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Deliverable D5.1: Business models and financial and social instruments

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Executive Summary

This document describes the first part of activities in ECOLOOP projects Work package 5 (WP5): Innovative business models, financial instruments and policy recommendations to foster rural development and circular economy. The findings and results of the first 3 tasks are collected in this document:

- Task 5.1: Innovate business models for a circular and sustainable bioeconomy in rural areas
- Task 5.2: Definition of the financial and social instruments for farmers and foresters to promote rural development
- Task 5.3 Guidance on policy development to optimise the contribution of agroforestry to support sustainable rural development

The first part of the activities in each task was data collection, overview and analysis of existing business model, financial instruments and policy documentation on the European level and pilot countries. For the business model development, successful practices of energy communities and innovative business models were collected, and a methodology for pilot business model design was selected and applied to the pilot configurations. The business model design that was selected includes 3 aspects: economic, social and environmental in order to design sustainable and viable operation of RES investments with inclusion of local actors. The studied methodology was used to design a questionnaire and a business model canvas, and as a result, pilot-specific business models, with key components defined, were prepared and are included in this document.

The analysis of EU financial instruments and mechanisms shows a robust and evolving framework supporting a fair, inclusive, and sustainable transition. Traditional funds such as the ERDF and CAP are complemented by targeted tools like the Just Transition Fund (JTF), Recovery and Resilience Facility (RRF), and EU Renewable Energy Financing Mechanism (RENEWFM). Instruments including EFSI, ELENA, and InvestEU play a catalytic role in mobilising private capital and innovation, while decentralised models, as in Spain, enhance accessibility for SMEs, farmers, and energy communities. Emerging approaches—crowdfunding, Power Purchase Agreements (PPAs), Pay-As-You-Go systems, and Local Energy Communities—further democratise energy access and participation. The findings highlight that effectiveness depends not only on investment scale but also on governance, coordination, and stakeholder engagement. Collectively, these instruments form a complementary financing ecosystem aligned with the European Green Deal and Fit for 55, fostering cohesion, resilience, and inclusive growth across Member States. Rural renewable energy development represents a critical pathway for achieving EU climate neutrality by 2050 while addressing rural economic challenges. With agricultural land and forests covering 80% of EU territory, rural areas possess vast renewable energy potential through solar, wind, and biomass resources.

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Administrative complexity (6 months–2 years permitting) and community acceptance - especially for wind - remain major barriers. Direct subsidies are most effective, while carbon credits have limited impact. Spain shows strong policy integration, Estonia excels digitally but faces acceptance issues, Bulgaria prioritises subsidies without community frameworks, and Slovenia demonstrates balance with community energy strengths.

A two-phase approach is recommended: **short-term (2024–2027)** measures - EU energy community frameworks, EAFRD allocation to renewables, rural advisory services, streamlined permitting, and benefit-sharing - and **long-term (2028–2034)** systemic change through integrated rural transition plans, institutional and market innovation, and positioning rural areas as leaders in sustainable technologies. The central message: rural renewable energy must move beyond capacity expansion toward reimagining rural areas as key actors in sustainable societies, requiring political commitment, resources, and genuine community partnership.

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1. Introduction

1.1. Purpose of the document

The project ECOLOOP will define and analyse innovative business models that will be tested and compared in different scenarios and conditions at the project's pilot sites. The report addresses existing barriers and considers new technologies and solutions to accelerate the promotion of renewable sources in rural and agricultural areas. The final purpose of the document is to give an overview of innovative business models, a methodology to design successful business operations with consideration of economic, social and environmental aspects. The methodology is applied to existing pilot assets and prepared for further application of the Business model design for new potential RES investments and energy communities.

When establishing new operations, financial aid can assist or even enable the investment as a whole. To give a clear overview of the available options, a detailed review of financial mechanisms at the EU, national and regional levels highlighted the most suitable, straightforward or user-friendly mechanism in each of the pilot settings.

Review of European and national legislation policy and directives created a comparative analysis of legislation on the European level, selected 4 pilot countries and based on the analysis of various practices, short-term and long-term policy recommendations were prepared.

1.2. Scope of the document

The document describes activities of WP5 tasks, where innovative business models, financial instruments and legal aspects were investigated. Findings of each task from T5.1 to T5.3 are described in this report in individual chapters. The tasks started with a literature review on an individual topic within the task. The second step was a detailed national analysis of pilot countries on legislation aspects, preparation of methodology for business model design and financial instruments' potential application to the pilot assets investments.

1.3. Structure of the document

The document presents intermediate results of active tasks in WP5 in the following order:

- **Chapter 1:** describes purpose, scope and structure of the document.
- **Chapter 2:** introduces the concept of energy communities, emphasising the role of citizens in the energy transition.
- **Chapter 3:** presents the business model methodology, introducing a three-layered framework for designing and analysing energy community business models
- **Chapter 4:** presents triple layered BMC application to the ECOLOOP pilots.
- **Chapter 5:** provides an in-depth overview of existing European public, private, and mixed financing mechanisms, detailing various EU funds, investment instruments, and financial schemes that can be leveraged by energy communities.
- **Chapter 6:** highlights innovative financial models, including emerging approaches such as local energy communities and pay-as-you-go systems, which offer promising alternatives for funding decentralised energy solutions.
- **Chapter 7:** focuses on the existing EU and national regulatory frameworks that support renewable energy in agroforestry systems, comparing policies across Bulgaria, Estonia, Slovenia, and Spain.
- **Chapter 8:** contains a review of National Energy and Climate Plans (NECPs), summarising how each country integrates rural development and renewable energy targets.
- **Chapter 9:** outlines the benefits of renewable energy production in rural areas, examining the positive impacts on both the agricultural and energy sectors, as well as their potential synergies.
- **Chapter 10:** concludes with a set of policy recommendations aimed at enhancing the role of renewable energy in rural development, structured around short- and long-term priorities.
- **Chapter 11:** contains conclusions of the document
- **Annex 1:** contains the business model canvas questionnaire
- **Annex 2:** provides detailed information on financial instruments.

2. Citizens and energy communities as foundation for business models

The European Union describes ECs (Energy Communities) as citizen-driven energy actions that contribute to the clean energy transition and advance energy efficiency within local communities. ECs enable collective energy actions and the clean energy transition. They affect the increasing public acceptance of renewable energy sources (RES) projects and make it easier for private entities to invest in clean energy transition. Besides their social impact, the establishment of ECs also lowers electricity bills, reduces energy poverty, increases energy efficiency, and creates green job opportunities.

ECs can take different forms of legal entities, including associations, cooperatives, partnerships, non-profit organizations, or limited liability companies. Acting as an entity means that every EC can access suitable energy markets on a level playing field with other market actors.

The EU backed ECs with a legislative change in 2019 through the "Clean Energy for All Europeans" package[1]. In this package, ECs were introduced as citizen energy communities and renewable energy communities. Later, the Directive on common rules for the internal electricity market was introduced to support the uptake of energy communities. This directive enabled active consumers to participate in energy markets through citizen energy communities or individually. They could participate by generating, consuming, sharing, and selling electricity or providing flexibility services through demand response and storage. The EU estimates that by the year 2030, more than 50 GW of wind power and more than 50 GW of solar power could be owned by ECs[3].

With the RED (Renewable Energy Directive) II (2018/2001/EU), the role of ECs became even stronger. The EU mandated countries to enable ECs and offer support schemes to accelerate the development of many ECs.

There are currently two legal definitions at the EU level: CEC (Citizen Energy Community) from the Electricity Market Directive and REC (Renewable Energy Community) from RED II[3]. The table below shows the key differences between these two versions. Most noticeable differences would be that CECs are technology-neutral and can operate across borders, while RECs are restricted to renewable sources and must involve members located in close proximity to the projects.

Table 2-1: Comparison of CEC and REC (Source: CEER and EU)

	CEC	REC
Governance and Members	Legal entity based on voluntary and open participation, controlled by shareholders or natural persons, local authorities, including municipalities, and small or micro enterprises.	Legal entity based on voluntary and open participation, autonomous, effectively controlled by shareholders or members who are in the proximity of the RES projects that are owned and developed by that legal entity. The shareholders or members can be a natural person, SMEs, or local authorities (including municipalities).
Primary Purpose	To provide environmental, economic, or social community benefits for local members and areas.	The primary purpose of a REC is to provide environmental, economic, or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.
Activities	Electricity generation, distribution and supply, consumption, aggregation, storage, or energy efficiency services. Generation of renewable electricity, charging services for EVs, or providing other energy services to its shareholders or members.	A REC can engage in activities based on renewable energy sources, including generation, energy efficiency, supply, aggregation, mobility, energy sharing, self-consumption, and district heating and cooling.
Technologies	Technology neutral	Limited to RES
Geographic Limitations	No geographic limitations, cross-border operations are allowed.	The shareholders or members must be in proximity to the renewable energy projects that are owned and developed by the Renewable Energy Community.

In recent years, the European Parliament has provided support and funding for three different projects that contributed to the promotion of best practices and provided technical support for the development of concrete EC initiatives across the EU. In addition to the Support Service and Citizen-Led Renovation and the Energy Communities Repository, the European Parliament funded the Rural Energy Community Advisory Hub, which was launched in June 2022. It was established to assist citizens, rural actors, and local authorities in setting up CECs or RECs in rural areas. The project offered technical and administrative advice and

encouragement in the development of various projects. The key activities of the project were described as follows:

- Identification of best practices concerning support frameworks for rural energy community projects, with close involvement of local authorities.
- Providing technical assistance to selected rural energy communities.
- Providing networking opportunities to local stakeholders.
- The project concluded at the end of March 2024.

In the last few years, many countries within the EU have taken part in establishing ECs and legal frameworks that enable consumers and producers to connect through ECs. Each country has considered EU directives but modified the system to suit its specific situations. Denmark, for example, has a long tradition of collective investments in wind turbines and has recently accelerated the deployment of PVs through collective investments, where utility companies not only connect the PVs to the grid but also partially own the projects. Germany also has a long tradition of ECs. On the other hand, Spain and Portugal have begun developing ECs in the last few years. Spain was the first country to enable collective self-consumption in 2018, the same year the RED II Directive was published. Outside the EU, ECs are also enabled; for example, Australia and the USA both offer some forms of ECs.

In terms of business models, much research has been done, and a wide range of literature is available. Over time, legal frameworks have changed, and suitable business models have evolved accordingly. Some business models have been developed specifically for rural ECs, which will be studied and evaluated in the chapters below. Due to the high demand for establishing ECs and the constant evolution of the field (technology improvements, social aspect evolution, political situations, and financing), previous evaluations of the models may change, and there may be a need to develop new business models.

3. Business model methodology

This chapter presents the selected methodology for business model design and its application to RES and community projects. Best examples of energy sharing, energy communities and third-party business models are presented in the second part of the chapter.

3.1. 3-layered business model concepts

The Business Model Canvas (BMC) condenses an organisation's business model (BM) into nine interconnected components: customer value proposition, segments, customer relationships, channels, key resources, key activities, partners, costs, and revenues. While the BMC can help users align profit and purpose to support more sustainability-oriented value creation, in practice, environmental and social value are often implicitly deemphasised due to the canvas's more explicit focus on 'profit first' or economic value.

It is important to understand that there is no specific or detailed definition of a BM, which is why it is necessary to develop and establish goals and criteria to understand what should be achieved with the development of the BMC. The three key aspects are:

- How value is delivered to the customer (integration of components, functions, or parts);
- How components, functions, or parts are interconnected within the organisation, its supply chain, and stakeholder networks;
- How value is generated, or profit is created, through these interconnections.

The Triple Layer Business Model Canvas (TLBMC) structure enables the integration of traditional economic aspects of a BM with innovative environmental and social considerations. The TLBMC can be seen as an enhancement of the traditional BM and the Triple Bottom Line (TBL). TBL theory broadens conventional business models by incorporating additional aspects, often referred to as the "3 P's": people, planet, and prosperity[4].

To decrease energy and resource consumption, BMs should not be viewed solely from an economic perspective. It is crucial to support individuals and organisations in pursuing sustainable, yet economically feasible, BMs. The TLBMC tools facilitate the reconstruction of existing economically oriented BMs and the creation of new, innovative ones. There are two main approaches to using BM tools: outside-in and inside-out. The outside-in approach involves integrating various established BMs into an organisation's structure to explore

innovations and optimise their systems. For instance, an organisation can implement one or a combination of different BM archetypes to transform its BM most sustainably and successfully. In the literature, this process is referred to as cross-pollination. Contrary to the outside-in approach, the inside-out approach starts with the existing elements within the organisation. The inside-out approach involves modifying the existing BM using tools or elements from other BMs.

With its simple design, the TLBMC is easy to visualise and understand. It is an enhancement of the existing structure of a BM. In the following chapter, the economic layer of the BM is presented. By creating similar social and environmental layers, the inter- and intra-layer connections are established. This enrichment of traditional BMs makes integration and sustainability more achievable.

3.1.1. Economic layer of the business model

Traditional BMs describe the relationships between different economic aspects of a business organisation. Due to the wide variety of organisations, it is challenging to standardise the structure and process of BM establishment. Each organisation has its unique products or services, along with distinct components of the BM, risks, and goals. In 2010, Osterwalder and Pigneur introduced the BMC, which graphically presents the connections between different aspects of a BM. The scheme below displays the nine segments that make up the BM. It is believed that only BMs built within the same canvas can be compared with one another and subsequently optimised to achieve greater profitability and success. In continuation, the nine segments that cover and connect the most important aspects of a BM will be presented, ranging from the offer and infrastructure to viability and customers[4].

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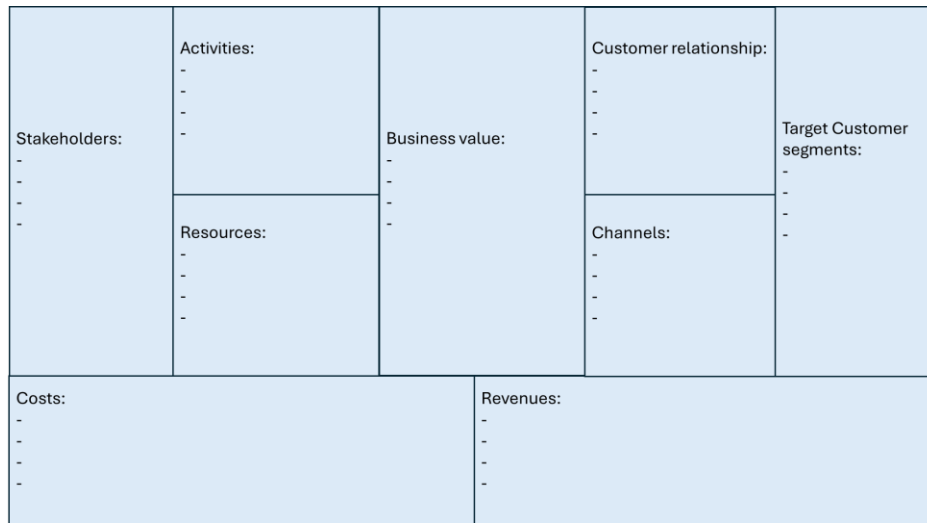


Figure 3.1: Economic layer template

Business Value means that customers are attracted to an organisation's product or service. This segment should describe how the organisation's product or service differs from others on the market. It can be explained as an aggregation, bundle, or set of benefits that the organisation offers to customers. Some business values may be innovative, representing a new option on the market, while others may be similar to existing values but optimised with new features or attributes.

Key resources include the most important assets required to make a BM work. Key resources can be physical, financial, intellectual, or human. They enable organisations to create and offer their value proposition, reach markets, maintain relationships with customer segments, and earn revenues. It should be noted that key resources are not always owned by the organisation; they can also be leased or acquired from key partners.

Key activities are closely connected with Key Resources and with the same goal of enhancing value propositions. Key Activities are the most critical tasks an organisation must perform to establish a successful BM. These key activities are essential for increasing the value proposition, reaching markets, maintaining customer relationships, and earning revenues.

Stakeholders are the partners in BM, and organisations must focus on their suppliers and other partners that make the BM work. Successful BMs rely on a strong rapport between the organisation and its suppliers, where each party has defined roles and responsibilities. The BM Canvas should enable organisations to identify critical routes and suppliers, prepare for critical situations, manage risks with risk management sheets, optimise the BM, and acquire necessary resources.

Customer relationship segment defines the relationship between the organisation and its customers. The organisation should specify the type of relationship it aims to establish. It is important to note that these relationships can range from personal to completely automated. Additionally, critical customer routes should be identified, and a risk management analysis should be performed.

Channels define how the value proposition will be delivered to customers. This segment encompasses communication, distribution, and sales channels. These channels are crucial to the BM, as they represent the “touch points” where customers interact with the organisation and its value proposition.

Target Customer segments include customers, who are the “heart” of the BM. An organisation’s success depends on the number and satisfaction of profitable customers. Given the high competition in the market, it is crucial to understand customers and their needs. To effectively meet customer needs, an organisation can group customers based on common needs, behaviours, or other attributes relevant to its product or service. Defining customer segments should be one of the first steps in creating the BMC, as it should be built around these segments.

Revenue Streams are closely connected to the previous one, Customer Segments. With a successful establishment of Customer Segments, Revenue Streams can be created. Revenue Streams represent the cash flow from customers to the organisation. The organisation should strategically determine the value of its products or services to generate one or more Revenue Streams. The mechanisms for defining Revenue Streams vary widely depending on the organisation. The choice of mechanism depends on the type of product or service offered and the customer segments in the organisation’s BMC. These mechanisms may include fixed list prices, bargaining, auctioning, market dependency, volume dependency, or yield management.

3.1.2. Environmental layer of the business model

The foundation of the Environmental layer is based on Life-Cycle Assessment (LCA), a formal method for measuring the environmental impacts of a product or service throughout its entire lifecycle. LCA provides various indicators for calculation and assessment, with the most popular being CO₂e, ecosystem quality, human health, resource depletion, and water use. TLBMCs are typically not integrated with technical and formal LCA analyses, but components of LCA are considered when establishing the environmental aspect of the BMC. When assessing the environmental aspect of a product or service, it is important to determine whether the organisation creates more environmental benefits than impacts. To expand, the

environmental layer in the TLBMC is not included solely to reduce the negative impact of a product or service, but to provide an opportunity to create products or services that also offer environmental benefits. In numerical terms, analyses aim not only for a negative result approaching zero but also enable products to achieve a positive impact[4].

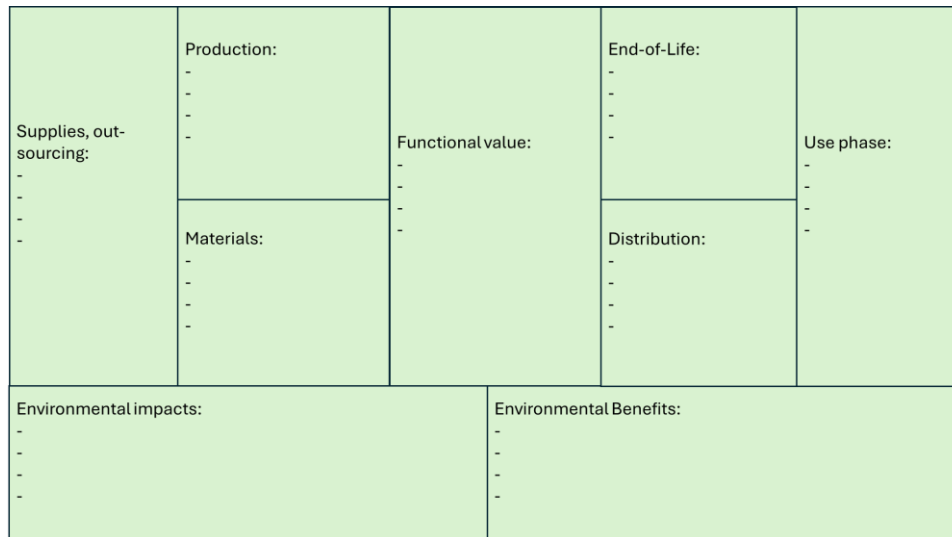


Figure 3.2: Environmental layer

Functional value represents the final focal output of the examined product or service. It is important to note that functional value is the sum of functional units over an agreed time span. Therefore, when performing an LCA analysis of a product or service, or when assessing the Environmental layer in the TLBMC, the functional unit must first be calculated, and then the functional value is established based on the period. The functional unit not only provides the necessary data for calculating functional value but also serves as a baseline for exploring the impacts of alternative business models. Additionally, results from LCA parameters, such as functional value, are meaningless without a period. Presenting values without a time frame can significantly distort the results. For product assessments, the lifespan is usually easily determinable; however, for services, which sometimes lack a defined end of life, one year is often used.

Materials, in contrast to the classical BMC, where materials are considered part of resources, the BMC should incorporate the materials used for its product or service. It is important to note that accounting for every material used in the process can be time-consuming, increase the complexity of the model, and make the results harder to interpret. The BMC should focus on acknowledging and incorporating the materials that are most important for different layers of the model. From an environmental perspective, one should consider scarce

materials, located in protected or hard-to-reach areas, etc. For synthetically produced materials, it is crucial to understand the sources of raw materials, the precursors and possible by-products of production, and the energy used to acquire these materials. It is important to remain objective and consider the most frequently used materials or those that need to be included in the risk management analysis. For manufacturing products, the segment of materials should be straightforward. Critical materials should be identified, as they are typically integrated into the production line of the product. Conversely, defining critical materials for service analysis using the BMC can be more challenging. Every step of the BM should be reviewed, and the determination of materials or equipment that might require risk management should be carried out.

Production is in the Environmental layer of the BMC, a replacement for the traditional Activities component found in the classical economic BMC. Similar to the Materials segment, the focus here should be on key activities that may require risk management or have an environmental impact. To identify critical elements within Production, it is essential to understand the manufacturing processes involved and how services are delivered to customers. The Production segment typically represents a significant portion of the Environmental layer of the BMC, highlighting its importance in sustainability and risk management analysis.

Supplies and outsourcing include all materials and production activities related to the organisation's value but not considered a "core" component. Each BMC may have its definition of what constitutes "core" activities. "Core" actions are typically unique to the organisation and provide value and advantage to its products or services. Conversely, utility expenses, such as electricity and water, are considered external and are therefore not classified as "core." The specific nature of Supplies and Outsourcing is that organisations often have limited control over these elements. However, in certain situations, organisations can gain control over them and thereby minimise their environmental impact.

Distribution can be understood as the physical means by which the organisation ensures access to its functional value. In the environmental layer, considerations should include transportation modes, distances travelled, and weights of the items being transported. Packing and delivery logistics are also important factors to consider.

Use phase refers to the period during which clients engage with the organisation's functional value, core service, or product. This includes maintenance and repair of the product, and, in some cases, the usage of the product or service itself. During this phase, there may be a demand for material resources or energy. For some products, the environmental impact during the use phase can be higher than during manufacturing; thus, the Use Phase can vary

significantly between different products and services. Organisations must consider the Use Phase in their BMC and not merely leave it to the user's responsibility. Additionally, the End-of-Life segment is crucial for a product or service and should also be considered in the BMC.

End-of-life is another segment that is not entirely dependent on the organisation. When a client decides to stop using a product or service, there should be a strategic plan for its subsequent handling. For products, End-of-Life considerations include material reuse through recycling, remanufacturing, repurposing, disassembly, incineration, or disposal. Organisations are required to account for the End-of-Life segment even before launching a product to the market, due to regulations imposed by national governments or, in the EU, by the European Commission. The goal is to manage the environmental impact of the product by extending its use beyond its original purpose. This segment can differ for organisations selling services, as many services can be improved and relaunched, potentially making End-of-Life considerations less relevant in those cases. Additionally, organisations can benefit from opportunities to create new BMs, such as product-service systems and industrial symbiosis.

Environmental impacts and benefits address the ecological costs and value creation associated with the organisation, its products, and services. Ecological costs can be evaluated using various factors such as LCA, CO₂e emissions, human health impacts, ecosystem effects, natural resource depletion, and water consumption. Value creation can be defined as minimising the negative ecological impact of the organisation over time, or a project, or even creating a positive environmental impact.

3.1.3. Social layer of the business model

With the addition of the Social Canvas to the classical BM, social impact is considered alongside economic gain. The Social Canvas is primarily built on a stakeholder management approach, which seeks to balance the interests of different stakeholders rather than focusing solely on the organisation's economic benefits. Typical stakeholders include employees, shareholders, the community, customers, suppliers, governmental bodies, and interest groups. Additionally, other social groups such as media, marginalised communities, and even non-human actors like natural ecosystems can be classified as stakeholders, connecting this canvas to the environmental layer of the TLBMC.

Assessments of social impact can be performed using various methods, including social life cycle assessments, ISO 26000, and other standards and social impact factors. Similar to the Environmental Canvas, the Social Canvas is constructed from the stakeholders' perspective and extends the traditional single-layer BM. The analysis of the Social Canvas can vary significantly between organisations, as the number of stakeholders and their relationships

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with the organisation differ. The canvas is again divided into nine segments, which explain the relationships among stakeholders and their connection to the organisation's product or service. Although the canvas is built from the stakeholders' point of view, it provides insights into the social value generated by the organisation's product or service[4].

