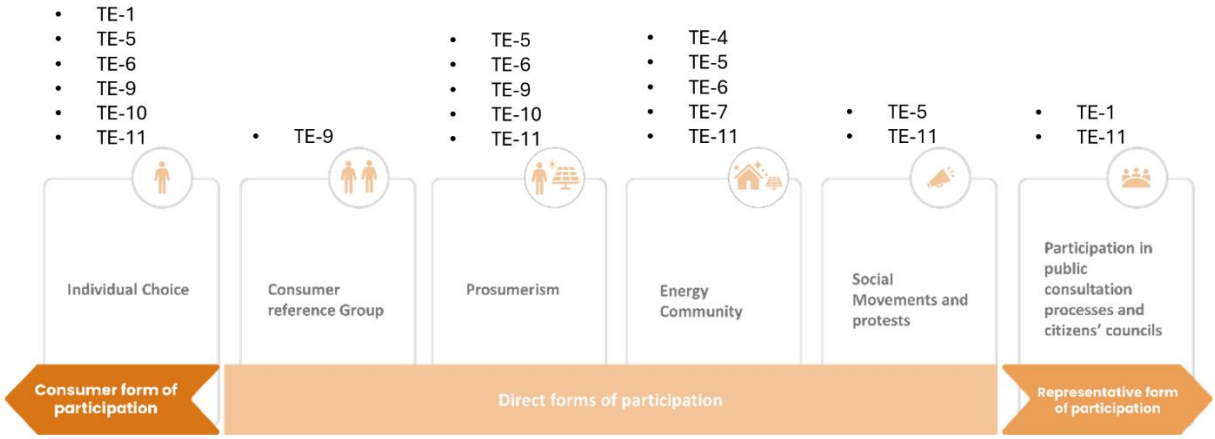


**Figure 12 Different levels of citizen participation activated by TEs within the Greek Pilot**

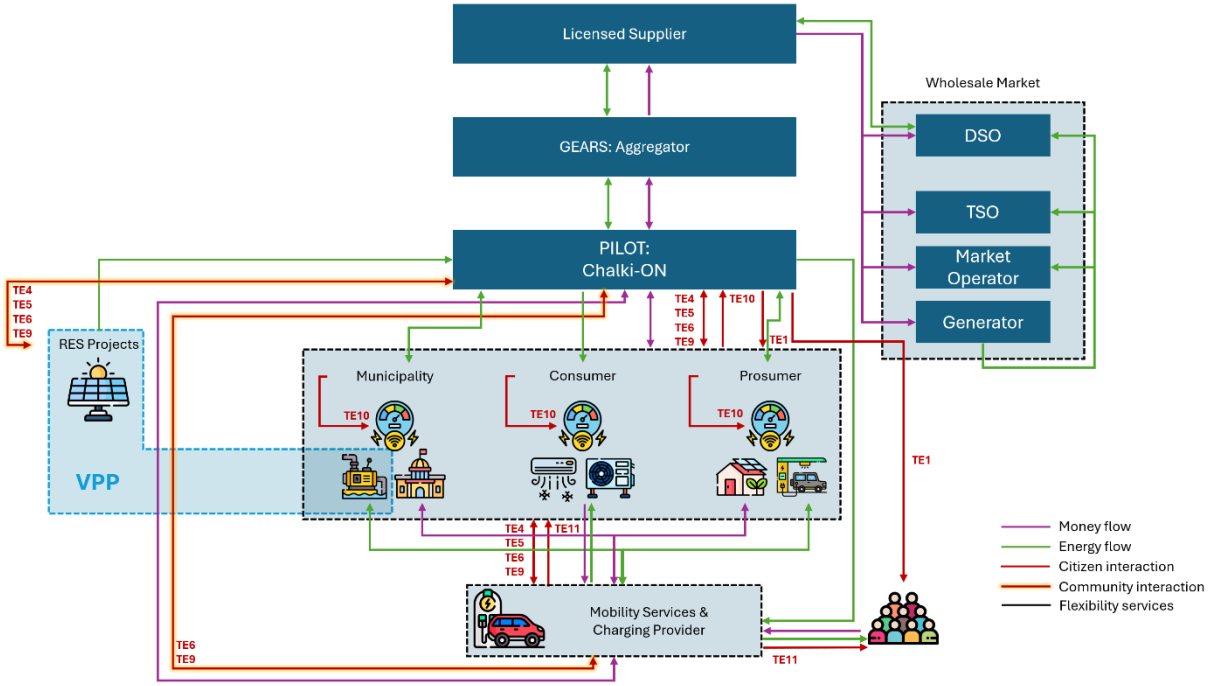


**Figure 13: Innovative consumer-centric BM - Greece.**

### 3.2.4 Ireland – Energy Cooperative BM archetype

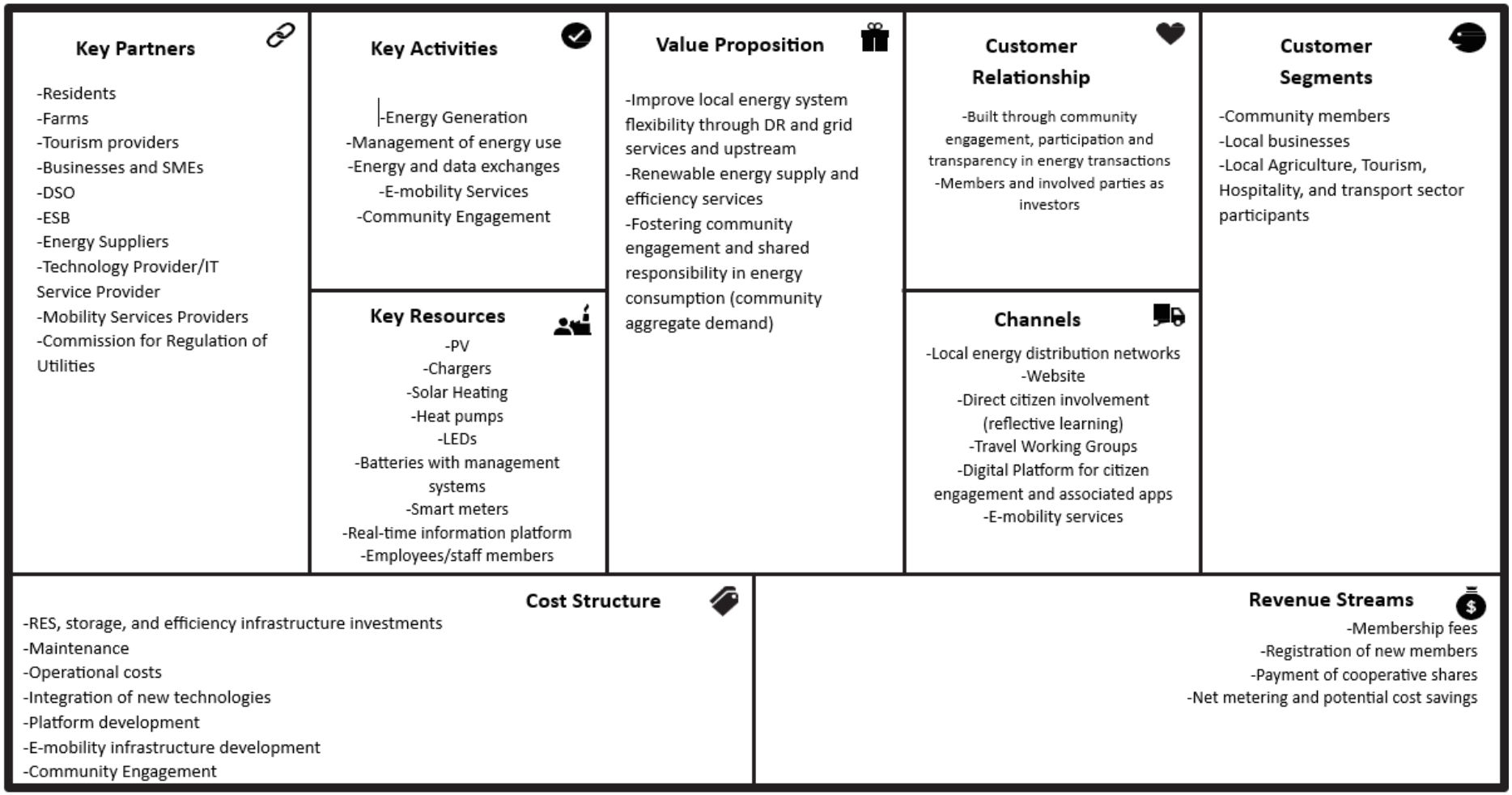


**Figure 14: BMC application in Pilot 4 - Ireland.**

The Irish pilot intends on implementing various Technical Enablers, which in return will affect the correlations between energy citizens and the community itself. More specifically, TE-1 will give consumers or external citizens access to the economic, social, and environmental benefits of becoming a community member or a prosumer, enabling them to take the leap and make the decision to actively participate in energy activities (consumer-form of participation). In this way, citizens' participation in public/civic life will be enhanced and they will be given an increased opportunity to express their opinion and their insights in public consultations, regarding the operation and the profits of the energy community, as they will have direct access to any related knowledge and information (representative-form of participation). TE-2 will bring knowledge to the EnC about new technologies and how valuable they will be for the community to invest in them, new BMs for the EnC and its members, possible outcomes of investing in shared assets and the benefits of sharing mechanisms. TE-3 is a platform for social engagement and information exchange, facilitating the progression of EnCs, linking citizens to service providers and opportunities for automated enrolment in utility flexibility/DR services. TE-3 is directly linked to TE-16. This TE will support and educate citizens on their own unique journey toward low carbon and resilient energy solutions, while making the Enc more energy efficient and resilient, covering the whole spectrum of energy democratization; making use of all possible ways of participation and acting both in their personal interest and in the light of the action of a collective, where the freedom and energy of each individual must not interfere with and hinder the action of the other.TE-4 will support Community engagement and strengthen its powers since it will be used as an energy data space-compliant tool, that ensures efficient data management and allows connectivity between all digital platforms.  TE-5 will enable increased end-user participation in personal energy data sharing either individually or within the framework of Data Cooperative. This specific TE will protect data transfer and data security and will increase the participatory level of citizens in the procedures (assets, services exchanges and reciprocal compensation), since it will act as a safety net against GDPR violations, supporting trust and sovereignty. TE-7 will only affect and strengthen the engagement of the Community, since it refers to a customer clustering and segmentation tool that is used to bundle behaviours and interpret socioeconomic characteristics of the segments involved in the Community. TE-1a privacy preserving tool for automated interoperable DR, that is driven toward the EnC and its members.