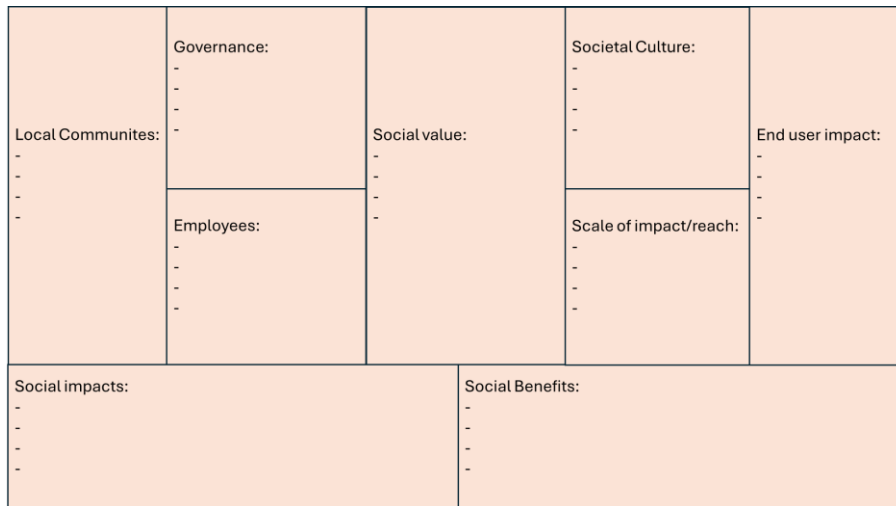


Figure 3.3: Social layer

Social value provides an estimation of an organisation's success in delivering social benefits to its stakeholders and society at large. Many organisations recognise the importance of social benefits beyond purely financial gains from their products or services. By focusing on improving social value, organisations not only enhance their sustainability orientation but also improve their reputation.

Employees are usually a crucial part of an organisation's social value. Its structure depends on the organisation's goals, values, and operational style. The analysis of the Employee section can include a wide range of elements, from basic information such as the number and type of employees to more detailed segments like gender, ethnicity, pay variations, and education. Given the many variables and parameters to consider, it is essential to focus on data that is most relevant to the organisation's functionality concerning its product or service, while less important data can be excluded. By narrowing the scope of data, complexity is reduced, making the analysis more effective, and the results more representative and easier to interpret.

This section should also discuss employee-oriented programs. Potential programs include training, professional development, and additional support initiatives such as onboarding programs. These programs contribute to the organisation's reputation, viability, and

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sustainability, while also enhancing employees' trust, confidence, and sense of belonging to the company.

Governance addresses the organisational structure and decision-making policies of an organisation, defining stakeholders and their roles within the organisation. Organisational arrangements can vary widely. Different organisations may have different ownership structures, such as cooperatives, not-for-profit entities, privately owned for-profits, or publicly traded for-profits. Internal structures also differ, including variations in hierarchy, functional versus unit specialisation, and decision-making policies such as transparency, consultation, non-financial criteria, and profit sharing. Given the numerous ways governance can influence organisational structure, there is no single correct approach to creating social value. It should be analysed thoroughly and tailored to each specific organisation.

Communities are also included in the social layer. While traditional business models typically consider only economic relationships with business partners, the TLBMC includes relationships between the organisation, its suppliers, and local communities. Although suppliers often operate independently, they collectively form a community that the organisation heavily relies on. Local communities are also a vital aspect of social value. Strong relationships between the organisation and the community can lead to mutual benefits. For smaller organisations with one or two operational plants close by, establishing a close rapport with the local community is generally easier. In contrast, organisations with plants in various locations around the world must navigate diverse local cultures and realities. These organisations often focus on building strong relationships with the communities around their headquarters but should also consider the communities near their other operational plants.

For some organisations, suppliers may also be part of the local community. This can create a mutually beneficial situation, but it also poses significant risks if the relationship with local suppliers or the community deteriorates. There is an external risk associated with the relationship between the local community and local suppliers. Organisations should anticipate potential critical situations, predict possible problems, and prepare risk management data sheets to respond swiftly to any changes in these relationships.

Societal culture focuses on the impact of the organisation on society and vice versa, suggesting that an organisation can only thrive within a "healthy" society. Non-governmental organisations (NGOs) also play a crucial role in fostering societal acceptance of the business. Their involvement can significantly influence how well the organisation is integrated and accepted within the community.

Scale of outreach describes the depth and breadth of the relationship between the organisation and its stakeholders. This scale can be expanded through long-term, integrative

relationships and by extending the geographical reach of the organisation's impact (local, regional, global). The organisation can enhance its presence and growth by considering diverse cultural and ethnic factors across different countries and regions.

End-users segment focuses on how the value proposition is delivered to the customer and how it meets their needs, either improving or declining their quality of life. Organisations often serve various groups of customers, so segmenting end-users can be beneficial. Grouping can be based on factors such as age, income, ethnicity, education level, etc. The goal of segmentation is not to exclude certain groups but to tailor products or services to different groups, enhancing inclusion and usability.

Social Impacts and benefits evaluate positive and negative value propositions. There is no standardised procedure for assessing an organisation's contributions—whether positive or negative—to society. Both Social Impacts and Social Benefits can be measured using various indicators, but these indicators are chosen by the organisations themselves. This self-selection can lead to a distortion of results, as only indicators that yield positive outcomes might be highlighted. However, organisations are best positioned to select and analyse indicators relevant to their own BM. Indicators for assessing social impacts might include working hours, cultural heritage, health and safety, community engagement, fair competition, and respect for intellectual property rights. Positive social benefits could include opportunities for personal development, direct and indirect training, and other developmental chances.

3.2. Energy sharing business models

With the 5D energy mega trends, namely decarbonisation, decentralisation, digitisation, democratisation and disruption-as-usual, the traditional energy market is entering the new era of decentralised, distributed, clean and smart energy systems. The transformation is taking place not only at the sector level but also at the actor level. At the sector level, the main differences happening are in the digitalisation and distributed energy resources. More and more power is provided from smaller assets with lower investment costs, which could initiate new local energy market models. Due to new movements and trends, such as ECs, new BMs are needed. Most innovative BMs are based on power purchase agreements (PPA), peer-to-peer (P2P) trading, community or collective self-consumption (CSC), and transactive energy (TE). ECs play an important role in the future development of energy markets, in the increase of the renewable energy sources (RES) consumption and serve as a protection against energy poverty.

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With the help of BMC most suitable BMs for ECs will be presented. Most of them are based on PPA, P2P or CSC trading mechanisms and differ in technicalities, economic aspects, and each has its own derivations, etc.

In the tables below, TLBMC for the ECs in general is presented. First, the economic aspect is tackled (Figure 3.4), then the environmental (Figure 3.5) and lastly the social (Figure 3.6). Due to many derivatives and specifics, each EC should have its own BMC; mostly economic aspects differ more between the derivatives. On the other hand, environmental and social BMC are similar, regardless of the derivation chosen. Due to the broad spectrum of ECs, the BMC presented below is not definitive but should be considered in terms of guidelines when designing a unique TLBMC.

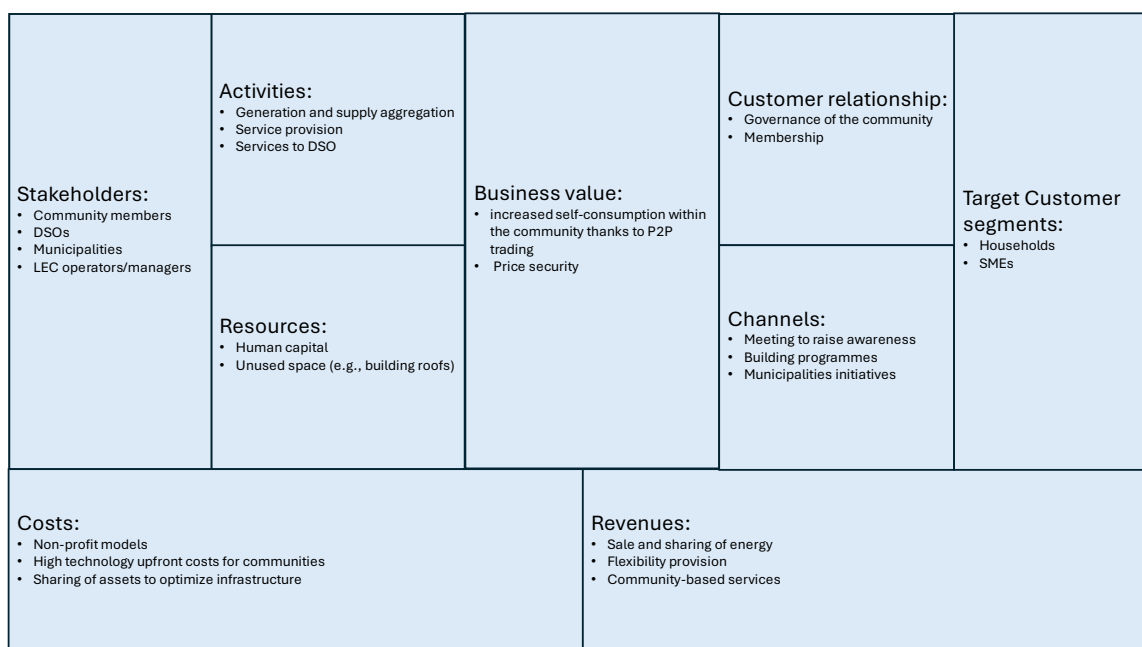


Figure 3.4: Economic layer of energy sharing bussines models

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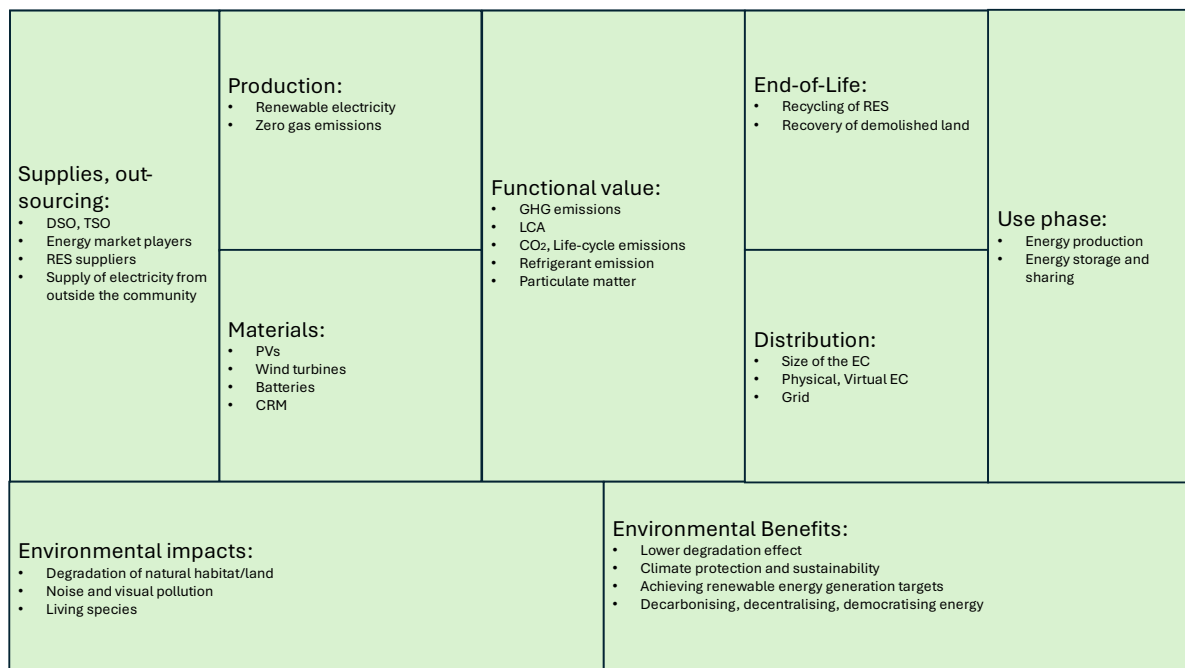


Figure 3.5: Environmental aspect of energy sharing business models

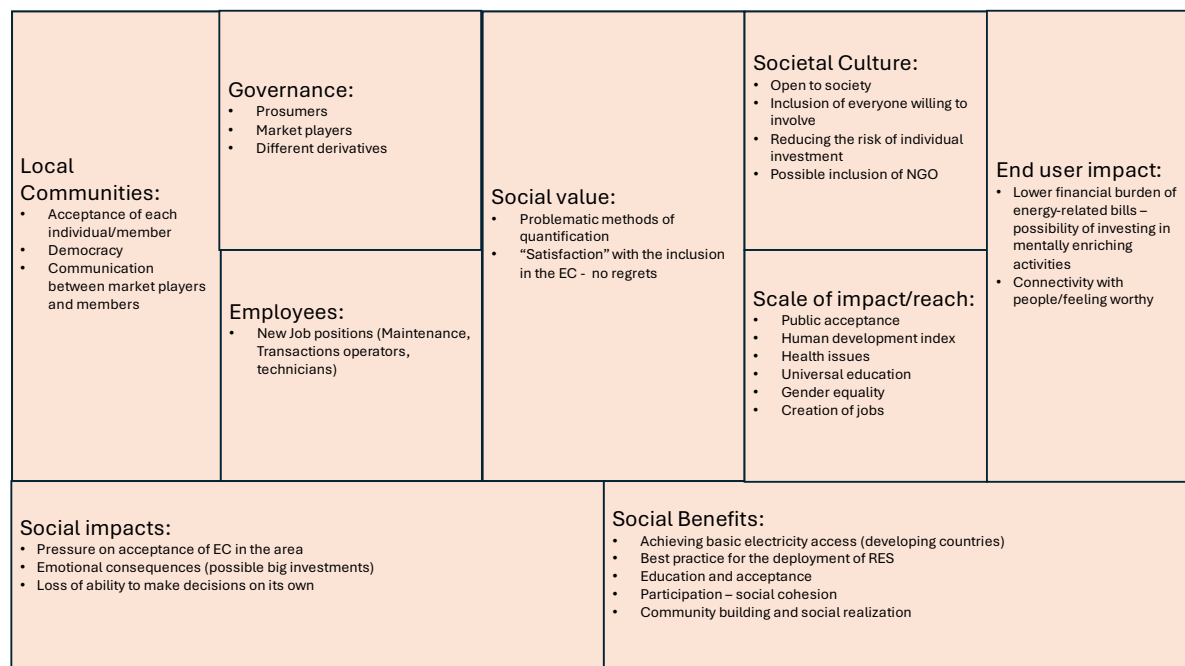


Figure 3.6: Social layer of energy sharing business models

3.3. Derivations of EC BMC

The BMC for ECs should be modified compared to a classic BM to achieve a more sustainable and efficient model. The first and most obvious difference is found in the segment of Key Consumers, where the BM focuses not on the market but on the citizens involved in the EC. Consequently, Customer Relationships, Key Activities, and Value Proposition are also adapted. In terms of Key Activities, there are additional tasks required to achieve the most efficient BMC, such as services to Distribution System Operators (DSOs) and ensuring security of supply. Recent reports have highlighted these activities as problematic due to varying legislation and regulations at the national level. With the rapid development of ECs, there is a need for unified legislation at the EU level.

With ECs being a sustainable and future-oriented approach to providing energy to citizens, the inclusion of the second and third layers of the BMC is necessary. Legislation is evolving and should be unified at the EU level, enabling ECs across the EU to more easily satisfy not only economic value propositions but also environmental and social ones. A segment that differs from the traditional BMC, as mentioned above, is Customer Relationships. In the context of ECs, Customer Relationships refer to the interactions between the governance of the community and its members.

The definition of ECs suggests that to establish ECs, community members must be financially involved, and the whole BM must be created by, for and with them. With that value, prepositions and risks are shared between EC members. Additionally, some ECs can also have external financial involvement; thus, from the investment perspective, EC BM can be categorised as Customer-side BM or even Third-party-side BM. It is important to acknowledge that ECs are not run solely for economic profit; nevertheless, investors or members should be guaranteed by BM the return of their investments. This could be directly or indirectly, meaning with a cheaper energy supply, selling surplus of generated energy or participation shares. As a revenue self-consuming option, and reduction in power grid dependency can be counted as well. In addition, there are also other revenues that are based on the environmental and social layer of TLBMC. In the scheme below (Figure 3.7), all nine segments of BMC are described thoroughly.

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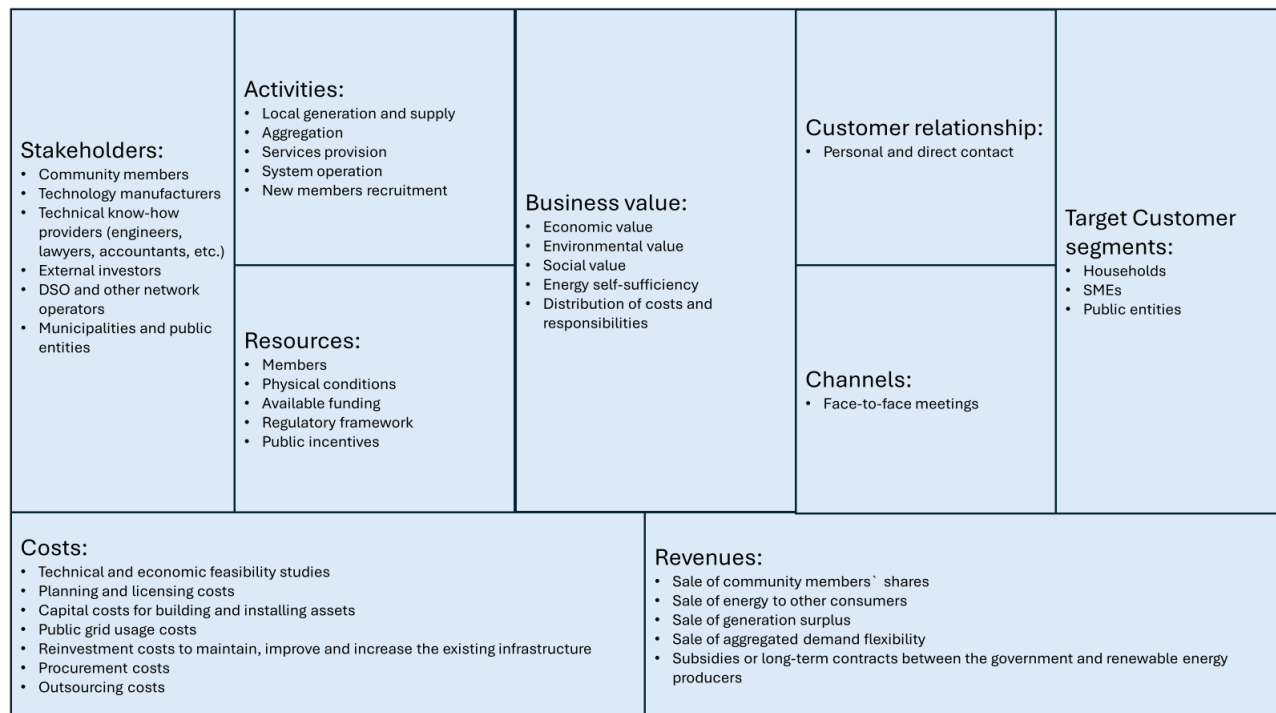


Figure 3.7: ECs economic BMC

ECs, even though clearly defined in EU legislation, are still in the early stages of development with very limited economic revenues. Currently, the main revenues for members come from reductions in expenditure through increased self-consumption, or from actual revenues generated via P2P transactions. Although the number of ECs is rapidly increasing, questions remain about their pure economic and technological potential. The main technological concerns are related to the grid, as most EC members are prosumers, sending electricity into the grid. Even though the transition and development of ECs are progressing effectively, they are predominantly focused on electricity generation and consumption, often neglecting other energy carriers such as heat and transport. Additionally, most ECs concentrate on RES from PV, while neglecting other sources. This focus is understandable since PVs are among the cheapest technologies and the easiest and quickest to build, but this could pose challenges for ECs in areas with fewer sun hours. Currently, Cluster ECs are concentrating more on increasing member involvement and reducing carbon footprints, aligning with the environmental and social layers of the TLBMC.

The situation with ECs is evolving rapidly, but current trends suggest that these communities are and will continue to be of interest to members and citizens who care about the environment. It is established that, even though ECs currently have a limited impact, they are essential as relays and showcases for sustainable energy practices. With the uncertainty

surrounding future energy sources and the potential for electricity price increases, ECs are likely to gain importance and attract more interest from investors and members and citizens.

Customer-side BMC

The most common version of ECs in Europe is energy cooperatives. These are citizen-led initiatives in which end-users join to raise funding for owning energy generation systems. While energy cooperatives can be run in various forms and ways, they share common principles such as voluntary and open membership rules, democratic control (typically one vote per participant), and economic involvement of all participants.

Energy cooperatives are usually established as retail co-operatives with shareholders involved in shared financing of medium and large-sized PV and/or wind power plants. With the establishment of a co-operative, they can compete in the market with other players. In some cases, energy cooperatives can also be run as non-profit organisations focused on self-consumption. Surplus energy can be sold to the grid, and profits are reinvested in the community. Additionally, energy cooperatives can act as local DSOs on regional low-voltage grids, allowing them to define their billing conditions, incentivise self-consumption, exempt members from specific use-of-system tariffs, and even purchase energy from the market to sell to their end-users.

Downside of the Customer-side BM is the high up-front costs and long-term payback periods; therefore, only homeowners and SMEs can enter this BM scheme. In addition, those prosumers need to fulfil conditions to install RES, have the demand flexibility and all the technology to completely exploit the BM upsides. The BMC is presented in the scheme below on Figure 3.8.

There is also an option for energy cooperatives to be controlled by a public entity, such as a municipality, which provides technical knowledge (and in some cases funding) and lowers the price of electricity for its consumers. In summary, the operation of energy cooperatives is usually defined by government and national legislation.

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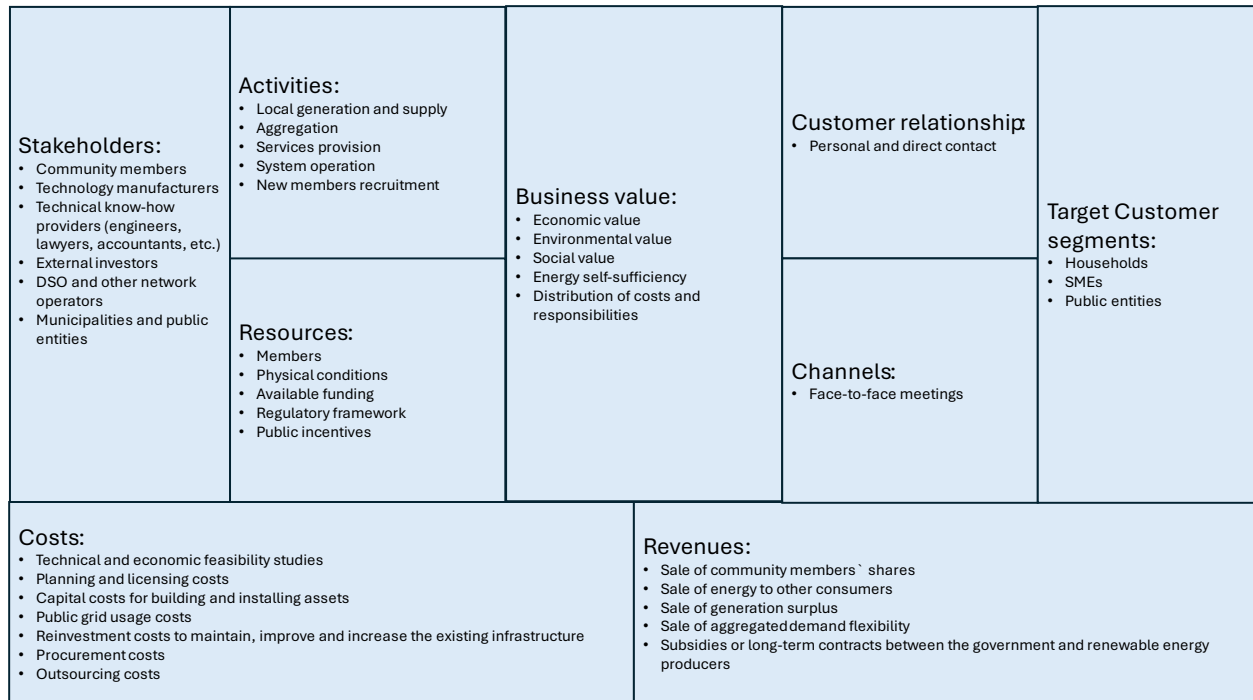


Figure 3.8: Customer side BMC

3.4. Third-party-side BMC

Contrary to Customer-side BMC, Third-party-side BMC has no high upfront costs for end-users, as the initial investment is made by third-party companies. That minimises the risks for the end-users but also takes asset control and ownership away from them. Similar to Customer-side BM, energy production is based on RES, which are usually installed on end-users' rooftops, backyards or in the vicinity of consumption sites when space is constrained. Investment companies usually own a few small-scale generation units and operate them as virtual power plants. Due to the involvement of many households or SMEs key partner in this BM is also DSO. With this derivative of BM, the creation of DSM-based services can be achieved as well. In that, derivative investment companies sign contracts with customers who commit to deliver a pre-defined power amount, which can be sold to the system operators. The third derivative of Third-party-side BMC is the possible establishment of Electric Energy (EE) services, which involves ESCO as well. In either derivative, revenues are created from the PPA or leasing contracts that enable customers to access lower energy prices and investment companies to benefit from the initial investment (Figure 3.9).

ECs are recognised as having high prospects, attracting investment from several organisations and entities. These organisations typically provide ECs with technical

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assistance and financial support, such as grant funding, dedicated investment funds, or full project financing. As financiers, these organisations usually retain ownership of the assets, governance, and investment decisions, categorising them as the main decision-makers. However, they must cooperate closely with local communities to create synergy between entities. In this arrangement, the organisation assumes the project risk, while customers sign long-term PPA contracts, enabling them to receive cheaper energy than from the energy market.

This type of ECs could also be promoted by non-profit organisations or governments, especially in areas with social challenges such as energy poverty and poor housing conditions. In these communities, social funding is typically required to initiate the project.

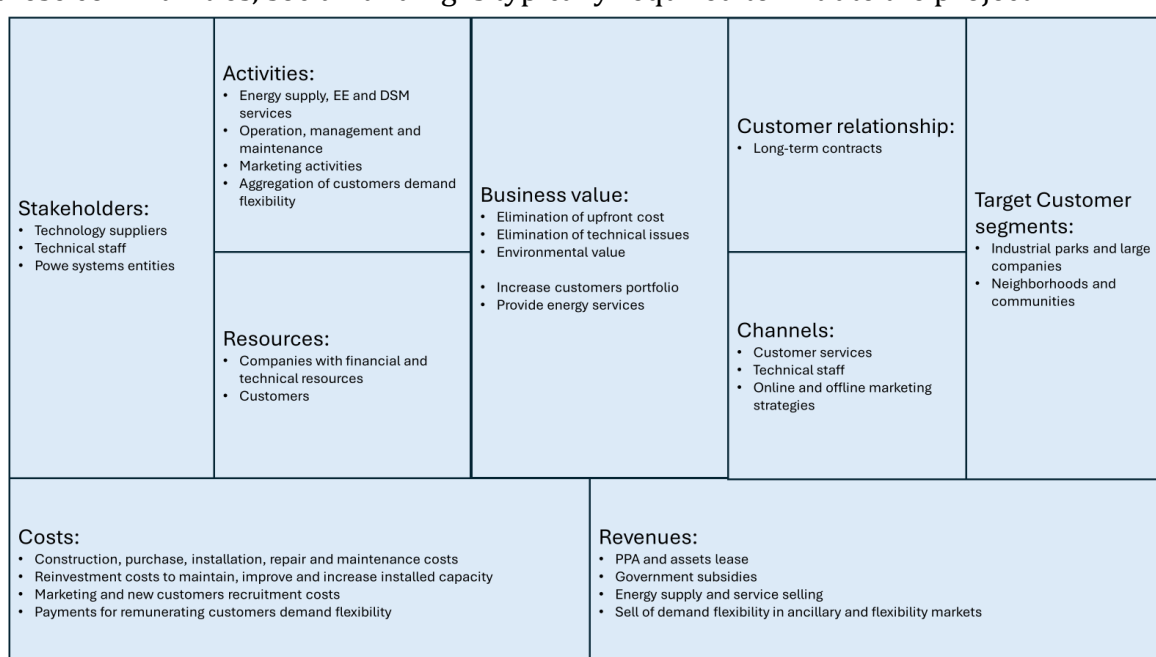


Figure 3.9: Third-party Economic BMC

Community prosumerism is based on bulk prosumerism, where prosumers unite in a group and play the roles of decision-makers, investors, and customers. The most important benefit of this derivative is the common acquisition of assets, which allows for a reduction in investment costs, gains in dimension, and makes the community more competitive in flexible markets. Additionally, initiatives to support RES are often based on minimum capacity requirements, which are easier to achieve collectively as a community rather than individually.

Members of the community usually sign long-term PPAs that enable them to sell surplus energy to energy suppliers. Typically, they can also sell energy within the Local Energy Market (LEM), benefiting both buyers and sellers as they are exempt from paying high and medium

voltage distribution and transmission network fees. There is also an option to trade energy outside the boundaries of the EC, but this incurs fees as the local energy supplier manages the transmission and records all transactions.

These energy suppliers can act as either active or passive players. As active players, they handle contract offers and later establish smart contracts. Another option for prosumers is to aggregate electricity within the EC, which generally requires higher investment costs but offers a better position in the electricity market, leading to improved conditions for selling electricity. Similar to Energy Cooperatives, profits are usually reinvested into the EC or the community at large, with significant social and environmental impacts.

Local energy markets (LEM) enable prosumers to sell their surplus energy to customers within their communities or to those involved in the LEM. It aims to maximise self-sufficiency, reduce the amount of power traded with external entities, and increase the volume of transactions within the LEM. One crucial benefit of LEM is that prosumers can choose whom they sell their electricity to, and customers can select their preferred energy providers. Typically, as with other derivatives of EC, both customers and prosumers benefit from the direct distribution of electricity without the involvement of traditional market players. The agreed price usually falls between the market price and the retail price, resulting in profit for both parties.

Although the trading platform is typically managed by the market participants themselves, they must still collaborate with other market entities, such as energy retailers and DSOs, to ensure supply and trading system reliability.

There are two derivatives of LEM. The first is the traditional LEM, where prosumers and consumers are located physically together within the same low-voltage area. This setup allows for easier management and direct trading of energy within a localised network, reducing the need for complex regulatory compliance and minimising transmission costs.

The second derivative is the virtual LEM, which is more advanced but less common due to regulatory and legislative challenges, particularly concerning trading and fees. In a virtual LEM, prosumers and consumers are not necessarily in the same physical location but are connected through a digital platform that facilitates energy trading. This approach requires sophisticated technology and compliance with more complex regulations, as it involves managing transactions over a broader geographic area and dealing with the associated transmission and distribution fees. Despite these challenges, virtual LEMs offer the potential for greater flexibility and scalability, enabling more participants to join the energy market regardless of their physical location.

For the undisturbed and effective operation of LEM, there is a need for high-performance ICT, net-metering infrastructures, and software-based trading platforms. Critical data to be measured is the amount of energy produced, and data on information and money transactions. In recent years, blockchain technology has been identified as a powerful tool for described activities, but it requires a considerable amount of computational power and electricity.

Community collective generation members traditionally cooperate to lower the investment expenses of RES and BESS. Usually, PV and storage systems are installed on the rooftops of multi-tenancy buildings or in the vicinity of consumption sites. As described, this type of community is suitable for multi-tenancy buildings but is not highly developed or popular due to legislative challenges across EU countries. To optimise functionality and provide transparency, net-metering and ICT-based infrastructure are required.

Community flexibility aggregation is operated and controlled by an aggregator. Aggregators are among the most complex concepts in the energy sector, and legislation surrounding them is not yet fully clear or uniform. The idea behind this derivative is to enable ECs to participate in flexibility markets, such as balancing, reserve, and ancillary markets. To achieve this, larger amounts of energy must be aggregated, stored, and then distributed; otherwise, shareholders with smaller amounts of energy produced may not be able to participate in these markets. Typically, the aggregator initiates the project but works closely with end-users.

The EC is usually managed by a local aggregator, but flexibility is often collected by a larger aggregator, as small aggregators cannot typically compete in the markets. The system operates on bilateral contracts between customers and the local aggregator, where customers commit to delivering a fixed amount of flexibility by altering their energy consumption patterns, thereby benefiting from reduced energy bills. The system can be run in either dispatchable or non-dispatchable forms. In dispatchable systems, customers voluntarily allow external operators to control their appliances during peak periods through direct load control. In non-dispatchable systems, also known as price-based programs, customers adjust their demand profile based on dynamic pricing signals. It should be noted that customers/prosumers operate under two different contracts: one with the energy supplier for buying or selling electricity, and a second with the aggregator.

For the system to work effectively, the installation of high-tech devices such as sensors, smart meters, HEMS, and monitoring apps is required and provided by the aggregators.

The Community Energy service company (ESCO) model focuses not only on electricity but also on heat. ESCO tasks include installing energy-efficient systems, renovating buildings, and

installing RES. These actions ensure customer savings and increase ESCO's revenue. The sharing of revenues between the ESCO and customers depends on the contract signed before the project starts. The systems can be either guaranteed savings or shared savings, differing in how revenues are distributed. Guaranteed savings mean the ESCO guarantees savings to customers, while shared savings involve distributing savings based on contract conditions. Although the ESCO owns the utilities and sets the project conditions, local communities are highly involved, as co-dependency in this BM is very high.

E-mobility cooperatives include EVs as mobility solutions. The idea behind e-mobility cooperatives is to use electric vehicles to reduce energy bills by procuring energy during off-peak hours and providing flexibility services, which can then be pooled by aggregators to deliver services to the market. Additionally, using BESS can lead to higher self-consumption and self-sufficiency. In e-mobility cooperatives, households, SMEs, public entities, and social and technical entrepreneurs are involved.

In areas with a high share of EVs, smart charging systems could be used to schedule load operations during off-peak hours or when there is locally generated energy (e.g., from PVs). Another option is to arrange an agreement between prosumers and EV owners to purchase surplus electricity. This arrangement benefits both parties, as the price is set between market and retail rates.

This cooperation requires advanced high-tech software solutions and may be challenging to integrate on a larger scale.

4. Pilot Business Models

Using the Triple Layer Business Model Canvas (3BMC) approach, which integrates economic, environmental, and social dimensions, tailored business models were developed for each pilot site. Economic, social and environmental aspects were investigated based on available pilot documentation. The filled canvases are presented in this chapter. For each of the pilots, a documentation with asset descriptions and aims of the pilot was reviewed in order to prepare business models. For each of the pilots, TLBMC is presented in the following subchapters.

4.1. Slovenian pilot: Biomasa pilot site

Table 4-1: Biomasa Economic layer

Stakeholders/partners - Suppliers of wood waste and biomass materials - Industrial zone end-users for heat distribution - Renewable energy technology providers (PV, battery storage, CHP manufacturers) - Kolektor sETup for aggregation and ancillary service market integration - Local municipalities and regulatory bodies	Activities - Processing wood waste into biomass energy products (electricity, heat, pellets) - Optimising energy asset operation for market efficiency and grid stability - Developing modular biomass power plant prototypes for small-scale users - Testing biochar production and utilisation in agriculture - Providing ancillary services through energy flexibility - Operating EV charging infrastructure powered by renewable energy	Value proposition - Sustainable energy production using wood waste - Enhanced grid stability through energy flexibility services - Modular biomass power solutions for small-scale industries - Biochar production for agricultural applications - Reduction of fossil fuel dependency through optimised biomass energy	Customer relationship - Collaboration with industrial users for excess heat utilisation - Integration with renewable energy markets and flexibility providers - Engagement with farmers and agribusinesses for biochar applications	Target customer segments - Industrial users in the biomass centre's vicinity - Small-scale businesses (sawmills, farms) requiring decentralised energy solutions - Energy aggregators and ancillary service markets - Agricultural sector for biochar applications
	Resources - Physical: Biomass processing plant, CHP units, biomass boilers, PV plants, battery storage, EV charging stations - Financial: Investment in new CHP units, PV plants, and storage systems - Intellectual: Expertise in biomass processing, energy flexibility, and biochar utilisation - Human: Engineers, technicians, operational and logistics staff		Channels - Direct partnerships with industrial users - Renewable energy markets and aggregators - Collaboration with municipalities and policymakers	
Cost - Investment in new energy infrastructure (CHP units, PV, battery storage, EV chargers) - Biomass processing and logistics - Operation and maintenance of power generation assets - Research and development for biochar and modular biomass systems			Revenues - Sale of electricity and heat to industrial customers - Ancillary services revenue from grid stability contributions - Pellet and biochar sales to markets - Monetisation of flexibility services through energy aggregation platforms	

Deliverable D5.1: Business models and financial and social instruments

Table 4-2: Biomasa Environmental Layer

Supplies and outsourcing - Procurement of raw biomass from wood industries - External support for energy aggregation and grid integration	Production - Biomass conversion through pyrolysis and gasification - Heat and power generation from CHP units - Pellet production for residential and industrial use	Functional value - Utilising wood waste for sustainable energy production - Reducing carbon footprint through bio-based power generation - Enhancing grid stability with flexible energy assets	End of life - Recycling of biomass processing residues - Sustainable disposal and repurposing of outdated energy infrastructure	Use phase - Long-term operation of biomass CHP units and boilers - Continuous energy flexibility management - Biochar use in soil enhancement and carbon sequestration
	Materials - Primary: Wood chips, pellets, biochar - Infrastructure: PV panels, battery storage, CHP components		Distribution - Heat supplied to industrial users within the zone - Electricity is fed into the grid and used for EV charging - Biomass pellets and biochar are distributed to markets	
Environmental impacts - Circular economy integration with biochar reutilization - Enhanced local air quality by replacing fossil fuels			Environmental benefits - Carbon emission reduction through biomass-based energy	

Deliverable D5.1: Business models and financial and social instruments

Table 4-3: Biomasa Social Layer

(Local) Communities - Industrial partnerships for heat and energy utilisation - Engagement with agricultural sectors for biochar adoption	Governance - Compliance with EU energy and environmental policies - Transparent decision-making with local stakeholders - Public-private cooperation for energy transition	Social value - Job creation in the biomass energy and sustainability sectors - Strengthening regional energy security and independence - Supporting local industries with heat and energy solutions	Societal culture - Promotion of sustainable biomass energy solutions - Encouraging decentralised energy production in rural areas	End user impact - Industrial consumers of electricity and heat - Farmers and agribusinesses utilising biochar - EV users benefiting from renewable-based charging
	Employees - Skilled workforce for biomass processing and energy management - Training programs for flexibility management and biochar production		Scale of impact/ reach - Local impact in the Nazarje industrial zone - Regional expansion through modular biomass power solutions	
Social impacts - Improved local employment and economic growth			Social benefits - Contribution to sustainable rural energy solutions - Strengthened community resilience through renewable energy initiatives	

4.2. Slovenian pilot: KIS pilot site

Table 4-4: KIS Economic Layer

Stakeholders/partners	Activities	Value proposition	Customer relationship	Target customer segments
	Resources		Channels	
- Agricultural Institute of Slovenia (KIS) - Biogas technology providers - Local farmers and agricultural cooperatives - Policy makers and subsidy regulators - Renewable energy market stakeholders	- Operation of a micro biogas plant for biomethane production - Conversion of organic waste into biogas and digestate - Development of a biomethane refuelling station for tractors - Optimisation of subsidy structures and business models for biogas - Assessment of biochar as an agricultural soil enhancer	- Sustainable biogas and biomethane production for agricultural use - Circular economy approach by utilising organic waste - Reduction of fossil fuel dependency in agriculture - Development of scalable business models for biogas - Biochar valorisation for soil health improvement	- Direct collaboration with local farmers for biomethane adoption - Engagement with policymakers to optimise subsidies - Partnerships with biogas technology providers for innovation	- Farmers and agricultural cooperatives - Policymakers and subsidy regulators - Renewable energy investors and technology providers
	- Physical: Anaerobic digester, biogas holder, CHP unit (7 kWe/16 kWth), biomethane storage, refuelling station - Financial: Investment in biomethane purification and infrastructure upgrades - Intellectual: Expertise in anaerobic digestion and biogas utilisation - Human: Engineers, technicians, agricultural specialists		- Direct supply of biomethane to agricultural users - Engagement through policy advocacy and regulatory frameworks - Research dissemination via agricultural institutes	

Deliverable D5.1: Business models and financial and social instruments

Cost - Investment in biomethane production infrastructure - Operational costs of the biogas plant and refuelling station - R&D for business model optimisation and biochar analysis - Policy development and stakeholder engagement	Revenues - Sale of biomethane as an alternative fuel for agricultural machinery - Digestate and biochar sales for soil enhancement - Government subsidies and incentives for renewable energy projects - Research and development funding, consulting
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Table 4-5: KIS Environmental Layer

Supplies and outsourcing - Procurement of organic waste from local farms - Collaboration with technology providers for biomethane purification	Production - Anaerobic digestion of organic waste to produce biogas - Upgrading biogas to biomethane purity levels - Biochar production through biomass pyrolysis	Functional value - Reducing greenhouse gas emissions through biogas utilisation - Sustainable management of organic waste - Carbon sequestration potential through biochar use	End of life - Repurposing of plant infrastructure for future expansions - Continuous recycling of organic waste for renewable energy	Use phase - Biomethane is used as a fuel alternative for tractors and machinery - Digestate applied as an organic fertilizer - Biochar is utilised for soil improvement and carbon storage
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Deliverable D5.1: Business models and financial and social instruments

	Materials - Organic agricultural waste as primary feedstock - Biogas processing and purification materials - Biochar as a soil amendment		Distribution - Biomethane refuelling station for agricultural machinery - Digestate and biochar distribution to farmers - Grid injection potential for excess biomethane	
Environmental impacts - Reduction of methane emissions from organic waste decomposition		Environmental benefits - Improved soil health through biochar integration - Circular economy benefits from closing agricultural waste loops		

Table 4-6: KIS Social Layer

(Local) Communities - Strengthening local agricultural economies through biogas solutions - Engagement with farmers to promote sustainability practices	Governance - Compliance with EU and national renewable energy policies - Transparent subsidy structures to support biogas expansion	Social value - Promoting sustainable agriculture and renewable energy use - Supporting local farmers with alternative fuel sources - Reducing rural dependency on fossil fuels	Societal culture - Encouraging the adoption of bio-based fuel alternatives in farming - Advocating for policy support for small-scale renewable energy initiatives	End user impact - Farmers using biomethane as a fuel source - Agricultural businesses utilising digestate and biochar
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Deliverable D5.1: Business models and financial and social instruments

	Employees - Skilled workforce for biogas plant operation and maintenance - Training programs for farmers on biomethane utilisation		Scale of impact/ reach - Local impact on agricultural communities in Slovenia - Potential regional expansion through scalable business models	
Social impacts - Reduction of environmental and economic vulnerabilities in agriculture			Social benefits - Increased energy independence for rural communities - Enhanced sustainability and resilience of farming operations	

4.3. Spanish pilot

Table 4-7: Spanish pilot Economic Layer

Stakeholders/partners - Agricultural cooperatives and local farmers - Renewable energy technology providers - Government agencies and policymakers - Research institutions specialising in Agri-PV and geothermal systems - Local and regional energy markets	Activities - Deployment and operation of Agri-PV and geothermal systems - Integration of biogas and biomethane production for sustainable energy supply - Research and optimisation of renewable energy solutions for agriculture - Development of a renewable energy community model - Implementation of a geothermal system for heating, cooling, and storage	Value proposition - Sustainable energy solutions for agriculture - Reduction of operational costs for farmers through renewable energy integration - Climate resilience by diversifying agricultural energy sources - Efficient utilisation of agricultural waste for energy generation - Community-driven energy model supporting local economic development	Customer relationship - Direct collaboration with farmers for Agri-PV and geothermal adoption - Partnerships with policymakers to enhance regulatory frameworks - Research collaboration with universities and innovation hubs	Target customer segments - Farmers and agricultural businesses - Renewable energy developers and investors - Policy makers and sustainability advocates - Research and educational institutions
	Resources - Physical: Agri-PV infrastructure, geothermal system, biogas plant, 120m² bifacial PV panels - Financial: Investments in energy infrastructure and research grants - Intellectual: Expertise in Agri-PV, geothermal energy, and biogas purification - Human: Engineers, agronomists, renewable energy experts		Channels - Direct supply of renewable energy to agricultural users - Partnerships with cooperatives and government programs - Knowledge dissemination through agricultural networks and research publications	
Cost - Investment in Agri-PV, geothermal, and biogas infrastructure - Maintenance and operational costs of energy systems			Revenues - Energy sales from Agri-PV and biogas production - Carbon credits and sustainability incentives	

Deliverable D5.1: Business models and financial and social instruments

- Research and development for system optimization - Administrative and policy engagement costs	- Government grants and research funding - Subscription-based community energy model
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Table 4-8: Spanish pilot Environmental Layer

Supplies and outsourcing - Procurement of advanced PV and geothermal technologies - Collaboration with research institutions for system optimisation - Sourcing agricultural waste for biogas processing	Production - Renewable energy generation from Agri-PV and geothermal systems - Biogas production through anaerobic digestion - Biomethane purification and grid integration	Functional value - Reducing reliance on fossil fuels in agriculture - Optimised land use by combining energy and food production - Sustainable waste management through biogas production	End of life - Recycling and repurposing of Agri-PV components - Continuous reuse of agricultural waste for biogas production - Infrastructure adaptation for future energy innovations	Use phase - Solar energy is used for heating, cooling, and electricity in agriculture - Geothermal energy for temperature regulation in greenhouses and storage - Biogas and biomethane are utilised for energy generation and vehicle and farm equipment fuel
	Materials - Photovoltaic panels for Agri-PV system - Geothermal heat exchangers and pumps - Agricultural waste as feedstock for biogas - Hydrophobic membrane technology for biomethane purification		Distribution - Direct energy supply to agricultural facilities - Biogas and biomethane distribution to rural energy users - Potential integration into regional energy grids	

Deliverable D5.1: Business models and financial and social instruments

Environmental impacts - Reduction of CO2 emissions through clean energy adoption	Environmental benefits - Enhanced soil health through digestate application - Improved energy efficiency and resilience in agriculture
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Table 4-9: Spanish pilot Social Layer

(Local) Communities - Strengthening local agricultural economies through sustainable energy - Engaging stakeholders in energy planning and resource management	Governance - Transparent community energy management model - Alignment with EU renewable energy and agricultural policies - Ensuring equitable energy access for farmers and cooperatives	Social value - Supporting farmers with affordable, clean energy solutions - Reducing economic risks associated with energy price volatility - Promoting sustainable farming and rural economic development	Societal culture - Encouraging transition to renewable energy in agriculture - Promoting cooperative and community-based energy solutions	End user impact - Farmers and agribusinesses are benefiting from renewable energy solutions - Rural communities accessing decentralised energy models
	Employees - Skilled workforce for energy system maintenance and management - Training programs for farmers on renewable energy integration		Scale of impact/ reach - Local impact in the L'Horta Sud district of Valencia - Potential regional and national replication of the pilot model	

Deliverable D5.1: Business models and financial and social instruments

Social impacts - Strengthened collaboration between the energy and agricultural sectors	Social benefits - Enhanced energy security and affordability for farmers - Increased adoption of climate-smart agricultural practices
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4.4. Bulgarian pilot

Table 4-10: Bulgarian pilot Economic Layer

Stakeholders/partners	Activities	Value proposition	Customer relationship	Target customer segments
- Local farmers and agricultural cooperatives - Renewable energy technology providers - Policymakers and regulatory bodies - Research institutions focusing on agriculture and renewable energy - Investors in sustainable rural development	- Integration of smart PV systems into greenhouses - Operation of a biogas facility for energy and biofertilizer production - Analysis of regional agricultural waste potential for biogas generation - Development of business models to promote decentralised energy solutions - Policy engagement to improve regulatory frameworks for rural renewable energy projects	- Sustainable agriculture powered by integrated renewable energy solutions - Energy self-sufficiency for rural communities - Circular economy through waste-to-energy conversion and biofertilizer production - Increased agricultural productivity with optimised greenhouse energy management	- Collaboration with farmers for energy-efficient agricultural solutions - Engagement with policymakers to promote regulatory improvements - Partnerships with renewable energy developers and investors	- Farmers and agribusinesses - Policymakers and regulatory bodies - Renewable energy investors - Local communities benefiting from decentralised energy systems

Deliverable D5.1: Business models and financial and social instruments

	Resources - Physical: PV-equipped greenhouses, biogas facility, pastures, storage halls, agricultural lands - Financial: Investments in renewable energy infrastructure and business model development - Intellectual: Research on energy integration, soil improvement, and waste-to-energy processes - Human: Agricultural experts, energy engineers, policy analysts	- Creation of policy frameworks supporting renewable energy adoption	Channels - Direct implementation at agricultural sites - Policy advocacy and engagement with national and regional authorities - Knowledge dissemination through research institutions	
Cost - Investment in smart PV and biogas infrastructure - Operational costs for energy production and waste management - Research and development expenses for business models and policy recommendations - Policy engagement and stakeholder collaboration		Revenues - Sale of renewable electricity from PV and biogas systems - Income from biofertilizer distribution - Government incentives and grants for renewable energy initiatives - Consultancy and research funding for rural development strategies		

Table 4-11: Bulgarian pilot Environmental Layer

Supplies and outsourcing - Agricultural waste sourced from local farms - Renewable energy technology sourced from specialised providers	Production - Biogas facility processing organic waste into energy and biofertilizers - PV-powered greenhouses regulate temperature and enhance crop yields	Functional value - Reducing reliance on fossil fuels through renewable energy integration - Waste reduction through biogas conversion - Enhanced soil fertility via biofertilizer application	End of life - Continuous recycling of agricultural waste into energy and fertilisers - Expansion of renewable energy infrastructure for increased capacity	Use phase - Biogas provides electricity and heat for agricultural production - PV systems powering greenhouses and site operations - Biofertilizer improves soil health and crop yields
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Deliverable D5.1: Business models and financial and social instruments

	Materials - Agricultural waste, food residues, and manure for biogas production - PV materials for renewable electricity generation - Biofertilizers derived from digestate		Distribution - Renewable energy is used on-site for agricultural processes - Biofertilizers distributed to local farms - Potential grid injection of excess electricity	
Environmental impacts - Sustainable land use through regenerative agricultural practices			Environmental benefits - Reduction of methane emissions from organic waste - Increased resilience of rural agricultural systems to climate change	