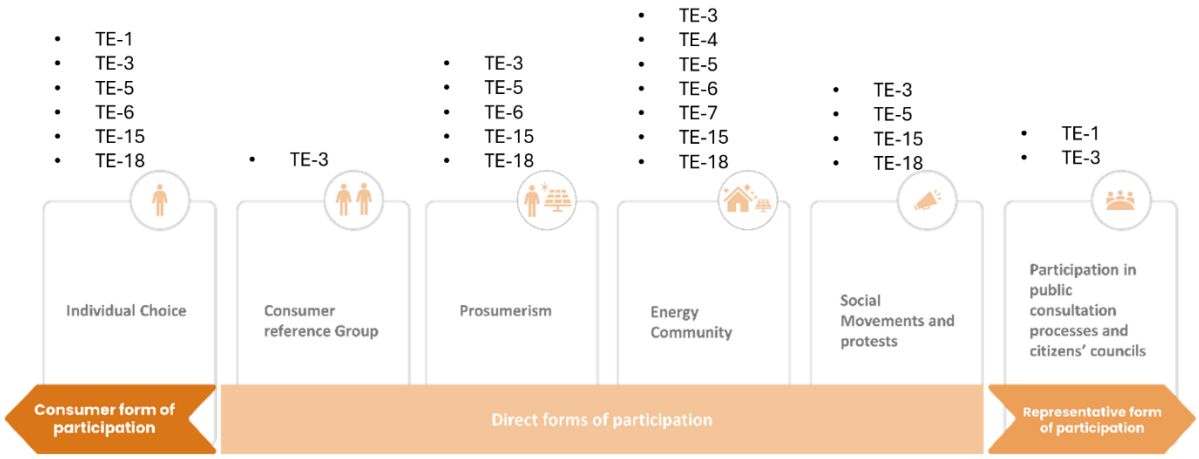


**Figure 15 Different levels of citizen participation activated by TEs within the Irish Pilot.**

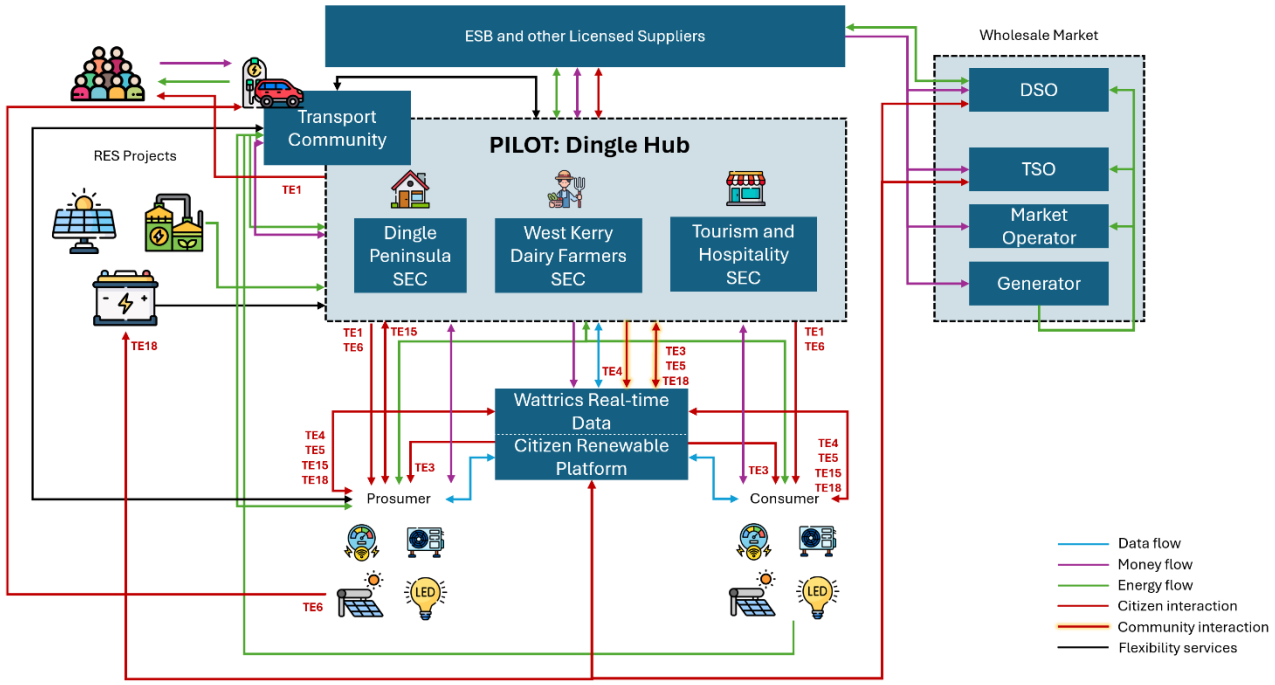


**Figure 16: Innovative consumer-centric BM - Ireland.**

### 3.2.5 Hungary – Community ESCO with E-Mobility Cooperative and LEM based on P2P trading BM archetype

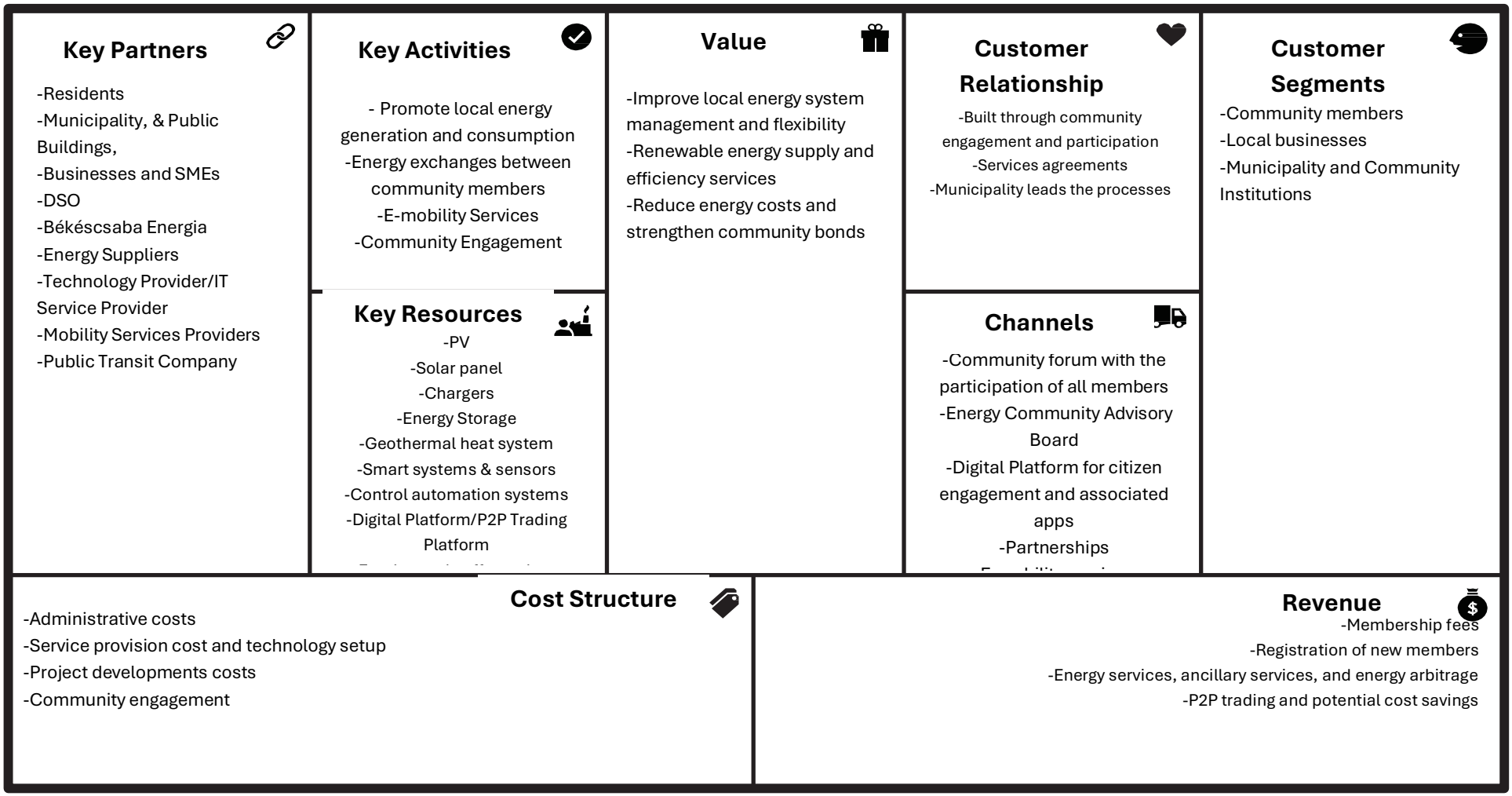


**Figure 17: BMC application in Pilot 5 - Hungary.**

In the case of the Hungarian Pilot, the EnC has not yet been established, as they are still an early adopter. However, this is under development as the Bekscsaba Energia Esco Ltd. that is a fully municipality-established and owned legal entity. Key goals of the Hungarian Pilot are the promotion of renewable local energy generation, energy exchange between community members creating a P2P marketplace with the help of OurPower, increasing community engagement and providing E-mobility services. Key partners of the EnC will be the municipality and public buildings, businesses and SMEs, the DSO, the Bekscsaba Energia Esco Ltd., energy suppliers, technology, service and mobility providers, as well as the public transit company. All the above place the EnC for the Hungarian pilot as a mixed-use EnC with municipality-driven features.

The key partners and the key goals of the Hungarian pilot composed of a fusion of BMs, are described below:

- Community ESCO BM archetype, since the EnC has technology and service providers