Table 4-12: Bulgarian pilot Social Layer

(Local) Communities - Strengthening rural economies through sustainable energy solutions - Providing alternative income sources for farmers through energy production	Governance - Policy recommendations to support renewable energy adoption - Development of cooperative-based business models for energy distribution	Social value - Empowering rural communities through decentralised energy solutions - Reducing agricultural dependency on fossil fuels	Societal culture - Promoting the circular economy in agriculture - Advocating for long-term renewable energy integration in rural development strategies	End user impact - Farmers utilising renewable energy for agricultural operations - Rural businesses benefiting from decentralised energy production
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Deliverable D5.1: Business models and financial and social instruments

	Employees - Skilled workforce for biogas plant operations, PV system maintenance, and agricultural management - Training programs for farmers on renewable energy and sustainable practices	- Enhancing economic resilience in rural areas	Scale of impact/ reach - Local impact in the region, collaboration with local farmers and nearby towns/ cities for waste management - Wider scale: example of good practices in waste management and circular economy	- Local communities are gaining economic and environmental benefits
Social impacts - Long-term improvement in environmental and economic resilience		Social benefits - Increased rural energy independence and self-sufficiency - Job creation in the renewable energy and sustainable agriculture sectors		

4.5. Estonian pilot

Table 4-13: Estonian pilot Economic Layer

Stakeholders/partners - Private forest enterprises (e.g., Foreko) - Biorefinery operators (e.g., Fibenol) - Policymakers and regulatory bodies - Research institutions specialising in forestry and biomaterials - Investors in sustainable forestry and carbon markets	Activities - Management of short-rotation forestry plantations for biomass production - Testing and refining novel biomaterial production processes - Development of a Carbon Calculator Tool for CO₂ sequestration assessment - Implementation of wood ash recycling for nutrient enhancement - Development of biostimulants and fertilisers for enhanced forest growth	Value proposition - Sustainable biomass production from fast-growing deciduous trees - Valorisation of wood residues into high-value biomaterials - Carbon credit generation through afforestation and biomass utilisation - Circular economy through wood ash recycling and biostimulant development - Open-access Carbon Calculator Tool for stakeholders	Customer relationship - Collaboration with forest owners for optimised plantation management - Partnerships with policymakers to support afforestation policies - Engagement with the biorefinery sector for novel biomaterial production	Target customer segments - Forest landowners and managers - Biorefinery and biomaterial industries - Carbon credit investors - Policymakers and environmental agencies
	Resources - Physical: Network of forestry plantations, Fibenol biorefinery, Carbon Calculator Tool - Financial: Investments in forestry management, biomaterial research, and carbon credit systems - Intellectual: Research on tree growth models, biomass utilisation, and carbon sequestration - Human: Forestry experts, biomass engineers, policy analysts		Channels - Direct implementation at forestry sites - Knowledge dissemination through online platforms (Carbon Calculator Tool) - Policy engagement and regulatory advocacy	

Deliverable D5.1: Business models and financial and social instruments

Cost - Investment in short-rotation forestry plantation establishment - Operational costs for biorefinery processes and tree monitoring - Research and development expenses for Carbon Calculator Tool - Policy engagement and stakeholder collaboration	Revenues - Sale of high-value biomaterials (lignin, wood sugars, special cellulose) - Carbon credit revenues from CO₂ sequestration - Government incentives and grants for afforestation and sustainable forestry - Consulting services for plantation forestry optimisation
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Table 4-14: Estonian pilot Environmental Layer

Supplies and outsourcing - Tree seedlings sourced from specialised nurseries - Wood ash sourced from biomass heating systems - Biostimulants and fertilizers developed in collaboration with research institutions	Production - Forestry plantations producing biomass for the biorefinery - Biorefinery converting wood residues into high-value biomaterials - Carbon sequestration monitoring through the Carbon Calculator Tool	Functional value - Carbon sequestration through afforestation - Sustainable wood biomass production for renewable biomaterials - Waste minimisation via wood ash recycling and residue utilisation	End of life - Continuous replanting and harvesting cycles ensure sustainable forestry - Recycling of wood processing residues into new biomaterials	Use phase - Biorefined products are utilised in various industrial applications - Wood ash improves soil health for afforestation efforts - Biostimulants enhancing tree growth and carbon sequestration
	Materials - Fast-growing deciduous trees (hybrid aspen, silver birch, black alder) - Wood ash for nutrient recycling - Biostimulants and mineral fertilizers for soil enrichment		Distribution - Biomaterials supplied to biorefinery industries - Carbon credit data distributed via the Carbon Calculator Tool - Wood ash and biostimulants applied to forest plantations	

Deliverable D5.1: Business models and financial and social instruments

Environmental impacts - Increased carbon sequestration and climate change mitigation	Environmental benefits - Reduction of waste through complete biomass utilisation - Enhanced soil fertility and afforestation of marginal lands
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Table 4-15: Estonian pilot Social Layer

(Local) Communities - Providing landowners with profitable and sustainable land-use options - Strengthening rural employment through forestry and biorefinery activities - Encouraging participation in carbon credit markets	Governance - Policy recommendations to support afforestation and biomaterial production - Development of transparent carbon credit frameworks - Establishing certification systems for sustainable forest fertilization	Social value - Promoting afforestation and rural economic development - Supporting forest owners with sustainable land-use solutions - Strengthening Estonia's position in the bioeconomy sector	Societal culture - Promoting a circular economy approach in forestry - Advocating for sustainable land management policies	End user impact - Biorefinery industries utilising renewable biomaterials - Landowners participating in afforestation and carbon credit schemes - Policymakers using data from the Carbon Calculator Tool
	Employees - Forestry specialists for plantation management - Biorefinery workers and process engineers - Researchers analysing biomass growth and CO₂ sequestration		Scale of impact/ reach - National impact through short-rotation forestry and afforestation initiatives - Potential international replication of carbon credit methodologies	

Deliverable D5.1: Business models and financial and social instruments

Social impacts - Increased rural employment and economic stability	Social benefits - Greater public awareness of sustainable forestry and carbon sequestration - Long-term environmental and economic benefits for Estonia's forestry sector
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4.6. Summary of the business models

The design of business models for the pilots builds on existing concepts of energy sharing and community-based business models that have already emerged across Europe. These include customer-side initiatives such as energy cooperatives, where citizens or farmers directly invest in renewable assets; third-party-side models where investment is carried out by external companies and communities' benefit through service contracts; and hybrid approaches like local energy markets, flexibility aggregation, ESCO schemes, or e-mobility cooperatives. Each of these derivatives highlights different degrees of ownership, risk, and benefit-sharing between communities, investors, and system operators.

When preparing the pilot business models, these established derivatives provided an important reference point for identifying which approaches can be replicated or adapted. For instance, pilots with strong farmer or forester involvement resonate with the cooperative logic of customer-side models, while large-scale biomass or biorefinery pilots share features with third-party-side models where private investors and industry carry the main financial risk. Similarly, use cases exploring carbon calculators, biomass valorisation, or renewable-based CHP systems demonstrate the potential to integrate local energy markets or flexibility services in the longer term.

At the same time, each pilot site remains unique in its local conditions, resource base, and community dynamics. This means that while some BMC elements are directly transferable from European practice, others must be newly defined to reflect the specific value chains, stakeholder networks, and policy frameworks at play. The comparison of pilots therefore not only illustrates common trends and shared goals across locations but also highlights the space for innovation, where established energy sharing models can be reinterpreted or combined into tailored business strategies.

To define and evaluate the business models of the pilot sites, the Triple Layer Business Model Canvas (TLBMC) was applied. This approach expands the traditional Business Model Canvas by incorporating environmental and social dimensions, enabling a holistic analysis of each pilot's contribution to economic viability, environmental sustainability, and social value creation. It is particularly well-suited for projects focused on renewable energy integration, circular economy practices, and community-driven innovation, offering a structured framework to align technological solutions with broader sustainability and policy goals. The environmental layer examines material and energy flows, resource use, emissions, and circularity potential, while the social layer addresses stakeholder engagement, equity, and wider societal impact. Together, these three layers provide a comprehensive lens to assess the feasibility, resilience, and community embeddedness of the solutions developed within the project. Annex 1: BMC questionnaire template provides a template with key topics to cover in design of the business model with 3LBMC approach.

Deliverable D5.1: Business models and financial and social instruments

	RES integration	Circular economy and Waste utilization	Policy and Business model innovation	Sustainable Agriculture and Soil Health	Energy Self- Sufficiency	Technology and Smart Solutions	Community and Cooperative models
Slovenia	3	2	3	2	3	2	1
Spain	3	2	2	3	2	3	2
Bulgaria	3	3	3	3	3	2	2
Estonia	2	2	2	3	2	3	1

Figure 4.1: Cross pilot comparison

The business model design across pilot sites, seen on Figure 4.1 highlights a common commitment to sustainability, technological innovation, and community inclusion. Despite regional differences, all pilots combine renewable energy systems with land-based practices—such as farming and forestry—to promote integrated, circular value chains. Technologies deployed include biomass-powered CHP, biomethane utilization, biogas, Agri-PV, geothermal energy, and carbon capture, as well as innovative cellulose production from short-rotation forestry plantations.

This convergence reveals strong potential for replicability and scalability of business models that align climate goals with rural development. Farmers and foresters play a key role, benefiting from new income streams, improved soil and crop performance, and access to digital tools and renewable inputs. The Triple Layer Business Model Canvas approach provided a structured lens to balance economic viability, environmental integrity, and social value—forming a solid foundation for resilient, low-carbon regional ecosystems.

5. Financial and social instruments for farmers and foresters to promote rural development

This section examines the financial mechanisms available to farmers and foresters within the European Union's 2021–2027 framework. It reviews public schemes, private investments, and mixed models, arranged from the most accessible to the more complex instruments, and then considers how these opportunities could be applied in the contexts of Spain, Bulgaria, Estonia, and Slovenia. Key information is presented in the following subchapters, while tables with more detail information are located in Chapter 15: Annex 2: Financial instruments.

5.1. Currently active European Public Financing Mechanisms

Public financing instruments remain a cornerstone of support for farmers and foresters across the European Union's 2021–2027 framework. In Spain, Bulgaria, Estonia, and Slovenia, these schemes are primarily channelled through the Common Agricultural Policy (CAP) and cohesion policy funds, complemented by a range of national and regional programmes. Although widely available, their accessibility for individual farmers and small-scale forestry operators varies according to administrative capacity, regional governance models, and programme design. While some measures are straightforward and provide direct support, others involve more complex procedures and compliance requirements. This section presents these public financing instruments in ascending order of difficulty for farmers and foresters to access, highlighting their role in fostering competitiveness, sustainability, and territorial cohesion in rural areas.

5.1.1. EU Framework Funds: Beyond the Common Agricultural Policy (CAP)

Within the framework of the European Union's financial instruments, the Common Agricultural Policy (CAP) plays a central role in supporting farmers and ensuring the sustainability of the agri-food sector. Before turning to the European Structural and Investment Funds (ESIF), it is important to outline the CAP and, in particular, its first pillar, financed through the European Agricultural Guarantee Fund (EAGF). This fund provides direct payments to farmers and other beneficiaries, helps ensure compliance with environmental and legal standards (such as Good Agricultural and Environmental Conditions (GAEC) and Statutory Management Requirements (SMRs)), promotes participation in Eco-schemes, and guarantees proper monitoring and control of support measures. Through this pillar, small farmers can receive additional benefits for implementing environmental measures or adopting green technologies. Funds are managed at the national level by designated ministries and paying agencies, which launch calls and distribute direct support to beneficiaries [5] [6].

Key features:

- Spain: €24 billion, administered by the Spanish Agricultural Guarantee Fund (FEGA) under the Ministry of Agriculture, Fisheries and Food (see Figure 5.1).

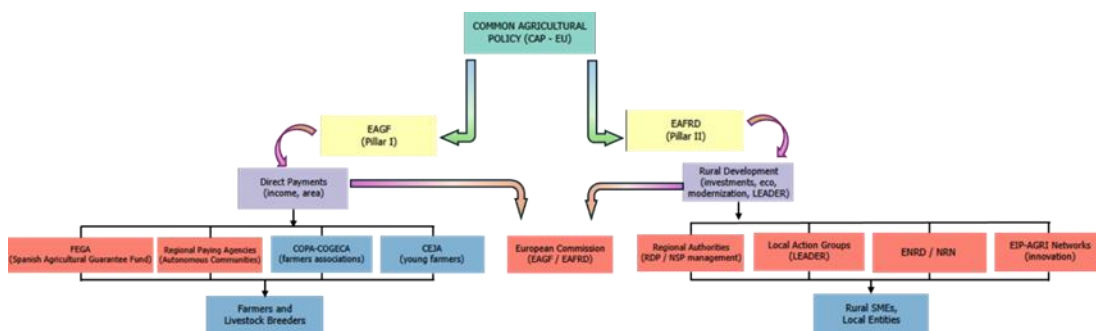


Figure 5.1: Diagram of CAP Subsidy Distribution in Spain. The different bodies involved in the allocation of funding are shown.

- Bulgaria: €843.2 million, distributed by the State Fund Agriculture under the Ministry of Agriculture and Food.
- Estonia: €165.4 million, overseen by the Agricultural Registers and Information Board (PRIA) under the Ministry of Regional Affairs and Agriculture (see Figure 5.2).

Deliverable D5.1: Business models and financial and social instruments

- Slovenia: €132.5 million, allocated through the Agency for Agricultural Markets and Rural Development under the Ministry of Agriculture, Forestry and Food.

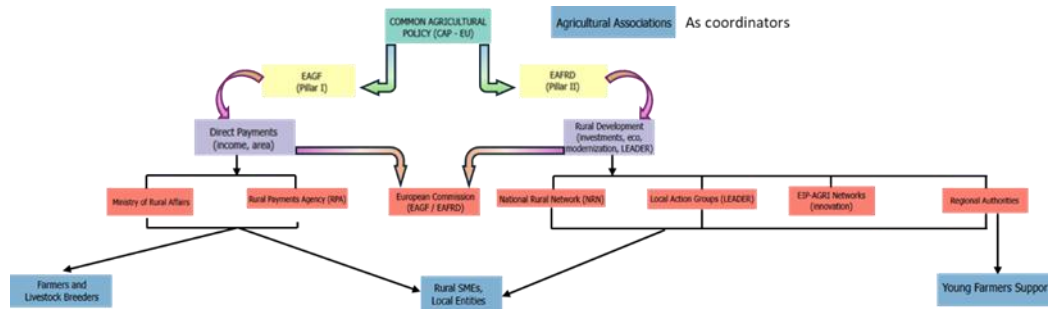


Figure 5.2. Diagram of CAP Subsidy Distribution in Estonia. The different bodies involved in the allocation of funding are shown.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain: Direct payments and Eco-schemes provide a major financial source for small farmers, particularly those adopting renewable or sustainable practices.
- Bulgaria: Payments distributed by the State Fund Agriculture are accessible nationwide, providing predictable support for farmers who meet CAP requirements.
- Estonia: PRIA centralises applications and monitoring, ensuring transparency and easier access for farmers adopting environmental measures.
- Slovenia: The Agency for Agricultural Markets and Rural Development supports farmers with both direct subsidies and calls linked to ecological transition priorities.

Practical implications for local applicants:

- Meeting GAEC and SMR conditionality is mandatory for accessing payments.
- Participation in Eco-schemes can generate additional income streams.
- Applications are channelled through national paying agencies, making it essential to follow their guidelines and timelines.
- Farmers focused on renewable energy or climate-friendly practices may gain priority in some calls.

5.1.1.1. European Structural and Investment Funds (ESIF)

The European Structural and Investment Funds (ESIF) are among the European Union's most important financial instruments for promoting regional cohesion and sustainable development. With a total budget of €523.73 billion for the period 2021–2027, these funds aim to reduce economic, social, and territorial disparities by investing in key priorities such as innovation, digitalisation, the green transition, connectivity, and urban development. The ESIF framework is made up of five funds: the European Agricultural Fund for Rural Development (EAFRD), the European Regional Development Fund (ERDF) [7], the Cohesion Fund (CF), the European Social Fund Plus (ESF+), and the Just Transition Fund (JTF). The first of these, the EAFRD, also represents the second pillar of the Common Agricultural Policy (CAP) and is therefore a central link between agricultural policy and cohesion policy. Since the ESF+ focuses primarily on employment, social inclusion, and education, it falls outside the specific scope of this review and will not be addressed in detail.

In this review, the funds are presented not according to their formal order in EU regulations, but rather following their relative accessibility to farmers and foresters. This approach begins with direct payments under the EAGF (already addressed), continues with the EAFRD as part of the ESIF, and then moves on to the ERDF, JTF, and finally the Cohesion Fund, reflecting a decreasing level of direct availability for the agricultural and forestry sectors.

5.1.1.1.1. European Agricultural Fund for Rural Development (EAFRD)

The European Agricultural Fund for Rural Development (EAFRD), also known as Pillar II of the Common Agricultural Policy, is the EU's main instrument to foster rural development [8]. Its objectives include enhancing the competitiveness of rural economies, encouraging adoption of new technologies, and supporting green growth as well as climate change adaptation and mitigation. Key measures under the EAFRD include investments in agricultural holdings (e.g. irrigation modernisation and renewable energy installations), support for agri-environment-climate measures (AECM) [9], and cooperation and innovation projects such as the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) [10].

A key element of the EAFRD is the LEADER programme [11], which promotes a bottom-up approach to rural development. Through Local Action Groups (LAGs) formed by local public and private stakeholders, LEADER supports community-led strategies and projects tailored

to the specific needs and potentials of rural areas. This fosters innovation, cooperation, and sustainable development at the local level, making it a crucial instrument for participatory rural governance. Importantly for ECOLOOP pilot regions, the EAFRD provides direct opportunities for SMEs and small farmers to modernise operations, improve sustainability, and access renewable energy solutions.

Key features:

- Spain: €7.8 billion (of €32 billion CAP allocation), including €540 million for LEADER Local Action Groups.
- Bulgaria: €354.6 million (of €12 billion CAP allocation), including dedicated support for the LEADER initiative.
- Estonia: €91.6 million (of €2.57 billion CAP allocation), including specific funding for LEADER.
- Slovenia: €119.1 million, with funding levels nearly equal to Pillar I, reflecting a balanced approach between direct payments and rural development.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain: strong opportunities through regionalised calls, particularly for renewable energy and irrigation modernisation projects. LEADER funds enable cooperative, bottom-up initiatives via Local Action Groups.
- Bulgaria: supports smaller farms through investments in competitiveness and green transition, while LEADER promotes local partnerships and rural innovation.
- Estonia: although smaller in scale, funds are highly targeted at innovation, rural modernisation, and climate adaptation, with LEADER engaging local actors.
- Slovenia: balanced distribution between Pillar I and II allows significant rural development support, including sustainability and innovation actions accessible to family farms.

Practical implications for local applicants:

- Farmers and foresters should look to EAFRD calls for financing renewable energy, irrigation efficiency, and agri-environment measures.
- LEADER funds represent an important entry point for collective projects, especially in smaller or less developed rural communities.
- Decentralised management at regional and local level ensures that applicants can align proposals with specific territorial priorities.

- Collaboration through EIP-AGRI or Local Action Groups can strengthen applications by embedding them in innovation or community-led frameworks.

5.1.1.1.2. European Regional Development Fund (ERDF)

The European Regional Development Fund (ERDF) [12] is one of the main cohesion policy instruments of the EU, with a budget of €214.4 billion for 2021–2027. Its primary goal is to strengthen economic, social, and territorial cohesion by addressing regional disparities. The fund supports five overarching Political Objectives: fostering innovation and competitiveness (Smarter Europe), promoting the ecological transition (Greener Europe), enhancing connectivity (More Connected Europe), improving social inclusion (More Social Europe), and strengthening local development (Europe Closer to Citizens). Resources are allocated to member states based on national and regional priorities, with funds managed at multiple levels—EU, national, regional, and local—through ministries, agencies, and intermediate bodies. This multilevel structure allows ERDF to tailor support to both multi-regional programmes and specific regional needs, ranging from large-scale R&D and innovation projects to targeted schemes for SMEs and local communities. Calls typically focus on renewable energy, energy efficiency, and digitalisation, aligning with the EU's ecological transition goals. The allocated amounts for each Political Objective and their corresponding Regional Objectives, as well as the funding available for Territorial Objective Partnership Actions, are detailed in Annex 2: Financial instruments.

Key features:

- Spain: €23.4 billion, distributed as 60% regional and 40% multi-regional (see Figure 5.3).
- Bulgaria: €5.4 billion ERDF plus €210 million for territorial partnerships. (see Figure 5.4).
- Estonia: €1.7 billion, focused on innovation and green economy (see Figure 5.5).
- Slovenia: €1.6 billion, the lowest allocation among ECOLOOP pilots (see Figure 5.6).

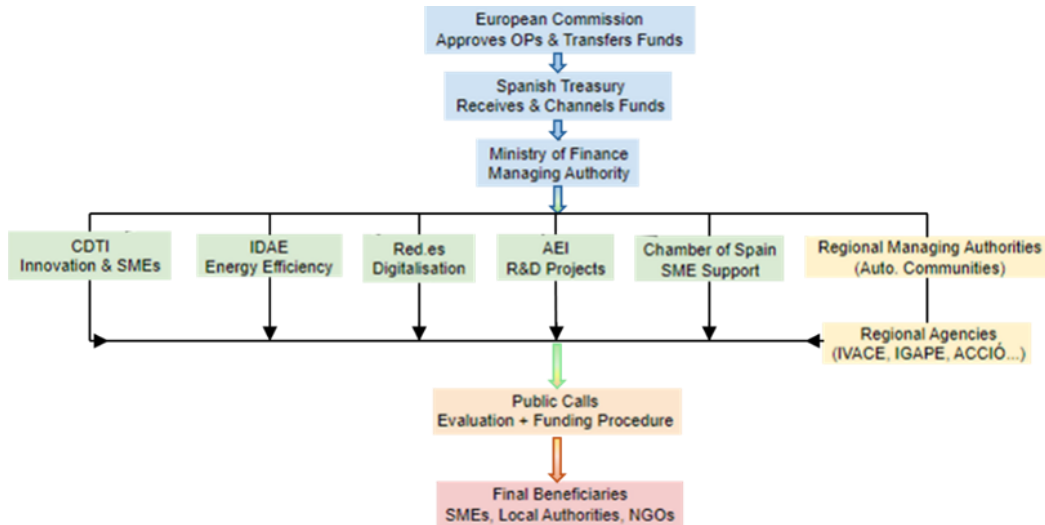


Figure 5.3: Diagram of the different bodies managing ERDF funds in Spain.

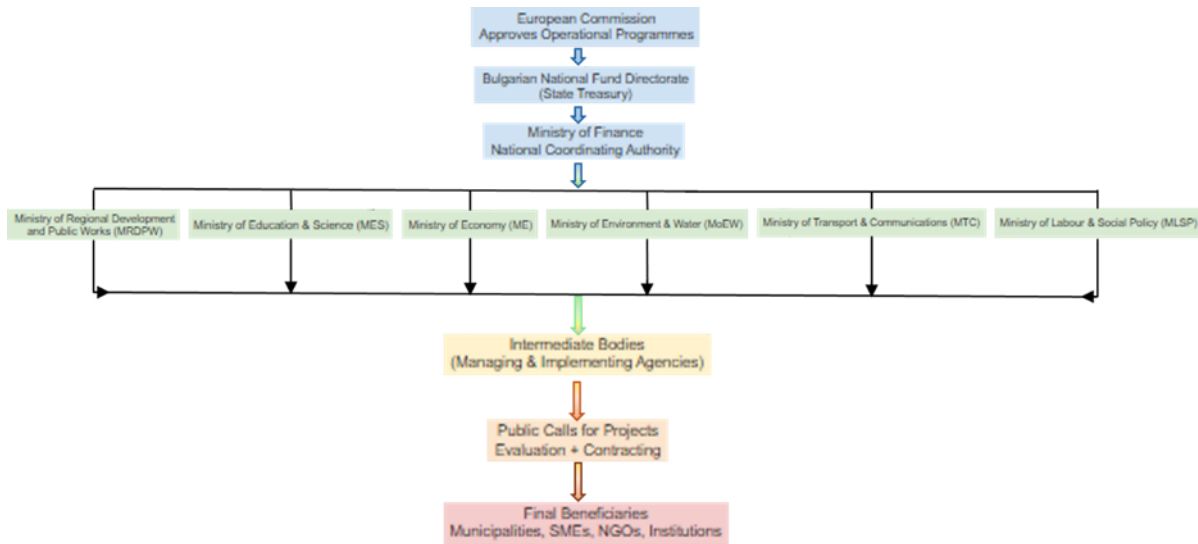


Figure 5.4: Diagram of the different bodies managing ERDF funds in Bulgaria.