- E-Mobility Cooperative BM archetype, as the EnC already has adopted EV charging stations and

- Local Energy Market (LEM).

In the community ESCO archetype, external companies establish partnerships with the EnC aiming to provide EE services driven toward energy demand reduction. Since the EnC in this case is a place of interest, the reimbursement of these entities depends on the energy saving achieved by customers in the community, the customers' savings can be shared between ESCO and the customers. Also in this BM archetype, the members of the community are usually deeply involved in decision-making processes, raising community engagement (that being one of the main goals of the Hungarian Pilot). The promotion of local energy generation and consumption can easily increase self-consumption, which forms another goal of Hungary and will be enhanced by the Self-consumption optimization tool (TE-9).

The existing EV charging station and electric bus chargers (which will be installed during the course of the ENPOWER project), encourage the use of EVs as mobility solutions, and provide fossil fuel-free transportation services, making them flexibility assets. The E-Mobility Cooperative BM archetype can develop alternative value streams, increase flexibility in the electricity grid by utilizing V2G both ways and use EVs as flexible assets involving community members as shareholders and decision-makers.

The Smart Grid real-time monitoring platform operated by ENASCO, allows for real-time data regarding production and consumption. The trading platform will be based on the implementation of the same information. Here the Closed-loop optimal load control and intelligent monitoring of electric appliances for residential users (TE-10) will take place. The LEM based on P2P trading are prosumer-driven communities, which aim to work in collaboration to maximize self-sufficiency and bring down the volumes of traded energy with entities from the external market. Trading conditions, such as pricing, can be negotiated between the market participants. Moreover, both prosumers and consumers have the freedom of choosing who the transaction will take place with. The revenues in such markets are distributed between the prosumers and consumers that benefit from the difference between tariffs in the local and outside markets. The trading platform itself will be an implementation of OurPower's P2P marketplace, managed by the market participants. To ensure system reliability, agreements should be signed with the DSO and energy retailers. When members of the LEM share common interests they can establish prosumer-community groups or use the storage systems virtual power plants (although yet difficult due to regulation in most EU countries). To ensure the smooth operation of the P2P trading platform the TE-5 will take place, implementing blockchain technologies, smart contracts, etc.