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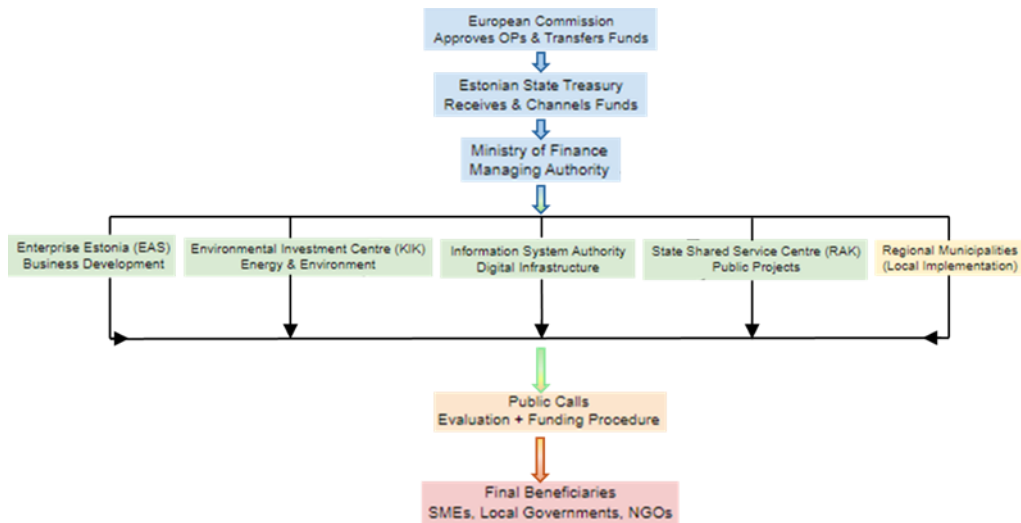


Figure 5.5: Diagram of the different bodies managing ERDF funds in Estonia.

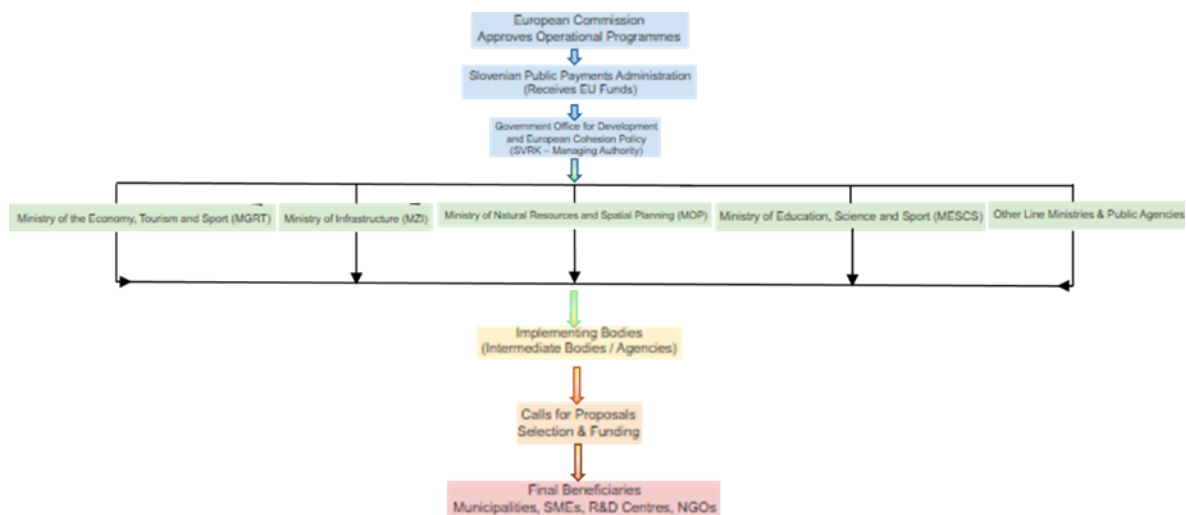


Figure 5.6: Diagram of the different bodies managing ERDF funds in Slovenia.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain: Regional calls allow Autonomous Communities to tailor programmes for renewable energy and energy efficiency in agriculture and forestry [13].
- Bulgaria: Programmes from the Bulgarian Small and Medium Enterprises Promotion Agency (BSMEPA) [14] and the Fund of Funds [15] offer entry points for SMEs and farmers, particularly in innovation, competitiveness, and energy efficiency.
- Estonia: Enterprise Estonia (EAS) [16] and the Environmental Investment Centre (KIK) [17] provide grants for innovation, climate action, and renewable energy, which can be adapted to farming and forestry contexts.

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- Slovenia: The Public Agency of the Republic of Slovenia for the Promotion of Investment, Entrepreneurship and Internationalisation (SPIRIT) [18] and the Slovenian Environmental Public Fund (Eko Sklad) [19] run schemes that support SMEs, households, and individuals in green and digital transition, energy efficiency, and renewable deployment.

Practical implications for local applicants:

- Farmers and foresters should prioritise regional-level calls, as these are more likely to address their scale and needs.
- Successful applications often depend on partnerships with SMEs or technology centres, especially in Spain and Slovenia.
- Calls linked to renewable energy, biomass, or circular economy present practical opportunities for farm-level modernisation.
- Awareness of national intermediaries such as the Centre for the Development of Industrial Technology (CDTI) in Spain, BSMEPA in Bulgaria, EAS in Estonia, and SPIRIT or Eko Sklad in Slovenia is crucial for navigating access points.

5.1.1.1.3. Just Transition Fund (JTF)

The Just Transition Fund (JTF) [20] is the EU's main instrument to support regions and workers most affected by the transition toward a climate-neutral economy under the European Green Deal. With a budget of €17.5 billion for 2021–2027, it forms one of the three pillars of the Just Transition Mechanism, alongside InvestEU [21] and a public sector loan facility with the European Investment Bank [22]. Member States must prepare Territorial Just Transition Plans (TJTPs), which identify the areas most dependent on carbon-intensive industries and propose strategies for economic diversification, reskilling, environmental rehabilitation, and energy transition. Eligible projects exclude fossil fuels and nuclear energy. Co-financing requirements vary between 50% and 85% depending on regional development levels. While the JTF aims to ensure fairness and inclusivity in the green transition, it has faced criticism regarding its limited budget and insufficient public participation in plan preparation.

Key features:

- Total EU budget: €17.5 billion, complemented by InvestEU and EIB loan facility.
- Focus on regions dependent on coal, peat, oil shale, or heavy industry.
- Eligible actions: worker reskilling, SME support, innovation, environmental rehabilitation, infrastructure modernisation, and renewable energy transition.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain, Bulgaria, Estonia, Slovenia: Potential opportunities where forestry, land use, or bioeconomy projects can support regional transition strategies.
- Farmers and foresters may benefit indirectly through diversification programmes, renewable energy adoption, and environmental restoration funded under TJTPs.
- Rural communities can be included in wider reskilling and SME support measures linked to sustainable land management.

Practical implications for local applicants:

- Access depends on the priorities defined in each country's Territorial Just Transition Plan.
- Applications must align with regional transition strategies, particularly in sectors moving away from carbon-intensive models.
- Farmers, foresters, and rural SMEs should position projects in areas such as renewable energy, biomass use, ecosystem restoration, and sustainable economic diversification.
- Monitoring the approval and implementation of national TJTPs is essential to identify entry points for funding calls.

5.1.1.1.4. Cohesion Fund

The Cohesion Fund [23] is one of the EU's key instruments for reducing economic and social disparities and fostering sustainable, integrated development. It targets Member States with a Gross National Income (GNI) per capita below 90% of the EU average, supporting their convergence with more developed economies. For 2021–2027, eligible countries include Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, and Slovenia. The fund focuses on two main areas: environmental infrastructure (sustainable water and waste management, renewable energy, energy efficiency, and climate adaptation) and transport (railways, clean public transport, inland waterways, and key corridors within the Trans-European Transport Network). Its aim is to enhance cohesion, reduce emissions, and improve connectivity across the EU.

Key features

- Budget 2021–2027: €42.6 billion, with €10 billion transferred to the Connecting Europe Facility [24].
- Minimum 37% of resources dedicated to climate-related actions.

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- Shared management between the European Commission and national/regional authorities.
- Exclusions: nuclear projects, airport infrastructure (except outermost regions), housing not linked to energy efficiency, and non-preventive landfill infrastructure.
- 2025 reform proposals: greater flexibility to reprogramme unused funds, support for defence, energy resilience, critical technologies, affordable housing, and dual-use infrastructure.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Bulgaria, Estonia, and Slovenia are direct beneficiaries as eligible countries; Spain is not covered by the Cohesion Fund.
- Opportunities for rural communities include improved infrastructure (transport and environmental services), renewable energy deployment, and climate resilience projects.
- Farmers and foresters may benefit indirectly through upgraded connectivity, access to clean transport networks, and enhanced regional competitiveness.

Practical implications for local applicants:

- Access requires alignment with national and regional operational programmes under Cohesion Policy.
- Applicants in Bulgaria, Estonia, and Slovenia should target projects linked to environmental infrastructure or clean mobility, particularly where rural and agricultural areas are included.
- Farmers and foresters can position themselves within initiatives promoting renewable energy, energy efficiency, and sustainable resource management.
- Monitoring upcoming reforms from 2026 will be key to identify additional funding opportunities under reprogrammed allocations.

5.1.1.2. Recovery and Resilience Facility (RRF)

Beyond the long-established European Structural and Investment Funds (ESIF), the European Union has developed a complementary instrument to address the unprecedented economic and social challenges posed by the COVID-19 pandemic: the Recovery and Resilience Facility (RRF) [25]. Established in 2021 as the central component of the NextGenerationEU package, it represents the largest stimulus ever financed by the Union, with a budget of €723.8 billion

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(€338 billion in grants and €385.8 billion in loans). The RRF seeks not only to repair immediate damage but also to drive long-term reforms and investments that make European economies greener, more digital, resilient, and inclusive. Funding is available until 2026, with projects expected to be completed within this period.

Key features:

- National Recovery and Resilience Plans (NRRPs) [26] are required to access funds, subject to approval by the European Commission and Council.
- Minimum spending requirements: 37% for climate-related projects and 20% for digital transformation.
- Disbursement is conditional on achieving pre-agreed milestones and targets, ensuring accountability.
- No co-financing model: payments are released upon verified progress.
- Integration with the European Semester [27] ensures reforms address country-specific structural weaknesses.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain: Allocated approximately €69.5 billion in grants from the Recovery and Resilience Facility (RRF). Additionally, the Spanish Recovery, Transformation and Resilience Plan [28] proposes a total mobilisation of up to €140 billion in grants and loans for investments and structural reforms.
- Bulgaria: Expected to receive around €6.2 billion in grants, supplemented with optional loans of about €4.5 billion. This funding is roughly equivalent to 3-4% of Bulgaria's GDP annually, supporting reforms and public investment projects.
- Estonia: Falls within the Central-Eastern group of countries receiving around 1-2% of its GDP annually in RRF grants, focusing on digital transformation and sustainable energy projects.
- Slovenia: Similarly, Slovenia is allocated funds equal to approximately 1-2% of its GDP annually under the RRF, with emphasis on green transition and rural development.

Practical implications for local applicants:

- Farmers and foresters cannot apply directly but may benefit through national and regional projects financed under approved NRRPs.
- Active monitoring of national calls and milestones is essential to identify opportunities in climate, energy, or digitalisation domains.

- Positioning within collaborative projects (e.g. renewable deployment, circular economy, or digital skills initiatives) may enhance access.
- Given the strict deadlines (end of 2026), applicants must act quickly to align with existing national programmes.

5.1.2. Thematic Funding Programmes

Within the European Union's financial landscape, Thematic Funding Programmes complement the European Structural and Investment Funds by targeting specific policy priorities across all Member States. These programmes are managed predominantly at the EU level and aim to advance areas such as research and innovation, environmental protection, climate action, digitalisation, and education.

5.1.2.1. EU Rural Development Programme (RDP)

The EU Rural Development Programme (RDP) [29] is a key component of the Common Agricultural Policy (CAP), designed to promote sustainable development in rural areas across Member States. It supports increased agricultural competitiveness, environmental protection, biodiversity, and the diversification of rural economies. Funding targets modernisation of farms, organic farming, rural entrepreneurship, and the conservation of natural and cultural heritage.

Through a co-financing mechanism combining EU and national funds, each Member State tailors its own programme to address specific regional and national priorities. For the 2021–2027 period, approximately €95.5 billion is allocated to rural development under the European Agricultural Fund for Rural Development (EAFRD) [30].

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain prioritises farm modernisation, sustainable agriculture, organic farming, and rural economic diversification to enhance competitiveness and environmental stewardship.
- Bulgaria focuses on improving forest management, agricultural efficiency, and boosting rural employment and socio-economic development.
- Estonia applies RDP measures for climate-smart agriculture and forestry, supporting bioeconomy initiatives and digital infrastructure in rural areas.

- Slovenia promotes rural vitality and environmental protection by integrating agricultural innovation with biodiversity conservation and ecosystem restoration.

Practical considerations for local applicants:

- Project funding under RDP is managed at national or regional level by designated authorities. Eligible beneficiaries include farmers, foresters, rural enterprises, and communities.
- Co-financing combines EU and national contributions, with rates depending on the measure and country. Applicants should monitor calls via managing authorities and seek support early to maximise success.

5.1.2.2. European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI)

The European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) [10], launched in 2012 under the Europe 2020 strategy, aims to foster competitive and sustainable farming and forestry that produce ‘*more and better from less*’. It connects farmers, researchers, advisors, businesses, and NGOs to develop practical innovations addressing real agricultural and environmental challenges.

Central to EIP-AGRI are Operational Groups [31]—multi-actor project teams funded primarily by the European Agricultural Fund for Rural Development (EAFRD)—which carry out innovation projects focused on improving productivity, sustainability, and rural resilience. EIP-AGRI also supports transnational thematic networks and knowledge exchange activities, now integrated within the broader EU CAP Network [31] to enhance policy coherence and innovation dissemination.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain actively engages in EIP-AGRI Operational Groups [32] emphasising sustainable agricultural practices, resource efficiency, and rural entrepreneurship.
- Bulgaria promotes multi-actor collaboration through EIP-AGRI to improve forestry management, innovation uptake, and sustainable rural development.
- Estonia supports climate-smart agriculture and bioeconomy innovations within EIP-AGRI projects, strengthening rural livelihoods and environmental sustainability.

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- Slovenia encourages knowledge sharing and innovation for biodiversity conservation, renewable energy adoption, and resilient rural economies through EIP-AGRI networks.

Practical considerations for local applicants:

- Applicants typically participate in multi-actor partnerships combining practical and scientific expertise. Funding is accessed mainly via national CAP Strategic Plans and Rural Development Programmes, with calls announced regionally and nationally.
- Engagement with national CAP Networks and EIP-AGRI service points is highly recommended to identify funding opportunities, form consortia, and receive advisory support.

5.1.2.3. LIFE Programme

The LIFE Programme [33] is the European Union's dedicated funding instrument focused on the environment, nature conservation and climate action. Established in 1992, it supports projects that help implement EU environmental and climate policies, driving innovation and best practices towards a sustainable, low-carbon, and climate-resilient economy. For the 2021–2027 period, LIFE has a budget of around €5.4 billion, structured into two main areas—Environment and Climate Action—further divided into four sub-programmes: Nature and Biodiversity, Circular Economy and Quality of Life, Climate Change Mitigation and Adaptation, and Clean Energy Transition.

LIFE finances a wide variety of projects aimed at conserving biodiversity, improving waste and water management, reducing emissions, promoting renewable energy and energy efficiency, and boosting communities' resilience to climate change. Emphasis is placed on innovation, sustainability, the replication of successful initiatives, and supporting EU policy priorities such as the European Green Deal and the Biodiversity Strategy.

Relevance for farmers and foresters in ECOLOOP pilot regions:

Note: see [34] for an interactive dashboard available on the European Commission's digital platform, which provides an overview of the various projects financed under the different European programmes, including the Life Programme.

- Spain has benefited from numerous LIFE projects integrating renewable energy solutions in rural and forested areas. These include initiatives promoting bioenergy

production and enhancing energy efficiency on farms and forestry estates, supporting climate change mitigation and rural development goals.

- Bulgaria participates in LIFE projects that focus on both biodiversity conservation and the energy transition in forestry, encouraging renewable energy technologies in protected and rural landscapes.
- Estonia has engaged in projects promoting sustainable energy use, energy-efficient renovations, and the adoption of clean energy in rural and forest communities, thus strengthening their environmental and economic resilience.
- Slovenia is involved in LIFE actions combining nature-based solutions and renewable energy to address climate challenges, fostering the sustainable management of forest ecosystems and rural development.

Practical considerations for local applicants:

- Funding through LIFE is primarily awarded via competitive European-wide calls. Therefore, applicants such as farmers, foresters, public authorities, and small enterprises should aim to participate in well-structured national or transnational partnerships. Co-financing rates typically range from 60% to 75% of eligible costs, dependent on project type and objectives.
- The programme prioritises innovative projects offering practical, replicable results aligned with EU climate and environmental policies. Applicants are advised to engage with national LIFE contact points, which provide guidance on proposal preparation and project management to improve chances of success.

5.1.2.4. InvestEU Programme

The InvestEU Programme [21], launched in 2021, is the EU's flagship initiative to stimulate sustainable investment, innovation, and job creation. Building on the "Juncker Plan," it forms part of the 2021–2027 budget and the NextGenerationEU recovery package [35]. By offering EU budget guarantees, it reduces financial risks for projects that would otherwise struggle to attract funding, aiming to mobilise around €372 billion in investment [see 36].

The programme is built on three pillars: the InvestEU Fund, which provides guarantees through partners such as the EIB Group and national promotional banks; the Advisory Hub, which supports project preparation; and the Portal, which connects developers with investors. Investments are directed towards four areas: sustainable infrastructure (renewable energy, circular economy, clean transport, digital connectivity), research and

innovation, SME growth, and social investment and skills. All supported projects must align with EU policy priorities, notably the Green Deal and the digital transition.

Relevance for farmers and foresters in ECOLOOP pilot regions

- Spain: Financing opportunities for renewable energy on farms, energy-efficient machinery, and bioeconomy projects, with national promotional banks acting as intermediaries.
- Bulgaria: Through EBRD-backed schemes, farmers and forestry enterprises can access green loans for renewable energy and sustainable forestry management.
- Estonia: Potential to channel cohesion funds into InvestEU-backed instruments for rural digitisation, energy efficiency, and biomass projects.
- Slovenia: Forest and farm cooperatives may benefit from guarantees supporting investments in sustainable forestry, wood innovation, and circular economy initiatives.

Practical considerations for local applicants

- Access is indirect, via financial intermediaries such as banks or funds rather than EU calls.
- The InvestEU Advisory Hub provides technical assistance to develop viable projects.
- Guarantees cover only part of the risk; applicants must contribute their own financing.
- Projects must align with EU sustainability and climate priorities.
- Member States can use cohesion funds within InvestEU national compartments, so opportunities vary by country.

5.1.2.5. European Energy Efficiency Fund (EEEF)

The European Energy Efficiency Fund (EEEF) [37], established in 2011 by the European Commission together with the EIB, Deutsche Bank, and Cassa Depositi e Prestiti, is a dedicated financial instrument to support sustainable energy investment across EU Member States. Its mission is to reduce greenhouse gas emissions by financing projects in energy efficiency, renewable energy, and clean urban transport. The fund primarily targets the public sector and public-private partnerships, offering long-term loans, leasing structures, guarantees, and equity or quasi-equity solutions tailored to municipal and regional needs.

A key feature is its Technical Assistance Facility [38], which provides grants to help smaller municipalities and public entities design bankable projects, addressing common barriers such

as limited technical or administrative capacity. Eligible projects must show environmental benefits, financial viability, and replicability. Typical areas of investment include the refurbishment of public buildings, LED-based street lighting, district heating and cooling networks powered by renewables, clean urban transport, and deployment of solar or biomass systems. Through these activities, the EEEF contributes to the European Green Deal and the Fit for 55 package [39] by facilitating local energy transition.

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain: Rural municipalities can use EEEF financing to modernise public infrastructure (e.g. energy-efficient irrigation, biomass heating systems), indirectly benefiting farmers and forestry operators.
- Bulgaria: Opportunities exist for forestry-linked communities and cooperatives via municipal projects in biomass heating and renewable-based district energy.
- Estonia: Local authorities could deploy EEEF support for public building renovation and rural energy efficiency, strengthening rural resilience and reducing operating costs.
- Slovenia: Municipal-level biomass and renewable heating projects have high potential to support sustainable forest management and create local energy markets.

Practical considerations for local applicants:

- Funding is channelled mainly through municipalities, regional authorities, and public service providers, not individual farmers.
- Farmers and foresters can benefit indirectly through local or regional projects (e.g. biomass demand, energy cost reduction).
- The Technical Assistance Facility is particularly useful for small municipalities with limited capacity to prepare viable proposals.
- Projects must be measurable, replicable, and aligned with EU climate and energy objectives.

5.1.2.6. Connecting Europe Facility (CEF)

The Connecting Europe Facility (CEF) [40] is a major EU funding instrument in the 2021–2027 period aimed at strengthening Europe’s infrastructure in transport, energy, and digital connectivity. It supports the development of high-performance, sustainable, and interconnected trans-European networks [41] (TEN-T, TEN-E, TEN-D) via grants and innovative financial instruments such as guarantees and project bonds. CEF acts as a key

enabler of the Green Deal by filling infrastructure gaps and leveraging private investment [42].

Relevance for farmers and foresters in ECOLOOP pilot regions:

- Spain: Enhancement of broadband/digital infrastructure in rural areas via CEF Digital [43] can support precision farming and remote forest monitoring.
- Bulgaria: Cross-border energy infrastructure projects (CEF Energy) may benefit remote farms by improving renewable energy access.
- Estonia: Improved digital backbones (fiber, 5G) through CEF Digital could reduce isolation of forested and rural areas.
- Slovenia: Transport infrastructure funded under CEF Transport could reduce logistics costs in remote forest and agricultural zones.

Practical considerations for local applicants:

- Applicants must respond to competitive calls under CEF, and projects are assessed by managing agencies.
- Funding is typically co-financed, so applicants must secure complementary funding.
- The project concept must align with core CEF priorities: connectivity, infrastructure, decarbonisation.
- Beneficiaries are typically public bodies, consortia, network operators; farmers and foresters benefit more indirectly (through infrastructure improvements).
- For digital projects, the CEF Digital component is managed by HaDEA [44].
- The transport component is often integrated with TEN-T objectives and supervised under CEF Transport calls such as the Alternative Fuels Infrastructure Facility (AFIF) [45].

5.1.2.7. Horizon Europe (Cluster 5)

Horizon Europe is the European Union's framework programme for research and innovation for the 2021–2027 period, with a total budget of approximately €95.5 billion. Within this programme, research activities are organised into thematic clusters; Cluster 5 — Climate, Energy & Mobility — addresses major social and environmental challenges linked to climate change, the energy transition and sustainable transport [46]. The cluster supports research and innovation to accelerate decarbonisation, advance clean and renewable technologies, improve energy efficiency, and promote smart and sustainable mobility solutions, while also

enhancing resilience and adaptation to climate impacts. Funding is directed mainly to collaborative projects involving companies, research centres, universities and public bodies, encouraging transnational cooperation to develop innovative, scalable solutions that can be deployed across Europe.

Relevance for farmers and foresters in ECOLOOP pilot regions:

Note: Cluster 5 is open to all EU Member States, and farmers and foresters may benefit through topics such as renewable energy integration, energy efficiency, rural mobility and digital solutions. The country-specific points highlighted below are indicative examples derived from the thematic scope of Cluster 5 and the rural and forestry contexts of each pilot country. Notably, the ECOLOOP project itself has been funded under Horizon Europe Cluster 5, which underscores the programme's direct relevance for advancing research and innovation in the fields of renewable energies. See [34] for an interactive dashboard available on the European Commission's digital platform, which provides an overview of the various projects financed under the different European programmes, including Horizon Europe (Cluster 5).

- Spain: opportunities to join or lead projects on renewable energy integration on farms, energy efficiency in agricultural processes, and sustainable transport of agri-products.
- Bulgaria: scope for participation in research on rural mobility, efficient timber logistics, and energy solutions for forest communities.
- Estonia: potential to engage in applied research on energy transition for remote farms and forests, and on digital/monitoring technologies for sustainable forest management.
- Slovenia: openings for projects linking forest management, local bioenergy solutions and low-emission transport of forest/agrarian outputs.

Practical considerations for local applicants:

- Most calls require international consortia: typically at least three partner organisations from three different EU or associated countries.
- Applications are submitted via the Funding & Tenders Portal [47]; some topics follow a two-stage procedure (concept note → full proposal).
- Use National Contact Points (NCPs) — GREENET is the Cluster-5 NCP network [48] — to find partners and get guidance.
- Check the Cluster-5 Work Programmes and call texts carefully: topics, expected impacts and funding rules change year to year; CINEA and REA publish calls and info sessions.

- Projects must demonstrate clear innovation, scalability and alignment with EU climate, energy and mobility priorities; budgetary and co-financing conditions vary by call.

5.2. Private Financing Mechanisms

Renewable energy deployment in the agricultural and forestry sectors in Spain, Bulgaria, Estonia, and Slovenia increasingly integrates private financing mechanisms supported by European Union programmes and funds designed to facilitate the clean energy transition in rural areas. Farmers and small-scale forestry operators can indeed use many of these financing instruments, but their accessibility and suitability vary depending on the instrument and local conditions. While some tools seem oriented to larger enterprises, specific programmes and adaptations exist to facilitate use by smallholders and rural entrepreneurs. This section presents these private financing mechanisms in ascending order of difficulty for farmers and foresters to access, detailing how each can support sustainable energy projects in rural areas.