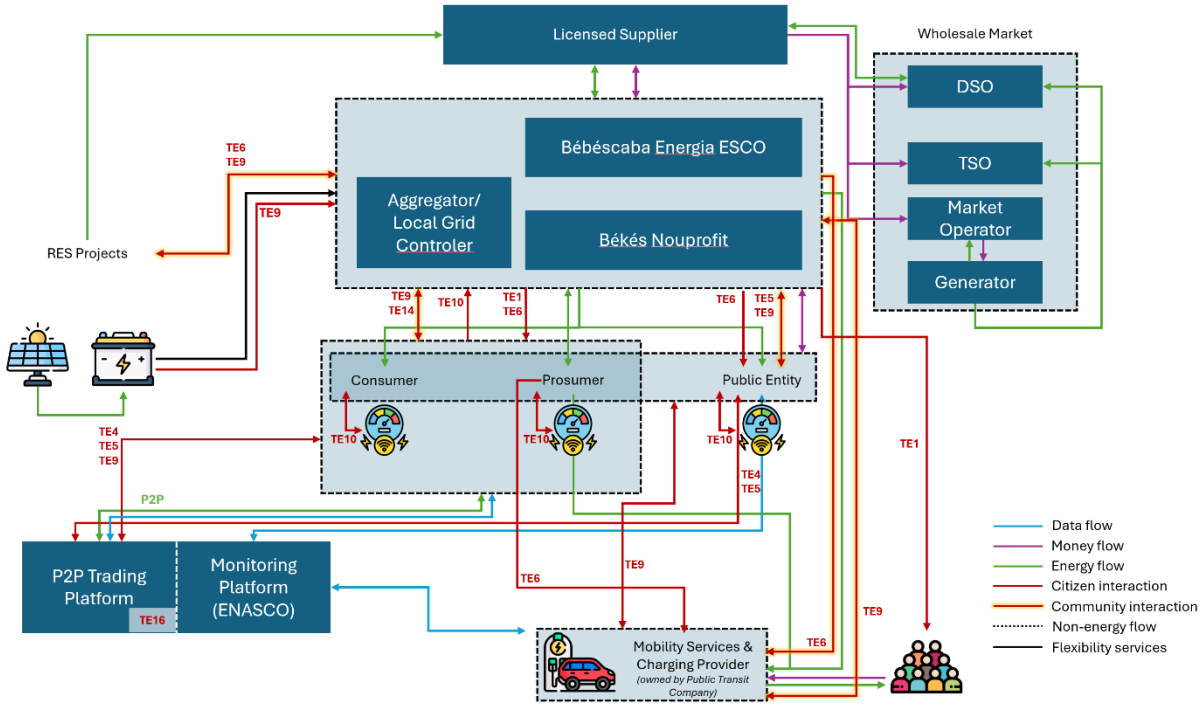


**Figure 18: Innovative consumer-centric BM - Hungary.**

### 3.2.6 Spain – Combination of Community ESCO BM with E-mobility Cooperative

**Key Partners**

-Residents
-Municipality (Town Hall), & Public Buildings,
-Vergy
-Local Grid controller and DSO
-Energy Suppliers
-Technology Provider/IT Service Provider
-User Experience Manager
-Mobility Services Providers

**Key Activities**

- Promote local energy generation and consumption
- Management of energy use
-Local Grid Controller
-E-mobility Services
-Community Engagement

**Key Resources**

-PV
-Solar Panels
-Remote management systems
-Digital platforms
-EV chargers with V2G
-Smart meters

**Value**

-Provide energy security, resilience and flexibility to isolated power distribution grid
-Reduce energy costs and strengthen community bonds
-Support energy citizens experience the "Living Lab"

**Customer Relationship**

-Built through community engagement and participation
-Services agreements
-Direct communication channel within City Hall and citizens

**Channels**

-Website, Whatsapp
-Localized energy infrastructure and smart technology networks
-Digital platform and associated apps

**Customer Segments**

-Community members
-Municipality and Community Institutions
-Grassroots organization

**Cost Structure**

-Administrative costs
-Service provision cost, digitalization of processes and technology setup
-Project development costs
-Community engagement

**Revenue**

-Membership fees
-Registration of new members
-Energy services and cost savings

**Figure 19: BMC application in Pilot 6- Spain.**

In the ongoing development of the EnC in the Spanish Pilot, intricate relationships are evident among various stakeholders. Notably, Vergy and a small DSO, CUERVA, the community developers, forge close ties with the Fornes Town Council. Moreover, the involvement of additional entities such as the City Hall, school, medical centre, swimming pool and most importantly the Utility Provider, further augment the creation of this residential community, which also holds the potential for the integration of small-scale businesses.

Within the framework of the Spanish Pilot initiative, the Utility Provider is assumed to have the role of an external company investing in the establishment of the EnC, thereby epitomizing the community ESCO BM archetype. Furthermore, the incorporation of Vehicle-to-Grid (V2G) projects, as part of the ENPOWER initiative, introduces an additional tier of the E-mobility Cooperative BM archetype. The synthesis of these two BM archetypes holds the promise of expanding EnC revenues while concurrently diminishing dependence on external power sources, thereby strengthening community self-sufficiency.