5.2.1. Bank Loans

Bank loans are financial arrangements in which a bank or lending institution provides a specific amount of money to a borrower under the condition that the money will be repaid over a defined period, along with interest. These loans are among the most common and traditional forms of financing, used for a wide variety of purposes, ranging from personal consumption to business expansion or real estate investment. When a bank grants a loan, the borrower receives the principal—the initial amount lent—and agrees to repay it in regular instalments, including both principal and interest. The interest serves as the cost of borrowing and represents the bank's profit and compensation for the risk it assumes [49].

Bank loans can vary significantly depending on their purpose, terms, and structure. Common types include unsecured personal loans, mortgage loans secured by real estate, and business or commercial loans. Other variations include short-term bridge loans or revolving credit lines. Terms generally specify the interest rate—fixed or variable, repayment schedule, loan duration, fees, and any required collateral. The process usually involves a credit assessment of the borrower's financial health, income, credit history, and repayment capacity. For businesses, banks may also evaluate business plans and financial stability [50].

For individual farmers or silviculturists, bank loans are often the most directly accessible instrument, provided certain prerequisites are met (e.g. credit history, collateral). In Spain, risk-sharing guarantee agreements (e.g. EIB & CaixaBank) have enabled banks to offer up to €900 million in new loans, of which €180 million is explicitly earmarked for agricultural projects, improving accessibility for individual farmers [51]. In Bulgaria, banks tend to demand high collateral and lending for small-scale renewables is still limited, which constrains individual farmers' access. Leasing institutions, however, sometimes step in with loan-like products (see 5.2.2). In Slovenia, banks offer loans tailored to energy efficiency and renewables, which can be accessible to forestry cooperatives. In Estonia, where financial services are highly digitalised, bank loans remain the most relevant instrument for individual foresters, although fintech solutions increasingly provide simplified processes for small agricultural borrowers.

5.2.2. Financial Leasing

Financial leasing is an increasingly relevant private financing tool, particularly in sectors such as renewable energy and the circular economy. It allows companies, cooperatives, and local authorities to access expensive equipment—such as solar panels, biomass boilers, or composting units—without large upfront investments. Leasing companies, typically financial institutions or specialised firms, retain ownership of the asset while granting the lessee the right to use it for a defined period, with regular payments covering capital and interest. This lowers entry barriers and provides long-term flexibility compared to outright purchase [52].

In Bulgaria, a leasing product by BDB Leasing supports farmers and agricultural companies in purchasing land, financing up to 90% of the value with seasonal repayment schedules that match agricultural income flows [53]. This makes leasing highly compatible with the needs of individual farmers. In Spain, cooperative banks and leasing firms offer agricultural equipment leasing, and when combined with subsidies, farmers can also access small renewable installations (solar PV, biogas). In Slovenia, forestry cooperatives can use leasing for machinery or renewable energy units, but uptake by individual foresters is less common. In Estonia, leasing has a stronger presence in corporate contexts, although small-scale renewable leasing remains a potential growth area.

5.2.3. Green Bonds

Green Bonds are specialised debt instruments issued by corporations, financial institutions, or local authorities to finance projects that generate measurable environmental benefits. Unlike conventional bonds, the proceeds are earmarked exclusively for sustainable investments such as renewable energy, energy efficiency, or circular economy initiatives. Issuers commit to transparency in the use of funds and often follow recognised frameworks such as the Green Bond Principles developed by the International Capital Market Association [54].

In Europe, Green Bonds have grown significantly, with the EU introducing the European Green Bond Standard (Regulation (EU) 2023/2631) to harmonise practices and align with the EU Taxonomy [55]. Corporates, banks, and municipalities are among the leading private issuers, attracting institutional investors such as pension funds and insurance companies seeking ESG-compliant instruments [56].

Green bonds are generally inaccessible to individual farmers and foresters as direct issuers or investors, due to high minimum issuance volumes and investor profiles. However, in Slovenia, private company GEN-I has issued green bonds to finance solar and wind projects, indirectly benefiting rural communities through infrastructure development [57]. In Spain, cooperatives exploring renewable pooling could in future make use of collective green bond issuance. In Estonia, institutional funds supported by national initiatives (e.g. SmartCap Green Fund) focus on investing in companies developing technologies that farmers may adopt, thereby providing indirect benefits. In Bulgaria, green bond markets are still at an early stage, with limited opportunities for individuals.

5.2.4. Private Investment Funds

Private Investment Funds are specialised vehicles that pool capital from accredited or institutional investors to generate medium- to long-term returns. Unlike public mutual funds, they are not available to the general public and operate under lighter regulation, giving fund managers flexibility in investment strategies. These funds typically require high minimum contributions and operate as closed-end structures, committing capital for several years. Increasingly, Private Investment Funds target sectors with positive environmental and social impacts, including renewable energy, clean technology, and circular economy business models [58].

Private investment funds generally exclude individual farmers and foresters due to minimum investment thresholds and regulatory restrictions. In Spain, some cooperative structures allow indirect participation by pooling resources, but the barriers remain significant. In Estonia, SmartCap Green Fund invests in Greentech firms, which may generate services and tools that farmers and foresters can adopt [59]. In Bulgaria and Slovenia, individual access is minimal; benefits are indirect, channelled through companies or cooperatives that receive private fund investment.

5.2.5. Venture Capital

Venture capital is a private financing method that provides equity funding to startups and emerging companies with high growth potential, particularly in innovative sectors such as renewable energy, circular economy, and decentralised energy systems. Venture capital firms accept higher risks in exchange for potential substantial returns. Beyond funding, they offer strategic guidance, networks, and expertise to accelerate growth. In Europe, specialised venture capital firms and funds such as InnoEnergy or Breakthrough Energy Ventures actively invest in clean technology startups, energy storage, and community energy platforms [60][61].

Venture capital is rarely accessible directly to farmers or foresters. Instead, they benefit when startups develop technologies or platforms tailored to agriculture or forestry. In Estonia, agri-tech startup eAgronom raised €10 million in a Series A2 to expand sustainable farming practices, providing services directly to individual farmers [62]. Similarly, Estonian biotech company ÄIO raised €6.1 million to build a demo plant using agricultural and forestry residues, showing how VC enables innovation that valorises rural resources [63]. In Spain, venture capital in renewable agriculture remains nascent, while in Bulgaria and Slovenia the sector is even less developed, meaning individuals are unlikely to access it unless integrated into larger entrepreneurial ventures.

5.3. Mixed Mechanisms

Financing opportunities for renewable energy in agriculture and forestry in Spain, Bulgaria, Estonia, and Slovenia are also increasingly shaped by mixed mechanisms that combine public and private resources. These instruments often leverage European Union funds, national or

regional budgets, and capital from financial institutions or private investors, thereby expanding the overall funding capacity for rural clean energy projects. This section presents a selection of these mixed mechanisms in ascending order of difficulty for farmers and foresters to access.

5.3.1. Crowdfunding

Crowdfunding is a method of collective financing that allows entrepreneurs, companies, or projects to raise capital through many small contributions made via online platforms. It is recognised in EU policy as an alternative source of finance that can complement bank lending and venture capital for smaller or early-stage projects [64]. Models include donation-based, rewards-based, equity crowdfunding (contributors receive shares) and crowdlending (peer lending with interest). In the context of sustainable energy, crowdfunding has been used to finance small-scale renewable and community energy projects across Europe; EU-level analyses and sector studies describe its potential and outline regulatory and investor-protection challenges to be addressed [65][66].

In Spain, crowdfunding for renewable energy is facilitated by a comparatively mature market and a tradition of community-based energy cooperatives, whereas in Bulgaria uptake has been slower, reflecting both lower awareness and less favourable regulatory clarity. Estonia's advanced digital economy aligns well with the online nature of crowdfunding platforms, giving it particular potential for renewable citizen projects, while Slovenia shows an intermediate profile where community initiatives exist but require aggregation and investor-protection frameworks to become financially sustainable [64][65][66].

5.3.2. Power Purchase Agreements (PPAs)

Power Purchase Agreements (PPAs) are long-term contracts in which an energy producer (frequently a renewable project) and a buyer agree that the buyer will purchase electricity at a predetermined price for an extended period. PPAs reduce revenue risk for developers and increase bankability (EIB Advisory Hub), and they are increasingly used in Europe as complements or alternatives to support schemes for renewable generation [67][68].

Spain has developed one of the most advanced PPA markets in Europe, driven by large-scale renewable deployment and the presence of corporate off-takers, while in Bulgaria the absence of strong contractual precedents has limited their role to niche agreements. Estonia

has a growing interest in PPAs, particularly in the wind and digital services sectors, but its smaller market size constrains volume. Slovenia remains at an early stage, where corporate demand could gradually create opportunities, yet regulatory stability will be decisive for wider adoption [67][68].

5.3.3. ELENA (European Local Energy Assistance)

The ELENA facility is a joint initiative of the European Investment Bank (EIB) and the European Commission that provides technical assistance grants to prepare energy efficiency, renewable energy and sustainable transport projects. ELENA grants can cover a high share of project preparation costs (e.g. studies, audits, business planning) and are designed to de-risk early project phases and support project aggregation to reach bankable scale [69][70].

In Spain, ELENA has been relevant for municipal and regional authorities preparing large portfolios of efficiency and renewable projects, while in Bulgaria the mechanism is particularly valuable to overcome capacity gaps at the local government level. Estonia benefits from its relatively strong administrative digital capacity, enabling efficient use of ELENA funding for project aggregation, whereas Slovenia shows a need for such technical support to bring small-scale initiatives up to bankable size, especially in municipalities with limited expertise [69][70].

5.3.4. EU Investment Plan (Juncker Plan)

The EU Investment Plan (the “Juncker Plan”) launched in 2015 sought to mobilise public and private investment across the EU by using EU budget guarantees to reduce risk and attract private capital, with the European Fund for Strategic Investments (EFSI) as its financial core. The initiative aimed to direct investments to strategic sectors including renewable energy and infrastructure and has been followed by successor instruments such as InvestEU [71].

Spain benefited significantly from the Juncker Plan through large infrastructure and renewable portfolios, while in Bulgaria the Plan was crucial to attract investment where private capital was otherwise scarce. Estonia, despite its smaller scale, used the mechanism to support innovation-oriented projects in line with its digital economy, whereas Slovenia’s experience illustrates the role of the Plan in unlocking mid-sized infrastructure investments, particularly where national financing capacity was limited [71].

5.3.5. European Fund for Strategic Investments (EFSI)

EFSI combined EU guarantees with EIB/EIF capacity to catalyse investments in high-impact sectors (renewables, infrastructure, innovation) and to mobilise private capital for projects that could otherwise be considered too risky. Its operations and legacy are documented in EIB/EFSI reporting and evaluations; its instruments benefited intermediaries (banks, funds) that in turn supported local projects and SMEs [72][73].

In Spain, EFSI has had broad impact via financial intermediaries channelling support to SMEs and large-scale renewable projects, while in Bulgaria it provided a critical risk-sharing tool for domestic banks with limited exposure to green financing. Estonia leveraged EFSI particularly in innovation and digital sectors with crossover into renewable deployment, whereas in Slovenia its use has highlighted the importance of intermediaries in extending finance to smaller actors in energy efficiency and infrastructure, sectors otherwise underserved by commercial lending [72][73].

5.3.6. Comparative Overview of Mixed Mechanisms in ECOLOOP Pilot Countries

This subsection presents a comparative overview of mixed financing mechanisms across Spain, Bulgaria, Estonia and Slovenia (see Table 5-1). A colour-coded table has been included to capture national differences in maturity, regulatory capacity and market uptake, offering a visual complement to the narrative discussion above. The use of this format underscores where contrasts are most pronounced, thereby providing a concise synthesis of the opportunities and challenges identified in the literature.

This section closes the examination of already existing public, private and mixed financial instruments available, highlighting the breadth of options to support renewable energy and rural development, but also the unevenness with which these options are deployed across Member States. While public instruments offer stability and scale, private instruments provide flexibility and market orientation, and mixed mechanisms bridge the two by tailoring solutions to national contexts. This comparative overview underscores that no single instrument can address all financing needs; rather, effective strategies require a combination

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of tools, adapted to institutional capacity, regulatory frameworks and market maturity. This integrated perspective provides the foundation for identifying gaps and designing more coherent financial support architectures at both EU and national level.

Table 5-1: Colour-coded comparative overview of mixed financing mechanisms.

A colour-coded scale is used to illustrate differences across Spain, Bulgaria, Estonia and Slovenia: green indicates more advanced application, yellow reflects intermediate development, and red denotes limited uptake or significant barriers.

INSTRUMENT	SPAIN	BULGARIA	ESTONIA	SLOVENIA
Crowdfunding	● Mature cooperative/community initiatives	● Slow uptake, limited regulation	● Strong potential with digital economy	● Intermediate, requires aggregation and protection
PPAs	● Advanced market, corporate off-takers	● Very limited, niche	● Growing, constrained by size	● Early stage, needs regulatory stability
ELENA	● Effective for large municipal portfolios	● Useful to address local capacity gaps	● Efficient with digitalised administration	● Needed for small-scale municipal projects
Juncker Plan	● Significant benefits in infrastructure and renewables	● Crucial where private capital scarce	● Strong for innovation/digital projects	● Useful for mid-sized infrastructure
EFSI	● Wide impact via intermediaries and renewables	● Risk-sharing tool for domestic banks	● Innovation and digital-renewable crossover	● Important for intermediaries in efficiency and infrastructure

6. Innovative financial models

Europe's energy transition requires not only technological advances but also new financial frameworks capable of mobilising large-scale resources and reducing risks for both investors and consumers. Innovative financial models have emerged as key tools to unlock renewable energy investment, enable participation from a range of stakeholders, and generate shared benefits. These mechanisms combine public, private, and community funding, underpinned by European regulatory frameworks designed to accelerate decarbonisation while ensuring greater social and territorial inclusion in the deployment of clean energy. The following sections present the most relevant financial models identified in the literature, highlighting their role in facilitating the renewable transition across Europe.

6.1. Public Financing Mechanisms

Public financing mechanisms are evolving beyond traditional subsidy schemes and grant programmes to experiment with innovative designs that promote cross-border cooperation, cost-sharing, and flexible deployment of renewables. These newer instruments, developed within the EU regulatory framework, not only provide funding but also introduce mechanisms for statistical benefit transfer, joint calls for projects, and dynamic allocation of investment and operational support. Their innovative character lies in testing ways of pooling resources and distributing both risks and benefits across Member States, thereby accelerating renewable deployment while fostering European integration.

6.1.1. EU Renewable Energy Financing Mechanism (RENEWFM)

The EU Renewable Energy Financing Mechanism (RENEWFM) was established through Regulation (EU) 2020/1294 under the Governance Regulation (EU) 2018/1999. It is designed to enable Member States to cooperate in meeting renewable energy targets by allowing one state to finance projects in another, while sharing the statistical benefits of the energy produced [74].

Member States may participate as contributors, providing financial resources, or as hosts, developing renewable projects within their territory. The European Commission coordinates

the mechanism, launching competitive calls and allocating energy statistics between contributors and hosts [75]. Funding can be awarded either for investment in new renewable installations or for operational support of renewable electricity generation [76].

Since its establishment, RENEWFM has organised only two calls for proposals. The first tender (2023/2024) involved Luxembourg as a contributing country, with Finland and Estonia acting as host states [77]. The second tender (2025) awarded €52.4 million to nine projects in Finland and Estonia, adding approximately 445 MW of renewable capacity [78]. This limited track record confirms that RENEWFM is still at an early stage, but already shows tangible benefits, particularly for Estonia as a successful host.

RENEWFM operates in parallel with the Connecting Europe Facility – Energy (CEF Energy), notably its Cross-Border Renewable Energy (CB RES) window, which supports multi-country renewable projects with European added value [79]. Such initiatives foster cost-sharing, cross-border grid integration, and innovation in renewable technologies.

Relevance for ECOLOOP countries:

- Estonia: Already engaged as a host country, benefiting from both RENEWFM calls to date.
- Spain: With strong solar and wind resources, Spain could participate either as a host of large-scale projects or as a contributor financing initiatives abroad.
- Bulgaria: Could attract cross-border investment to accelerate its solar PV and onshore wind expansion, positioning itself as a competitive host.
- Slovenia: Although smaller in scale, Slovenia could join regional partnerships under the CB RES framework, improving integration and decarbonisation efforts.

6.2. Mixed Financing Mechanisms

Innovative mixed financing approaches are not limited to large-scale institutional frameworks but also extend to decentralised, citizen-oriented and consumer-driven models. Among the most prominent are Local Energy Communities (LECs) and Pay-As-You-Go (PAYG) schemes, both of which represent new ways of blending financial, social and regulatory tools to expand access to renewable energy.

6.2.1. Local Energy Communities

Local Energy Communities (LECs) are citizen-led or local authority-led groups that jointly produce, manage and consume renewable energy at local scale. They are a flexible, bottom-up route to deploy distributed renewables while addressing social objectives (inclusion, energy poverty, local employment). The Clean Energy for All Europeans package provides the legal basis: Renewable Energy Communities (RECs) are covered by the Renewable Energy Directive (RED II), while Citizen Energy Communities (CECs) are defined in the Electricity Market Directive. These two instruments frame rights, governance options and non-discrimination principles for local communities across the EU [80][81].

The European Commission explicitly recognises and supports energy communities, describing their forms, objectives and potential benefits (increased participation, social inclusion, local jobs and energy poverty alleviation) on its Energy Communities portal. The Commission has also collected national transposition measures and policies in the Energy Communities Repository to track Member State approaches and gaps [82][83].

LECs typically deploy distributed technologies (rooftop PV, small wind, batteries, smart metering and sharing platforms) and combine technical with social measures (participatory governance, training). Funding and technical support are available via EU projects and instruments (e.g. Horizon-funded demonstration projects such as LocalRES) alongside regional/national grants and ERDF/Horizon/InvestEU windows [84].

Relevance for ECOLOOP countries:

- Spain – Spain hosts numerous documented pilot cases and modelling studies showing that well-designed LECs can deliver economic, social and environmental benefits (examples and technical models from Spanish universities and case studies show positive results for shared PV + storage schemes). These academic and case-study sources document both urban and rural pilots that address energy poverty and local participation [85][86].
- Slovenia – Recent public programmes and EU support have accelerated community energy initiatives. Reporting in Build Up and industry press notes EU funding awards and national grant packages specifically supporting community solar and self-supply schemes, illustrating an active policy push to scale LECs [87][88].
- Bulgaria – Development of LECs is emerging: national transposition and pilot activity exist, but multiple analyses indicate that regulatory and financing frameworks are still maturing. There are concrete pilot initiatives (for example, local pilot groups such as

Izgrei in Plovdiv) and country analyses that map barriers and opportunities for scale-up [89][90].

- Estonia – Community energy is in an early but growing stage. Local cooperatives and pilot projects have been created (e.g. small energy cooperatives and island pilot activities) and regional initiatives aim to support community pilots and capacity building in rural and island contexts [91][92].

6.2.2. Pay-As-You-Go Models

Pay-As-You-Go (PAYG) models are financing mechanisms that lower the barrier of upfront investment for renewable energy systems by spreading costs over time [93]. In Europe, these arrangements typically appear as solar subscription offers, leasing contracts or rent-to-own schemes for rooftop PV and batteries. Consumers avoid large capital expenditure and instead pay predictable instalments, while providers retain asset ownership until the end of the contract period [94]. The European legal framework does not define PAYG explicitly, but these models fall under existing consumer-protection and energy market rules. The Renewable Energy Directive (RED II) and Electricity Market Directive provide the overarching framework for prosumers, while EU consumer law regulates pre-contractual information, billing transparency and disconnection safeguards [95][96]. Providers often access institutional financing (e.g. EIB credit lines) to cover upfront installation costs and recover them through aggregated consumer payments. Funding opportunities include EU-level support through InvestEU, ERDF and EIB facilities, which can de-risk portfolios, and Horizon-funded demonstration projects that integrate financing innovation with technical pilots [95][97].

EU guidance stresses the need for consumer protection in prepayment and subscription-based schemes, especially regarding affordability, transparency of terms and safeguards against remote disconnection. The European Data Protection Supervisor also highlights privacy risks linked to smart metering, which is central to digital PAYG billing [98][99].

Relevance for ECOLOOP countries:

- Spain – PAYG-like offers have grown through solar subscription and “solar-as-a-service” providers. Spanish regulation on self-consumption has improved profitability, and private financing models (e.g. venture-backed SolarMente) show increasing uptake of zero-upfront PV.
- Slovenia – Recent regulatory initiatives for PV self-supply create conditions for PAYG pilots, particularly if combined with guarantees or grants to lower consumer costs [102].

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- Bulgaria – PAYG deployment remains limited, but targeted national support schemes could be combined with PAYG structures to expand access, especially for households unable to finance PV upfront.
- Estonia – A strong digital payment infrastructure facilitates remote billing and monitoring, making Estonia well-positioned to pilot PAYG subscription offers at scale [103].

7. Existing policies for agroforestry optimisation to support sustainable rural development

7.1. Introduction and scope of work

The transformation of rural and agricultural sectors through renewable energy integration represents one of the most significant opportunities for achieving the European Union's climate neutrality objectives while simultaneously addressing long-standing challenges of rural economic development. This comprehensive analysis examines the complex interplay between renewable energy policies and rural development strategies across four diverse EU member states—Bulgaria, Estonia, Slovenia, and Spain.

The scope of this work encompasses a detailed examination of the multi-level governance frameworks that shape renewable energy deployment in rural areas, from overarching EU regulations to specific national implementation strategies. The analysis synthesises findings from extensive policy document reviews, practitioner experiences documented through structured questionnaires, and recent academic research to provide a nuanced understanding of both the opportunities and challenges facing rural communities in their transition to renewable energy prosumership.

Rural areas across the European Union face a unique set of circumstances that both facilitate and complicate renewable energy development. However, rural areas frequently struggle with limited grid infrastructure, restricted access to capital, lower population densities that challenge project economics, and regulatory frameworks that were often designed with urban contexts in mind. The agricultural and forestry sectors are uniquely positioned to benefit from and contribute to the renewable energy transition. Farmers and foresters control the vast majority of the EU's land area, making them critical stakeholders in any landscape-scale renewable energy deployment.

The concept of farmers and foresters as "prosumers"—simultaneously producing and consuming energy—has emerged as a powerful framework for understanding their potential role in the energy transition. This analysis is particularly timely given recent developments in EU energy policy, including the adoption of the revised Renewable Energy Directive (EU) 2023/2413, the implementation of emergency measures to accelerate renewable

deployment, and the increased ambition reflected in updated National Energy and Climate Plans.

7.2. Regulatory framework in the field of energy from renewable sources at the EU level

7.2.1. EU Regulations

The European Union's regulatory framework for renewable energy in rural areas has evolved significantly over the past decade, reflecting both increased climate ambition and growing recognition of the specific needs and potential of rural communities. At the heart of this framework lies Regulation (EU) 2018/1999[105] on the Governance of the Energy Union and Climate Action, which establishes the fundamental architecture for member state planning and reporting on renewable energy deployment.

This governance regulation takes a comprehensive approach to rural renewable energy development, recognising that successful deployment requires more than simply setting targets. The regulation mandates that member states develop integrated national energy and climate plans that specifically address the role of agriculture and forestry in renewable energy production. These plans must outline concrete measures for infrastructure development, including the critical challenge of grid connectivity in rural areas where existing electrical infrastructure was often designed for one-way power flow from centralised generation to dispersed consumers.

The regulation's approach to infrastructure modernisation is particularly noteworthy. It requires member states to assess and plan for the grid reinforcements necessary to accommodate distributed renewable generation in rural areas. This includes not only physical infrastructure upgrades but also the deployment of smart grid technologies that can manage the variable and distributed nature of renewable energy sources. The regulation recognises that without adequate grid infrastructure, the renewable energy potential of rural areas cannot be fully realised, regardless of the availability of resources or the willingness of farmers and foresters to invest.

Financial mechanisms established under the governance regulation also demonstrate a nuanced understanding of rural development needs. The Renewable Energy Financing Mechanism (REFM), introduced to help member states meet their renewable energy targets, explicitly allows for cross-border cooperation in renewable energy development. This mechanism is particularly relevant for rural border regions where renewable resources may

be abundant but local demand is limited. By enabling investment flows across borders, the REFM creates opportunities for rural areas to benefit from their renewable energy potential even when local consumption is insufficient to justify investment.

Community involvement emerges as another critical theme in the governance regulation. The regulation mandates early and effective public participation in renewable energy planning processes, recognising that social acceptance is often the determining factor in project success or failure. For rural communities, this requirement for participation provides opportunities to ensure that renewable energy development aligns with local development priorities and that benefits are retained within the community rather than extracted by external developers.

Building on this governance framework, Council Regulation (EU) 2022/2577[106][105] introduces emergency measures to accelerate renewable energy deployment in response to the energy crisis. This regulation represents a significant shift in approach, establishing a presumption of overriding public interest for renewable energy projects. For rural areas, this presumption can help overcome longstanding barriers related to land use planning and permitting delays that have historically slowed renewable energy development.

The acceleration regulation introduces specific provisions that are particularly beneficial for rural renewable energy projects. It establishes shortened permit-granting deadlines, with maximum timeframes of three months for solar installations in artificial structures—a provision that facilitates the deployment of solar panels on agricultural buildings, warehouses, and other rural infrastructure. The regulation also streamlines procedures for the repowering of existing renewable energy plants, recognising that many early rural renewable energy installations are now reaching the end of their initial operational period and could benefit from upgraded technology.

Perhaps most significantly for rural areas, the acceleration regulation addresses the critical issue of grid connection procedures. It mandates that grid operators provide clear information about available connection capacity and process connection requests within defined timeframes. This regulatory certainty is essential for rural project developers who often face uncertainty about whether and when a grid connection will be possible. The regulation also introduces provisions for temporary grid connections, allowing projects to begin operation even while permanent grid reinforcements are being completed.

7.2.2. EU Directives

The directive framework complementing these regulations provides the detailed implementation pathways that translate high-level objectives into practical reality. Directive

(EU) 2018/2001[108] on the promotion of the use of energy from renewable sources, commonly known as RED II, establishes comprehensive rights and frameworks that are particularly relevant for rural renewable energy development.

Central to RED II's approach is the establishment of robust prosumer rights that enable farmers and foresters to become active participants in the energy system. The directive guarantees the right to generate renewable energy for self-consumption, to store and sell excess electricity, and to participate in energy sharing arrangements. These rights are fundamental to the economic viability of rural renewable energy projects, as they ensure that farmers can capture the full value of their renewable energy investments rather than being limited to whatever terms utilities might offer.

The administrative simplification measures in RED II address one of the most persistent barriers to rural renewable energy development. The directive requires member states to establish simplified and streamlined authorisation procedures, including the creation of single contact points that coordinate all necessary permits. For rural project developers who often lack the administrative expertise of professional energy companies, these simplification measures can make the difference between a viable and non-viable project. The directive sets specific deadlines for permit decisions—one year for power plants and two years for offshore wind—providing the certainty needed for investment planning.

RED II's sustainability criteria for biomass and biofuels are particularly relevant for rural areas where agricultural and forestry residues represent significant renewable energy resources. The directive establishes detailed criteria to ensure that biomass use for energy does not compromise food security, biodiversity, or soil quality. These criteria include requirements for sustainable forest management, restrictions on the use of certain agricultural feedstocks, and greenhouse gas emission saving thresholds. While these requirements add complexity, they also assure rural communities that renewable energy development will not undermine the natural resource base upon which their livelihoods depend.

The directive's provisions on renewable energy communities represent a potentially transformative framework for rural areas. It establishes the legal concept of renewable energy communities as legal entities that are effectively controlled by local members, including citizens, small enterprises, and local authorities. These communities have the right to produce, consume, store, and sell renewable energy, including through power purchase agreements. For rural areas where community bonds are often strong and collective action has historical precedent through agricultural cooperatives, this framework provides a pathway for community-led renewable energy development that keeps benefits local.

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The recent adoption of Directive (EU) 2023/2413[107], known as RED III, further strengthens the framework for rural renewable energy development. This revised directive increases the EU's renewable energy target to 42.5% by 2030, with an indicative additional 2.5% that would bring the total to 45%. Meeting these ambitious targets will require full mobilisation of rural renewable energy potential, and the directive includes several provisions specifically designed to facilitate this mobilisation.

RED III introduces the concept of "renewables acceleration areas"—specific locations where renewable energy deployment faces fewer constraints and can proceed more rapidly. Member states are required to identify these areas through mapping that considers renewable energy potential, environmental constraints, and grid availability. For rural areas, designation as an acceleration area can provide significant advantages, including shortened permitting timelines (maximum six months) and simplified environmental assessments. The directive requires that the designation process involve local and regional authorities, ensuring that rural communities have input into where accelerated development occurs.

The revised directive also strengthens provisions for the system integration of renewable energy. As renewable penetration increases, system flexibility becomes increasingly important. It introduces requirements for member states to assess and develop system flexibility, including through energy storage, demand response, and sector coupling. For rural areas, these provisions create opportunities to develop new value streams—for example, by using agricultural facilities for energy storage or by coupling renewable electricity generation with hydrogen production for agricultural machinery.

Innovation support mechanisms in RED III specifically mention the need to support innovative renewable energy technologies in agriculture and forestry. This includes support for agrivoltaics (the combination of solar energy generation with continued agricultural use of land) and for advanced biomass conversion technologies. The directive requires member states to include specific measures for promoting innovation in their integrated national energy and climate plans, ensuring that rural areas are not left behind in the development of next-generation renewable energy solutions.

The complementary role of Directive 2012/27/EU on energy efficiency should not be overlooked in the rural renewable energy context. While primarily focused on energy efficiency, this directive includes provisions that create synergies with renewable energy development in rural areas. The directive's requirements for energy audits and energy management systems can help rural businesses identify opportunities for combining energy efficiency improvements with renewable energy installations, maximising the economic benefits of both interventions.

7.3. Regulatory framework in the field of energy from renewable sources at the national level

7.3.1. Bulgaria

Bulgaria's regulatory framework for rural renewable energy reflects the country's transition toward EU compliance while addressing specific national circumstances, including significant agricultural and forestry sectors, limited grid infrastructure in rural areas, and ongoing economic development needs. The National Energy and Climate Plan[112] serves as the primary strategic document outlining Bulgaria's approach to rural renewable energy development.

The Bulgarian framework emphasises biomass and biogas development alongside solar installations, reflecting the country's significant agricultural and forest resources. Key regulatory instruments include the Energy Act, which establishes the basic legal framework for renewable energy development, and the Renewable Energy Sources Act, which provides specific provisions for different renewable technologies and support schemes.

Permitting procedures in Bulgaria have been recently simplified following administrative reforms in late 2023. The country now requires 3-6 months for most renewable energy projects, representing the shortest timeframes among the studied countries. This improvement addresses the previous complexity that had been identified as a significant barrier to rural renewable energy development.

However, Bulgaria faces a critical regulatory gap regarding energy communities. Unlike other EU member states, Bulgaria lacks any legal definition or framework for energy communities, despite these being mandated by EU directives. This gap particularly disadvantages rural areas, where community-based approaches often represent the most viable development model, given limited individual financial capacity and the benefits of shared infrastructure.

Table 7-1: Support mechanisms in Bulgaria

Support Mechanism	Coverage/Benefit	Duration	Target Group
Direct grants	50-70% of installation costs	One-time	All rural developers

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Feed-in tariffs	Guaranteed pricing	20 years	Renewable energy producers
Tax incentives	Equipment and revenue exemptions	Ongoing	Rural energy investors
CAP integration	Stacked funding opportunities	Variable	Agricultural producers

The country demonstrates strong integration with Common Agricultural Policy implementation, enabling farmers to stack different funding sources for integrated modernisation projects.

7.3.2. Estonia

Estonia's regulatory approach to rural renewable energy leverages the country's strengths in digital infrastructure and forestry while addressing specific challenges, including community acceptance and grid integration. The Estonian framework emphasises efficiency and innovation over scale, reflecting the country's small size and focus on technological solutions.

The primary legal framework includes the Electricity Market Act, which establishes basic renewable energy provisions, and supporting regulations that address specific technical and administrative requirements. Estonia's approach prioritises biomass and forest residues utilisation, aligning with the country's extensive forest resources covering approximately 50% of the national territory.

Administrative procedures in Estonia typically require 1-2 years for project completion, with environmental impact assessments emerging as the primary administrative barrier. The country has implemented digital application systems to streamline procedures, reflecting its broader emphasis on digital government services.

Estonia demonstrates variable effectiveness in policy implementation, with significant differences in practitioner experiences. Community acceptance emerges as a major challenge, particularly for wind energy development, with local community scepticism identified as a persistent barrier.

Table 7-2: Support mechanisms in Estonia

Support Mechanism	Coverage/Benefit	Duration / Certainty	Target Group / Features
Investment subsidies	Up to 75% of costs	One-time	Eligible rural projects
Feed-in tariffs	Guaranteed pricing	Long-term	Rural renewable energy producers
Contracts for Difference	Price stability via auctions	Multi-year certainty	Market participants; ensures predictable revenues
Nord Pool market access	Participation in regional electricity markets	Ongoing	Producers integrated into the Nordic/Baltic energy system

Estonia's approach emphasises market-based mechanisms and integration with regional energy markets.

7.3.3. Slovenia

Slovenia adopts a measured approach with a 27% renewable energy target by 2030, focusing on well-managed forest resources for sustainable biomass production while maintaining strict environmental standards. The regulatory framework demonstrates particular strength in community energy models, reflecting strong cooperative traditions in rural areas.

Key legal instruments include the Energy Act establishing basic renewable energy provisions, the Act on the Promotion of the Use of Renewable Energy Sources, providing specific support mechanisms and supporting regulations addressing technical and administrative requirements. Slovenia's framework emphasises sustainable biomass supply requirements and environmental compliance.

Permitting procedures typically require 6-18 months, with environmental assessments and land use permissions identified as primary barriers. Slovenia has implemented streamlined approval procedures for smaller projects while maintaining comprehensive assessment requirements for larger installations.

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Slovenia demonstrates particularly strong development of energy community frameworks, addressing multiple implementation barriers simultaneously through collective action:

1. Legal provisions enabling cooperative formation
2. Technical assistance for community project development
3. Shared infrastructure investment support
4. Collective purchasing and negotiation support

Table 7-3: Financial support in Slovenia

Financial Support Type	Coverage Level	Project Focus	Key Features
Small-scale grants	Up to 75%	Projects <50 kW	Streamlined procedures
Biogas subsidies	60-75%	Agricultural waste	Priority for livestock
Feed-in tariffs	Market price + premium	All eligible producers	15-year guarantees
Tax incentives	Accelerated depreciation	All renewable investments	Improved cash flow

Slovenia leverages EU co-financing through the Cohesion Fund and the European Agricultural Fund for Rural Development programs.

7.3.4. Spain

Spain demonstrates the most comprehensive regulatory framework among the studied countries, targeting 42% of total energy consumption from renewable sources by 2030. The Spanish approach integrates renewable energy development with rural development strategies through dedicated institutional structures and coordinated policy implementation.

Deliverable D5.1: Business models and financial and social instruments

The regulatory framework centres on the Electricity Sector Act establishing basic renewable energy provisions, Royal Decree 244/2019 regulating administrative, technical, and economic conditions for self-consumption, and supporting regulations addressing specific technologies and market arrangements. Spain's framework particularly emphasises geographical advantages in regions such as Andalusia and Castilla-La Mancha.

Administrative procedures typically require 1-2 years, with multi-level coordination identified as the primary complexity factor. Spain has developed one-stop shop approaches for specific project categories while maintaining comprehensive assessment procedures for larger installations. The country demonstrates the most developed inter-sectoral coordination through institutions like the Ministry for the Ecological Transition and the Demographic Challenge.

Table 7-4: Support mechanisms in Spain

Support Mechanism	Coverage/Benefit	Duration / Certainty	Target Group / Features
Direct grants	50–70% of installation costs	One-time	SMEs and rural developers
Feed-in tariffs	Stable pricing	Long-term	Renewable energy producers
Power Purchase Agreements	Long-term contracts	Multi-year certainty	Producers securing stable revenue with buyers
Tax incentives	Comprehensive packages	Ongoing	Broad range of renewable energy investors

Spain's mature renewable energy market provides advantages through established supply chains, experienced service providers, and proven technology solutions. This market maturity reduces technology risks and implementation costs while providing learning opportunities for other member states. Spain demonstrates the most integrated approach, combining financial incentives with regulatory streamlining and social support mechanisms.

8. Overview of National Energy and Climate Plans (NECP) for sustainable rural development

8.1. Bulgaria

Bulgaria's NECP[112] highlights the twin benefits of reducing carbon emissions and promoting rural development, positioning rural areas as key drivers for achieving the 34.1% renewable energy target by 2030. The strategic framework includes several key elements:

1. Coordination between renewable energy support and agricultural funding streams
2. Joint advisory services providing combined agricultural and energy expertise
3. Simplified application procedures for projects combining agricultural and energy objectives
4. Specific measures addressing grid infrastructure limitations in rural areas

The NECP establishes clear metrics for assessing progress beyond traditional renewable energy indicators, including changes in rural employment, farm income, and energy poverty rates. European Commission feedback highlighted the need for more concrete measures addressing implementation barriers, particularly the regulatory gap around energy communities and persistent administrative complexity.

8.2. Estonia

Estonia's NECP reflects the country's unique position as a digital leader with a strong forestry sector and ambitious climate objectives. The plan articulates a vision where rural areas, particularly the forestry sector, play a central role in Estonia's energy transition while benefiting from economic opportunities created by renewable energy development[113].

The strategic approach emphasises efficiency and innovation over scale, leveraging digital infrastructure, forest resources, and technical expertise to achieve transformative rural renewable energy deployment. With renewable energy targets aligned with EU requirements, Estonia's plan demonstrates how a small member state can leverage specific advantages to achieve significant deployment.

Primary technology priorities include biomass systems utilising forest residues and agricultural waste, biogas infrastructure converting agricultural waste streams while reducing methane emissions, smart grid integration deploying advanced digital technologies for distributed generation management, and precision agriculture combining renewable energy with digital farming technologies.

The plan addresses specific implementation challenges, including community acceptance through enhanced stakeholder engagement processes, grid integration requirements for distributed generation, technical capacity building for rural project development, and coordination between forestry and energy policies to maximise resource utilisation efficiency.

Estonia's approach includes provisions for contracts for difference auctions providing long-term price certainty, Nord Pool market access enabling rural producers to participate in regional electricity markets, digital platform integration supporting project development and management, and targeted support for biogas development using agricultural waste streams.

8.3. Slovenia

Slovenia's NECP adopts a measured approach with a 27% renewable energy target by 2030, focusing on well-managed forest resources for sustainable biomass production while maintaining strict environmental standards[114]. The plan demonstrates particular strength in community energy models, reflecting strong cooperative traditions in rural areas.

The strategic framework emphasises sustainable biomass supply requirements and environmental compliance, recognising the need to balance renewable energy development with ecosystem service provision. This approach addresses concerns about biomass sustainability and ensures long-term resource availability while maintaining environmental integrity.

Key support mechanisms for energy communities include a legal framework enabling cooperative formation, technical assistance for community project development, shared infrastructure investment support, and collective purchasing and negotiation support. Slovenia's energy community approach addresses multiple implementation barriers simultaneously through collective action.

The plan includes grants covering up to 75% of installation costs for small-scale projects with streamlined application procedures, prioritised subsidies for biogas projects, particularly in regions with high agricultural activity, feed-in tariffs ensuring stable long-term income from surplus energy supplied to the grid, and tax incentives including reduced income taxes and accelerated depreciation schedules.

Environmental integration measures ensure renewable energy development enhances rather than degrades rural landscapes through appropriate environmental assessments, biodiversity protection measures, sustainable forest management requirements, and coordination with agricultural land use planning to optimise multiple land use objectives.

8.4. Spain

Spain demonstrates the most ambitious approach among the studied countries, targeting 42% of total energy consumption from renewable sources by 2030, with rural areas playing a central role. The Spanish NECP particularly emphasises geographical advantages in regions providing ideal conditions for large-scale solar and wind developments while maintaining focus on rural community benefits[115].

The comprehensive framework demonstrates strong alignment between financial incentives, regulatory streamlining, and social support mechanisms. This integrated approach reflects Spain's relatively mature renewable energy sector and provides advantages through established supply chains and experienced service providers.

Institutional coordination occurs through dedicated structures like the Ministry for the Ecological Transition and the Demographic Challenge, enabling coordinated policy development and implementation across traditional sectoral boundaries. This coordination includes joint agricultural-energy advisory services, integrated permitting procedures addressing multiple regulatory requirements, cross-sectoral planning coordinating rural development and energy strategies, and multi-level consultation mechanisms.

Financial support includes substantial grants covering up to 50-70% of installation costs, particularly targeted at SMEs in rural areas, feed-in tariffs providing guaranteed pricing and reducing market-related risks, power purchase agreements enabling long-term revenue certainty, and comprehensive tax incentive packages including exemptions and accelerated depreciation allowances.

The plan includes specific provisions for renewable energy auctions, ensuring competitive pricing while maintaining rural developer access, modernisation programs supporting precision farming systems powered by renewable energy, community benefit-sharing mechanisms ensuring local communities receive direct financial benefits, and innovation support for advanced technologies, including agrivoltaics and next-generation biomass conversion.

The four NECPs, compared in Table 8-1, demonstrate distinct but complementary pathways for integrating renewable energy with sustainable rural development. Spain stands out with the large-scale deployment of solar and wind, combining strong institutional coordination and significant financial incentives. Estonia, while smaller in scale, positions itself as an innovation leader by merging digital technologies with forestry and agriculture, showing how a small state can leverage niche advantages. Bulgaria emphasizes rural integration and metrics beyond energy (employment, income, poverty reduction) but faces regulatory and administrative hurdles. Slovenia focuses on sustainable biomass and community cooperatives, balancing energy production with strict environmental safeguards.

Together, the cases highlight the diversity of rural-focused renewable strategies within the EU, shaped by national resource endowments, governance traditions, and policy maturity.

Table 8-1: Comparative Dimensions of NECPs in Bulgaria, Estonia, Slovenia, and Spain

Dimension	Bulgaria	Estonia	Slovenia	Spain
Strategic Focus	Rural areas as drivers of renewable transition; integration of agriculture & energy	Leverage digital leadership & forestry sector; efficiency and innovation	Biomass from well-managed forests; cooperative energy models	Large-scale solar & wind, rural community benefits, agrivoltaics
Coordination & Governance	Alignment of renewable and agricultural funding; joint advisory services	Strong policy-forestry coordination; stakeholder engagement; digital platforms	Legal framework for energy cooperatives; shared infrastructure support	Ministry for Ecological Transition & Demographic Challenge ensures cross-sectoral coordination

Deliverable D5.1: Business models and financial and social instruments

Dimension	Bulgaria	Estonia	Slovenia	Spain
Priority Technologies	General RES integration; attention to grid	Biomass, biogas, smart grids, precision agriculture	Sustainable biomass, biogas, small-scale projects	Solar, wind, precision farming, agrivoltaics, biomass conversion
Support Mechanisms	Simplified procedures; progress metrics incl. employment, farm income, energy poverty	CfD auctions; Nord Pool market access; biogas incentives; digital tools	Grants up to 75%; feed-in tariffs; biogas subsidies; tax incentives	Grants (50–70%); feed-in tariffs; PPAs; tax packages
Community & Rural Measures	Metrics on rural employment, income, energy poverty; need for more clarity on energy communities	Rural participation in Nord Pool; stakeholder engagement to build acceptance	Strong cooperative traditions; collective purchasing & negotiation support	Community benefit-sharing; rural SMEs targeted in subsidies
Implementation Challenges	Regulatory gap on energy communities; administrative complexity	Grid integration of distributed generation; rural technical capacity	Balancing biomass with environmental protection	Permitting and coordination complexity despite mature RES sector
Environmental Integration	Grid infrastructure in rural areas highlighted	Focus on efficiency & methane reduction from agri-waste	Strict environmental standards; biodiversity	Rural landscape integration not detailed, but mature

Deliverable D5.1: Business models and financial and social instruments

Dimension	Bulgaria	Estonia	Slovenia	Spain
			protection; sustainable forest management	sector experience supports planning

9. Benefits of renewable energy production in rural areas

9.1. Benefits for the agricultural sector

Renewable energy production provides multiple benefits (Table 9-1) for the agricultural sector, fundamentally transforming rural economic models through revenue diversification, operational cost reduction, and enhanced resilience against market volatility.

Primary agricultural benefits include:

- Revenue diversification through additional income streams independent of commodity markets
- Energy cost reduction improves operational economics by 20-40% compared to grid electricity
- Operational synergies when renewable installations integrate with agricultural activities
- Enhanced market positioning, accessing premium markets, valuing sustainable production
- Risk mitigation through reduced exposure to volatile energy prices and diversified income sources

Table 9-1: Benefits for the agricultural sector

Benefit Category	Impact Level	Time Frame	Implementation Requirements
Revenue diversification	High	Immediate	Grid connection, support schemes
Cost reduction	Medium-High	1-3 years	On-site generation capacity
Market positioning	Medium	2-5 years	Certification, supply chain integration
Risk mitigation	High	Long-term	Integrated business models

Technology integration opportunities enable farmers to combine renewable energy with precision agriculture technologies, creating comprehensive farm management systems that optimise both agricultural and energy production.

9.2. Benefits for the energy sector

Rural renewable energy development provides significant benefits for the broader energy sector through distributed generation, grid stability enhancement, resource diversification, and system resilience improvement as described in Table 9-2.

Key Energy sector benefits, among others are:

1. Distributed generation reduces transmission losses and improves grid efficiency by generating electricity closer to consumption points
2. Grid stability enhancement, which could provide diversity of renewable resources across rural areas, creating natural smoothing of variable generation
3. Resource diversification as biomass resources from agricultural and forestry waste, plus diverse renewable resources including solar, wind, and small hydro
4. System resilience as distributed generation reduces vulnerability to large-scale system failures while providing backup power during grid outages.

Table 9-2: Benefits for the energy sector

Benefit Type	Primary Impact	System-Wide Effect	Rural Contribution
Load balancing	Peak shaving	Reduced transmission strain	Agricultural demand alignment
Resource diversity	Risk reduction	Improved reliability	Multiple technology types
Emergency backup	Local resilience	System redundancy	Microgrid capabilities
Innovation testing	Technology advancement	Sector development	Demonstration platforms

Innovation acceleration occurs through rural renewable projects serving as testing grounds for new technologies and business models, providing opportunities for demonstrating energy storage, smart grid integration, and sector coupling approaches.

9.3. Synergies between the agriculture and energy sectors

The convergence of the agriculture and energy sectors through renewable energy development creates synergies that exceed the sum of individual sector benefits. These synergies encompass economic integration, operational efficiency, environmental enhancement, and systemic transformation (Table 9-3).

1. Economic Synergies

- Shared infrastructure reduces per-unit costs for both agricultural and energy operations
- Revenue integration provides stability through complementary income streams.
- Tax optimisation through integrated operations, enabling more favourable treatment.
- Financing advantages with lower interest rates for integrated projects

2. Operational Integration

- Water management systems integrating renewable-powered irrigation with energy storage
- Labour resources are shared between agricultural and energy operations
- Seasonal coordination with agricultural workers contributing to renewable energy construction
- Maintenance synergies through a shared skilled workforce and equipment

Table 9-3: Synergies between agriculture and energy sectors

Synergy Type	Implementation Approach	Expected Benefits	Timeline
Infrastructure sharing	Common electrical systems, roads	15-25% cost reduction	Immediate
Revenue coordination	Energy sales during agricultural off-seasons	Income stability	1-2 years

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Resource optimisation	Waste-to-energy conversion	Circular economy benefits	2-3 years
Market integration	Agricultural-energy value chains	New business models	3-5 years

Environmental synergies emerge through integrated land management approaches, optimising multiple objectives simultaneously. Agrivoltaics systems provide crop protection benefits while generating clean energy, potentially improving agricultural productivity in hot climates. Technology convergence creates comprehensive farm management systems integrating energy generation with agricultural production optimisation.

10. Practitioner Perspectives on Rural Renewable Energy Implementation

Data was collected through a structured questionnaire administered to renewable energy practitioners in rural agricultural and forestry sectors across the four pilot sites of ECOLOOP project in Bulgaria, Estonia, Slovenia, and Spain. The questionnaire was designed as a follow-up to the previously presented policy analysis research, targeting practitioners with direct experience in renewable energy project implementation.

The questionnaire comprised 47 questions organised into seven thematic areas:

1. Technology adoption patterns
2. Policy implementation gaps
3. Administrative procedures and barriers
4. Financial support mechanisms
5. Policy integration and coordination
6. Stakeholder engagement
7. Policy recommendations

Descriptive statistics and cross-country comparisons were conducted for closed-ended questions, including effectiveness ratings, ranking questions, and categorical responses. Given the small sample size, analysis focused on identifying patterns and variations rather than statistical significance testing. Open-ended responses were analysed using the Framework Method, involving systematic coding, thematic development, and cross-case pattern identification. The analysis followed seven stages: transcription, familiarisation, coding, framework development, application, summarisation, and interpretation.

The study limitations include small sample size, potential selection bias toward practitioners with strong renewable energy backgrounds and limited geographic representation within countries. However, the depth of practitioner knowledge and diversity of country contexts provide valuable insights into implementation realities.

10.1. Technology Adoption Patterns and Regional Variations

The adoption of renewable energy technologies exhibits distinct regional patterns, reflecting both technological suitability and local socio-economic conditions. All respondents identified Solar PV and Biomass/Biogas as the most successfully adopted renewable energy technologies in their regions. Wind energy adoption showed variation, with strong adoption in Spain and Bulgaria but limited adoption in Estonia due to community resistance and geographic constraints. Agri-PV (combined agricultural and solar production) emerged as an innovative approach in Bulgaria, Slovenia, and Spain, indicating growing interest in land-use optimisation strategies (Table 10-1).

Table 10-1: Renewable Energy Technology Adoption Patterns by Country

Country	Technologies Successfully Adopted
Estonia	Solar PV, Biomass/Biogas
Slovenia	Solar PV, Biomass/Biogas, Agri-PV
Spain	Solar PV, Biomass/Biogas, Wind, Agri-PV
Bulgaria	Solar PV, Biomass/Biogas, Wind, Agri-PV, Hydropower

Community acceptance represents a consistent challenge, particularly pronounced in Estonia's wind energy development but present across all countries and technologies. This finding aligns with broader European research on renewable energy acceptance and suggests that technical policy solutions alone are insufficient without addressing social and cultural dimensions of energy transitions.