The primary objective of the Spanish Pilot revolves around enhancing self-consumption levels and optimizing scheduling through the utilisation of various flexibility assets within the community. Simultaneously, it aims to raise consumer awareness and foster greater engagement within the community. The community ESCO BM archetype emerges as a pivotal focal point, illustrating significant interest from both the external company (the utility provider) and EnC members, as it holds a crucial role in enhancing the income stream.

Within this structure, the principal remuneration schemes involve reducing external power supply demand, through the implementation of diverse EE strategies (such as energy audits, building renovations, insulation etc.). Additionally, the initiative could expand its reach by offering services to customers beyond the confines of the EnC.

The installation of additional capacity for the PV plant, bringing it to a total of 100kW, represents a meaningful step towards bolstering EnC self-consumption levels. Consequently, this initiative serves to diminish external power supply demands. This action can only be realized through investment on behalf of the utility provider. Upon reflection, this effort can be construed as a form of shifting energy demand so that it is met through renewables. The goal is that the energy balance will be improved through energy demand reduction, behaviour changes, or even efficiency measures.

Moreover, the addition of batteries and V2G technology, acting as storage solutions, holds the potential to further increase self-consumption. These assets not only improve flexibility within the energy system, but also offer e-mobility services, thus fostering greater member engagement and augmenting revenues for the EnC. This integration of V2G technologies demonstrates the essence of the E-mobility Cooperative BM archetype, where EnC participants assume roles as shareholders, mobility customers and decision-makers, collectively contributing to the EnC's sustainable energy activities.

By installing V2G e-chargers, the EnC stands to secure substantial benefits, as follows:

Generation of an income stream, by offering e-mobility services not only to EnC members but also to consumers outside the EnC.

Implementing e-mobility services for both EnC members and external customers. Prosumers can generate additional income when offering surplus energy upon payment, or reduced service prices to e-mobility providers. (Regulatory framework considerations are excluded from this discussion.)

Utilising V2G technology as originally envisioned, specifically as storage for peak-load hours, functioning both as vehicle-to-grid and grid-to-vehicle as required, thus acting as a valuable

flexibility asset. community assets, such as EVs, buses, and motorcycles can be exploited as flexibility resources within this context.

Such hybrid BMs seamlessly integrate flexibility and mobility solutions, offering an all-inclusive approach to sustainable energy management.

Leveraging the Living Lab platform, grants for the acquisition of real-time data on production and consumption, facilitating the identification of patterns and trends related to energy production and consumption. Moreover, using data from the Living Lab platform enables the use of advanced tools such as the AI-powered Virtual Manager (TE-13), the OSTEC-Optimised Scheduling Tool for EnCs (TE-12), and the SITEC-Sizing tool for EnCs (TE-2).

Utilizing these tools, the EnC may gain valuable insights and capabilities in energy consumption optimisation, scheduling, and resource allocation. Moreover, these technologies empower EnC engagement by providing stakeholders with the necessary tools and information to dynamically participate in decision-making processes and contribute to overall sustainability goals.

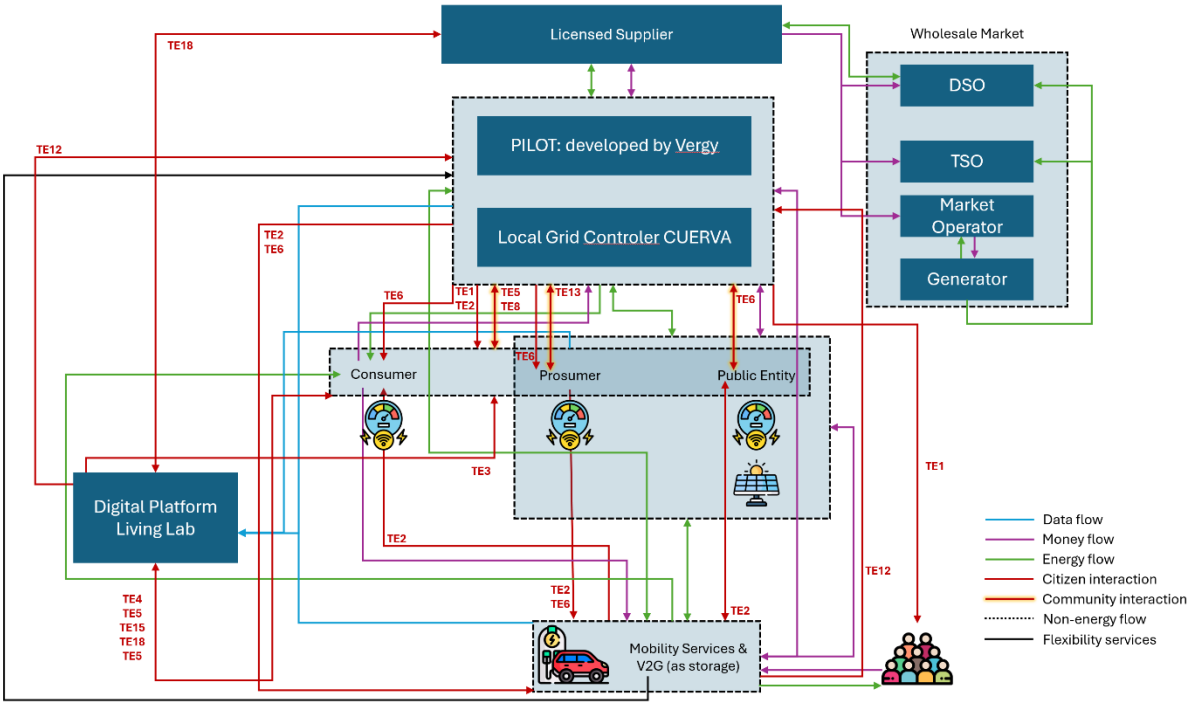


**Figure 20: Innovative consumer-centric BM - Spain.**

# 4. Conclusions

As mentioned in D2.2 "Energy Activated Citizens and Data-Driven Energy-Secure Communities for a Consumer-Centric Energy System" active participation in the energy sector empowers individuals and communities by giving them a voice in shaping their energy future. BMs should include and depict this parameter, since citizen engagement may also result in the creation of new value propositions for each EnC. Active participation can help mobilize public support for renewable energy initiatives, energy efficiency measures, and other sustainable practices. It also encourages behavioural changes and lifestyle choices that contribute to a more sustainable energy future. Overall, active societal participation in the energy sector is essential for promoting transparency, accountability, and inclusivity in decision-making processes, fostering innovation and creativity, building social acceptance for energy projects, and empowering individuals, communities, businesses, and authorities to contribute to a more sustainable and resilient energy system.

The main challenge in the existing BMs, is their failure to recognize the value of active behaviour from individuals within EnCs. To address this, the ENPOWER project, proposes innovative consumer-centric BMs that leverage citizens' engagement in all community procedures from energy production to ownership and management of community-level assets and representation in collective decision-making procedures. Through developing these business models, we have introduced new market roles that put consumer participation centerplate.

Firstly, these were spotted by the use of BMC for each pilot case, then diagrams of flows of energy and money were designed and in the very last step these archetypes were enriched by adding data flows and "citizen engagement" and "community involvement flows", constructing a very complex archetype, that illustrates the complexity of relationships between the involved actors, the directness of the information exchanges, the dependency between the actors and the multi prismatic interactions of the energy citizens both within the framework of the Community but also with external market stakeholders.

ENPOWER's business models foster a diverse and inclusive ecosystem involving stakeholders at local, regional, and national levels, with the inclusion of innovative technologies, such as interactive digital tools, engagement and management platforms, nudging apps and decision-making and supporting tools, as a "change agent" towards more energy democratized and dynamic models. These new business models offer potential new sources of benefits and revenues and fully customized solutions (mainly occurring through the increased powers and freedom of choices and actions of the energy citizens) tailored to the unique needs of individual energy consumers across ENPOWER's six pilot cases.

Some TEs allow citizens to directly address other sellers, transform themselves into buyers, shape their consumption behaviours, decide when to store and increase their level of energy literacy.

Other enablers allow citizens to express their opinions and insights and share their experiences in community/advisory board meetings, citizens' council and public consultations, reinforcing a more collective and representative form of participation in the EnC procedures.

Strengthening consumer leeway via technical enablers results in the new conceptualisation of energy citizenship and energy democratisation. The extended powers from the digital tools that are given to energy citizens work as a safety net, against the commercialisation of the operation of the communities, support trust, efficiency, and transparency of the procedures within the

community, and upgrade the role of citizens. However, despite efforts made at the legislative level by the EU and the national/regional authorities, despite the incentives to encourage citizen participation in energy communities, there is a mismatch between real participation and the demand for active participation. This parameter will be further explored by the end of the ENPOWER project.

The next steps of Task 2.5 include the Integration of the key findings of D2.2 (key factors underlying decision-making processes for the activation of energy citizens and their preferences regarding engagement measures) in the developed BMs, and the re-design of the BMs based on the evolution of the TEs for each pilot EnC.

Lastly, real-life consumers of the front-runner pilot EnCs will be approached (close-type questionnaires and two roundtables of online discussions) to confirm the designed flows arising from their participation and share their perspectives of how they perceive the "power" gained from each TE.

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