The analysis reveals consistent implementation gap patterns across diverse national contexts, suggesting that certain challenges transcend specific policy designs or national characteristics. Administrative complexity emerges as a universal challenge, even in countries that have recently implemented simplification measures. This finding suggests that administrative simplification requires ongoing attention and cannot be addressed through one-time policy reforms.

The policy conflict matrix reveals that food security/agricultural production conflicts are universal (100% of respondents), while biodiversity/nature conservation, landscape preservation, and water management conflicts affect most cases. Estonia shows the highest conflict intensity across all domains, while Bulgaria reports the fewest conflicts, potentially reflecting earlier stages of renewable energy deployment.

The prevalence of policy conflicts across countries indicates that renewable energy integration cannot be addressed through energy policy alone. Successful implementation requires coordination across multiple policy domains, particularly agriculture, environment, and land use planning.

10.2. Policy Priorities and Instrument Effectiveness

Practitioners provided clear guidance on policy priorities for accelerating rural renewable energy adoption. The priority rankings in Table 10-2 reveal strong consensus on the importance of simplified administrative procedures (ranked 1 by three countries) and increased financial support (ranked 1-2 by most countries). Energy community support shows moderate priority, while technology-specific incentives consistently rank lower in importance.

Table 10-2: Policy Priority Rankings for Accelerating Rural Renewable Energy Adoption

Country	Simplified Administrative Procedures	Increased Financial Support	Policy Integration	Energy Communities	Technology Incentives
Estonia	1	2	3	1	3
Slovenia	5	5	4	4	4
Spain	3	1	2	4	5
Bulgaria	1	4	2	3	5

Note: 1=Most Important, 5=Least Important for accelerating adoption Source: Own contribution

Practitioners rated the effectiveness of six policy instruments on a scale from "Very Ineffective" to "Very Effective." Feed-in Tariffs showed mixed effectiveness, with Estonia rating them as "Very Effective" while other countries showed more moderate ratings. This variation reflects different national implementation approaches and market maturity levels.

Investment Subsidies were consistently rated as effective across countries, with Slovenia and Estonia providing particularly positive assessments. This finding suggests that direct financial support remains crucial for rural renewable energy adoption. Tax Incentives' effectiveness varied significantly, with Slovenia rating them as "Very Effective" while Estonia found them "Not Applicable," reflecting different national tax policy approaches.

Energy Community Support was generally rated as less effective, with Bulgaria rating it as "Very Ineffective" and other countries showing neutral to moderate effectiveness. This finding highlights the nascent state of energy community development across these countries.

Direct subsidies and grants ranked highest in effectiveness across multiple countries, with feed-in tariffs showing strong performance in specific contexts. This pattern demonstrates the continued importance of direct financial support in rural contexts. Carbon credit payments consistently ranked lowest across countries, suggesting limited practical implementation or awareness of these mechanisms in rural contexts.

Financial support typically covers 21-60% of total project costs, with significant variation by country and project type. Estonia showed lower coverage (0-20%) while Slovenia and Bulgaria achieved higher coverage levels (41-60%). The strong preference for direct subsidies and grants across countries suggests that upfront capital barriers remain more significant than operational support needs. This finding contrasts with theoretical preferences for market-based mechanisms and suggests that rural renewable energy adoption still requires substantial public financial support.

The limited effectiveness of carbon credit payments indicates either poor implementation of these mechanisms or limited awareness among rural practitioners. This finding suggests opportunities for enhanced education and support for market-based environmental payment systems.

10.3. Administrative Challenges and Regulatory Barriers

Administrative procedures remain a critical determinant of renewable energy project viability, often shaping both the pace and feasibility of implementation. Cross-country

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differences in permitting timelines and key regulatory barriers in Table 10-3 illustrate how environmental assessments, grid access, and land-use rules create uneven challenges across the studied regions.

Table 10-3 Administrative Timelines and Primary Barriers

Country	Permitting Timeline	Primary Administrative Barriers
Estonia	1-2 years	Environmental impact assessments, Grid connection applications, Community/public consultation requirements
Slovenia	6-12 months	Environmental impact assessments, Land use change permissions, Subsidy/grant application processes
Spain	1-2 years	Environmental impact assessments, Grid connection applications, Subsidy/grant application processes
Bulgaria	3-6 months	Environmental impact assessments, Grid connection applications, Land use change permissions, Building permits

Permitting processes typically require 6 months to 2 years, with significant variation by country and project type. Bulgaria demonstrated the shortest timelines (3-6 months) following recent administrative simplifications, while Estonia and Spain require 1-2 years for most projects.

Environmental impact assessments emerged as the most common barrier across all countries, followed by grid connection applications and building permits. Slovenia and Bulgaria additionally face significant challenges with land use change permissions. Three countries (Estonia, Spain, Bulgaria) reported significant regional variations in regulatory requirements, creating additional complexity for developers and investors.

Bulgaria's recent administrative simplifications demonstrate rapid policy learning and adaptation. The reduction of permitting timelines from years to months following 2023 reforms provides a model for other countries facing similar administrative barriers.

The existence of significant regional variations in regulatory requirements across multiple countries creates additional complexity for developers and investors. This finding highlights the need for greater harmonization of administrative procedures not only at the national level but also across different regions within countries.

10.4. Policy Integration and Implementation Insights

The degree of integration between energy and agricultural policies varies across EU countries, influencing the extent to which policy objectives are harmonised or come into conflict. The analysis in Table 10-4 indicates that policy integration between energy and agriculture remains uneven across the studied countries. All countries report conflicts between renewable energy deployment and other policy priorities.

Table 10-4 Energy-Agriculture Policy Integration Assessment

Country	Integration Level	Primary Policy Conflicts
Estonia	Some coordination but operating largely independently	Biodiversity/nature conservation, Landscape preservation, Water management, Rural tourism/cultural heritage, Food security/agricultural production
Slovenia	Limited coordination with occasional conflicts	Food security/agricultural production, Biodiversity/nature conservation, Landscape preservation, Water management
Spain	Some coordination but operating largely independently	Food security/agricultural production, Biodiversity/nature conservation, Landscape preservation, Water management, Rural tourism/cultural heritage
Bulgaria	Limited coordination with occasional conflicts	Food security/agricultural production

Estonia's emphasis on market-based mechanisms and grid integration (Nord Pool) provides long-term investment certainty while maintaining competitive pricing. However, this approach faces challenges with community acceptance and political stability.

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Slovenia demonstrates effective balance between financial support and regulatory stability, though the small country size may limit scalability of this approach to larger member states.

Spain's integrated approach through the National Energy and Climate Plan provides policy stability while maintaining flexibility for regional adaptation. The emphasis on public-private partnerships offers lessons for other countries. Spain's more developed coordination mechanisms provide a model for other countries, though the effectiveness of these mechanisms requires longer-term evaluation to assess their impact on implementation outcomes.

The consistently low effectiveness ratings for energy community support mechanisms reveal significant implementation gaps in this critical policy area. Despite EU-level emphasis on energy communities as vehicles for rural energy development, practical support mechanisms remain underdeveloped across all countries studied.

Energy community development requires more fundamental capacity building and regulatory development than initially anticipated by policymakers. This finding highlights the gap between policy aspirations at the EU level and practical implementation capacity at the national and local levels.

The analysis reveals that certain implementation challenges transcend specific policy designs or national characteristics. The universal nature of administrative complexity, community acceptance issues, and policy coordination challenges suggests that these represent fundamental aspects of renewable energy transition that require sustained attention across different national contexts.

The variation in country-specific approaches and their relative success provides valuable insights for policy learning and adaptation. Countries with shorter administrative timelines, better policy coordination, and stronger financial support mechanisms demonstrate higher implementation success, offering models for other countries facing similar challenges.

11. Policy recommendations

11.1. Short-term recommendations

1. EU Level Actions

The most urgent priority involves establishing common definitions and frameworks for energy communities across all member states seen in Table 11-1. The European Commission should issue detailed guidance within eighteen months clarifying minimum requirements for energy community frameworks, including provisions for agricultural cooperatives to transform into or establish energy communities without losing agricultural status and benefits.

Table 11-1: Priority Action Timeline

Action	Timeline	Resource Requirements	Expected Impact
Energy community guidance	18 months	Moderate funding	Enable 500+ communities
EAFRD 15% allocation mandate	24 months	Policy reallocation	Predictable funding
Rural Advisory Service launch	24 months	Sustained investment	Support 10,000 projects annually

Financial mechanism enhancement requires mandating that at least 15% of European Agricultural Fund for Rural Development funds be allocated to renewable energy and energy efficiency measures. The European Investment Bank should establish a dedicated financial instrument for rural renewable energy with simplified access procedures, recognising that rural project developers often lack the sophistication to navigate complex financial instruments designed for large-scale projects.

The establishment of an EU Rural Renewable Energy Advisory Service operational within 24 months should provide free technical assistance to rural project developers, standardised

training curricula for national agricultural advisory services, and a comprehensive online platform sharing best practices and technical guidance.

2. National Level Actions

National governments should establish comprehensive support frameworks addressing administrative, technical, and financial barriers as described below in Table 11-2.

Implementation Requirements

1. One-stop shops for renewable energy permitting and support services within 12 months
2. Publicly accessible grid capacity maps are updated quarterly with real-time information.
3. Agricultural extension services integrating renewable energy expertise
4. Streamlined regulatory frameworks, reducing conflicts between sectoral regulations

Table 11-2: National level actions timeline

National Action	Implementation Timeline	Resource Requirements	Success Metric
One-stop shops	Short-term	Significant investment per country	Substantial permit time reduction (e.g. 50%)
Grid capacity mapping	Short-term	Moderate investment per country	Reduced development cost (e.g. 30%)
Advisor training	Ongoing	Sustained annual investment	Growth of qualified advisors
Regulatory streamlining	Medium-term	Administrative reform	Reduced compliance burden

Agricultural extension services should integrate renewable energy expertise through training programs targeting a certain number of qualified advisors per major agricultural member state, providing comprehensive support covering technology selection, financial planning, regulatory compliance, and maintenance requirements.

3. Regional and Local Implementation

Regional authorities should launch pilot project support programs, funding at least 10 demonstration projects per region, showcasing the successful integration of renewable energy with agricultural operations within 18 months. These pilots should demonstrate technological diversity across solar, wind, biogas, and small hydro systems while showcasing different business models, including individual ownership, cooperatives, and third-party investment arrangements. Systematic documentation and dissemination of learnings should ensure each pilot generates knowledge benefits exceeding direct impacts.

Mandatory benefit-sharing mechanisms should be implemented for all projects exceeding 1 MW capacity within six months, ensuring local communities receive direct financial benefits beyond land lease payments. These mechanisms could include community ownership requirements with a minimum of 20% local ownership, annual payments to affected municipalities of a minimum of EUR 5,000 per MW, or requirements to provide discounted electricity to local consumers.

LEADER Local Action Groups should explicitly incorporate renewable energy into local development strategies within the next planning cycle. Scoring criteria for rural development projects should award additional points for incorporating renewable energy components, recognising synergies between energy and broader rural development. Joint application procedures should allow farmers to apply simultaneously for agricultural modernisation support and renewable energy funding through single processes, reducing transaction costs and improving project integration.

11.2. Long-term recommendations

1. Strategic Framework Development

The development of integrated Rural Energy Transition Plans (Table 11-3) at the regional level represents a foundational long-term intervention requiring coordination across multiple governance levels and policy domains.

Framework Components:

- Multi-scale coordination integrating EU policy frameworks with local implementation mechanisms
- Sectoral convergence aligning agricultural, forestry, and energy policy domains
- Innovation governance structures enabling rather than constraining technological advancement.

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- Community partnership ensuring genuine co-design processes where rural communities drive transformation.

Table 11-3: Long-term recommendations timeline

Transformation Goal	Target Timeline	Success Indicators	Resource Requirements
Economic diversification	2028-2030	Multiple revenue streams	Major investment in installations
Energy independence	2030-2032	Regional self-sufficiency	Substantial grid modernisation
Innovation leadership	2032-2034	Technology demonstration	Significant R&D programs
Community empowerment	Ongoing	Local ownership rates	Sustained capacity building

By 2034, rural areas should achieve multiple revenue streams from agricultural production, energy generation, and energy services; reduced dependency on single commodity markets through integrated operations; enhanced access to energy markets complementing traditional agricultural markets; and local value creation through energy processing and storage rather than raw resource export.

2. Institutional Innovation Requirements

Long-term success requires fundamental governance innovation moving beyond traditional sectoral approaches toward integrated rural development frameworks. This includes:

- cross-sectoral institutions with mandates spanning agriculture, forestry, and energy domains;
- integrated planning incorporating energy infrastructure alongside traditional rural development;
- unified regulatory approaches reducing conflicts between sectoral regulations;

- integrated metrics assessing economic, environmental, and social outcomes simultaneously.

Market development should create supportive ecosystems for rural renewable energy through specialised supply chains serving remote locations, transparent information systems reducing market information asymmetries, appropriate financing mechanisms recognising unique characteristics of rural renewable investments, and secondary markets enabling investment liquidity and risk distribution.

Innovation frameworks should position rural areas as leaders in sustainable technology development through demonstration projects showcasing next-generation technologies, research and development partnerships between rural communities and academic institutions, technology transfer mechanisms sharing successful innovations across regions, and adaptive management processes enabling continuous learning and improvement.

3. Implementation Timeline

Success indicators should include quantitative metrics such as MW of renewable energy capacity installed in rural areas annually, GWh of renewable energy generated from rural installations, percentage of rural renewable energy successfully integrated into grid systems, proportion of locally generated energy consumed locally, percentage of farm income derived from renewable energy activities, total investment in rural renewable energy projects annually, direct and indirect jobs created in rural renewable energy sector, and reduction in energy costs for rural consumers through local generation.

Qualitative assessment should evaluate regulatory coherence across sectors and governance levels, farmer and community satisfaction with policy frameworks, ability of policy frameworks to respond to changing conditions, extent to which policies enable rather than constrain innovation, and success in ensuring all rural communities benefit from transformation rather than only early adopters or well-resourced areas.

11.3. Conclusions on Policy Analysis: Implementation Uncertainties and Risk Factors

The recommendations presented in this analysis must be understood within the context of significant uncertainties that characterise rural renewable energy development.

Implementation timelines may vary substantially based on local conditions, political priorities, and resource availability that cannot be fully predicted at the policy design stage.

1. Timeline Uncertainty Factors

- Political cycles and government changes may alter policy priorities and implementation approaches.
- Economic conditions and budget availability fluctuate based on broader macroeconomic trends.
- Technical challenges may emerge that require additional time for problem-solving and adaptation.
- Stakeholder engagement processes may take longer than anticipated, particularly in areas with limited prior renewable energy experience.
- Regulatory coordination across multiple governance levels often involves complex negotiations that extend beyond initial planning estimates.

2. Resource Requirement Variability

- Infrastructure development costs vary significantly based on geographic conditions, existing grid capacity, and technology choices.
- Human capacity building requirements depend on existing skill levels and institutional capabilities that differ across regions.
- Market development speed influences the need for ongoing support mechanisms, with mature markets requiring different interventions than emerging markets.
- Community acceptance levels affect implementation costs, with higher opposition potentially requiring additional engagement resources and modified project designs.

3. Impact Assessment Challenges

- Rural renewable energy benefits may take longer to materialise than initially projected, particularly for broader economic development impacts.
- Synergies between the agricultural and energy sectors depend on farmer adoption rates and business model evolution, which are difficult to predict precisely.
- Environmental benefits vary based on technology choices, siting decisions, and management practices that evolve.
- Social outcomes depend on community dynamics and local leadership that cannot be easily quantified or controlled through policy instruments.

These uncertainties necessitate adaptive management approaches that build flexibility into policy frameworks while maintaining clear direction toward long-term objectives.

The comprehensive analysis presented in this document demonstrates that optimising renewable energy's contribution to sustainable rural development requires sophisticated

policy approaches operating across multiple scales and timeframes. The evidence from Bulgaria, Estonia, Slovenia, and Spain reveals both the transformative potential of rural renewable energy and the complex barriers that must be addressed through coordinated policy action.

The convergence of climate urgency, energy security concerns, and rural development needs creates an unprecedented opportunity for transformative change that benefits both rural communities and broader society. The technical and policy tools for rural renewable energy transformation exist. What remains is the political will to implement them comprehensively and the commitment to genuine partnership with rural communities in shaping their sustainable future.

When rural communities control their energy future, they gain tools for economic diversification, social revitalisation, and environmental stewardship that extend far beyond energy to encompass comprehensive sustainable development. This analysis demonstrates that the opportunity for transformative rural development through renewable energy integration requires immediate and sustained action to realise its full potential.

12. Conclusions

This report presents the intermediate results of WP5, which investigates innovative business models, financial instruments, and policy recommendations to foster rural development and circular bioeconomy. The work is structured across three core tasks: (i) the design and evaluation of business models for pilot sites, (ii) the identification of financial and social instruments supporting farmers and foresters, and (iii) the review of policies enabling agroforestry and rural renewable energy integration. Together, these activities provide a coherent framework for assessing how economic, environmental, and social objectives can be jointly advanced in rural regions through renewable energy and circular practices.

The business model analysis applied the Triple Layer Business Model Canvas (TLBMC) to the pilot sites, ensuring a holistic evaluation that integrates economic viability, environmental sustainability, and social value creation. Despite regional differences, pilots in Slovenia, Spain, Bulgaria, and Estonia converge around renewable energy solutions linked with land-based practices, such as biomass CHP, biogas, biomethane, Agri-PV, and forestry innovations. This approach highlights strong replicability potential and demonstrates how farmers and foresters can benefit from diversified income streams, improved resource efficiency, and participation in low-carbon value chains. The TLBMC provided the foundation for designing resilient and community-embedded models that balance technological innovation with local development needs.

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The financial instruments analysis revealed a diverse and complementary European financing ecosystem, spanning structural funds, targeted transition mechanisms, and innovative models such as crowdfunding, PPAs, and local energy communities. These instruments demonstrate strategic alignment with the European Green Deal and Fit for 55 package, while enabling territorial cohesion and fostering inclusive access to capital for SMEs, farmers, and rural communities. Importantly, their effectiveness depends on transparent governance, cross-sector coordination, and active stakeholder engagement. Emerging instruments show potential to democratize energy access and stimulate private investment, thereby strengthening resilience and promoting sustainable rural development.

The policy review underscored both opportunities and uncertainties in advancing rural renewable energy. Comparative analysis of national frameworks revealed strong integration in Spain, digital innovation but acceptance challenges in Estonia, reliance on direct support in Bulgaria, and balanced community approaches in Slovenia. Key barriers include administrative complexity, resource variability, and the unpredictability of social and environmental impacts. The recommendations therefore propose a phased approach: short-term actions (2024–2027) targeting immediate barriers, and long-term transformation (2028–2034) enabling systemic change. Ultimately, achieving sustainable rural energy transitions requires adaptive policy frameworks, political commitment, and genuine partnership with rural communities to ensure that renewable energy catalyses broader economic, social, and environmental benefits.

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13.2. Acronyms

Table 13-1: Acronyms

Acronym	Description
ARRS	Slovenian Research Agency
BM	Business Model
BMC	Business Model Canvas
BSMEPA	Bulgarian Small And Medium Enterprises Promotion Agency
CAP	Common Agricultural Policy
CDTI	Centre For The Development Of Industrial Technology
CEC	Citizen Energy Community
CF	The Cohesion Fund

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CFE	Connecting Europe Facility
CINEA	European Climate, Infrastructure And Environment Executive Agency
CSC	Community Or Collective Self-Consumption
DSOs	Distribution System Operators
EAFRD	European Agricultural Fund For Rural Development
EAGF	European Agricultural Guarantee Fund
EARI	Ministry Of Innovation And Growth
EBRD	European Bank For Reconstruction And Development
ECs	Energy Communities
EEEF	The European Energy Efficiency Fund
EFSI	The European Fund For Strategic Investments
EIB	European Investment Bank
EIP-AGRI	European Innovation Partnership For Agricultural Productivity And Sustainability
ELENA	The European Local Energy Assistance
ENCP	National Energy And Climate Plans
ERDF	European Regional Development Fund

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ESCO	Energy Service Companies
ESF+	European Social Fund Plus
ESIF	European Structural And Investment Funds
FEGA	Spanish Agricultural Guarantee Fund
GAEC	Good Agricultural And Environmental Conditions
GNI	Gross National Income
JTF	Just Transition Fund
LCA	Life-Cycle Assessment
LEM	The Local Energy Market
MAF	Ministry Of Agriculture And Food
MAPA	Ministry Of Agriculture, Fisheries And Food
NGOs	Non-Governmental Organizations
NRRP	National Recovery And Resilience Plan
OGs	Operational Groups
P2P	Peer-To-Peer Trading
PAYG	Pay-As-You-Go
POTA	Territorial Activities Association Agreement

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PPA	Power Purchase Agreements
PRIA	Agricultural Registers And Information Board
RDP	Eu Rural Development Programme
REC	Renewable Energy Community
RED	Renewable Energy Directive
RENEWFM	The Eu Renewable Energy Financing Mechanism
RES	Renewable Energy Source
RRF	Recovery And Resilience Facility
RSOs	Regional Specific Objectives
SMEs	Small And Medium Enterprises
SMRs	Statutory Management Requirements
SPIRIT	Public Agency Of The Republic Of Slovenia For The Promotion Of Investment, Entrepreneurship And Internationalization
TE	Transactive Energy
TLBMC	Triple Layer Business Model Canvas

14. Annex 1: BMC questionnaire template

14.1. Economic Layer questionnaire

Table 14-1: Economic Layer template

Component	desc.	Info
Key Partners	Organizations in the Key Partners segment should prioritize suppliers and other partners for successful business partnerships, fostering strong relationships, risk management, and resource acquisition.	
Key Activities	Key Activities are critical tasks for organizations to establish a successful business model, enhancing value propositions, reaching markets, maintaining customer relationships, and earning revenues.	
Key Resources	Key Resources encompass essential assets for a business model (BM), including physical, financial, intellectual, and human assets. They enable organizations to create value propositions, reach markets, maintain customer relationships, and generate revenue.	
Business Value proposition	High business value refers to an organization's unique offering to customers, which can be innovative or optimized with new features, attracting them to its product or service.	

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Customer relationship	The Customer Relationships segment outlines the organization's relationship with customers, ranging from personal to automated, identifying critical routes, and conducting risk management analysis.	
Customer segments	Customer satisfaction is crucial for an organization's success, and understanding their needs is essential due to high market competition. To meet these needs, organizations can group customers based on common needs, behaviors, or attributes relevant to their product or service.	
Channels	Distribution Channels, which include communication, distribution, and sales channels, are essential for BM as they represent the "touch points" where customers interact with the organization and its value proposition.	
Cost structure	The Cost Structure outlines the key costs incurred in a business model, including value creation, customer relationship maintenance, and revenue generation. It can be calculated by defining Key Resources, Activities, and Partnerships.	
Revenue streams	Customer Segments are closely linked to Revenue Streams, which represent cash flow from customers to the organization. To generate one or more Revenue Streams, organizations should strategically determine product or service value. Mechanisms for defining Revenue Streams vary depending on the type of product or service offered and customer segments in the BMC, including fixed list prices, bargaining, auctioning, market dependency, volume dependency, or yield management.	

14.2. Environmental layer questionnaire

Table 14-2: Environmental Layer Template

Component	desc.	Info
Functional Value	Functional Value represents the final output of a product or service, calculated as the sum of functional units over a defined time span, such as a product's lifespan or one year for services. This serves as a baseline for exploring alternative business models.	
Materials	Materials are central to the Environmental layer of the Business Model Canvas (BMC), emphasizing critical or scarce materials due to their environmental impact and sourcing challenges. Focusing on essential materials, rather than every component, helps manage risk and streamline production.	
Production	Production replaces the traditional "Activities" segment in the Environmental BMC and focuses on environmentally impactful or high-risk activities. It is a key aspect of sustainability analysis, relevant for both manufacturing products and delivering services.	
Supplies and Outsourcing	This cover non-core activities that add value but are managed externally. Core activities provide a competitive edge, while outsourced supplies, such as electricity and water utilities, can influence environmental outcomes.	

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Distribution	Distribution involves the physical methods of delivering functional value to customers, considering transportation modes, distances, and the weight of goods. It includes packaging logistics and aims to minimize the environmental footprint of the delivery process.	
Use Phase	The Use Phase is the period when customers utilize a product or service, where maintenance and repairs add to material and energy demand. Often, environmental impact during use exceeds that of manufacturing, encouraging companies to consider Use Phase impact rather than leaving it to customers.	
End-of-Life	End-of-Life planning addresses the stage when a product or service is no longer in use, focusing on recycling, remanufacturing, or disposal. Regulations, such as EU policies, require organizations to account for this phase, which can also offer new business model opportunities	
Environmental Impacts and Benefits	This evaluates ecological costs, including CO2 emissions and resource depletion, with an emphasis on minimizing or reversing negative impacts. Positive environmental outcomes can bolster both sustainability and market competitiveness, highlighting the importance of long-term ecological benefits.	

14.3. Social layer questionnaire

Table 14-3: Social Layer template

Component	desc.	Info
Social Value	Social Value represents an organization's success in delivering societal benefits, enhancing sustainability, and strengthening its reputation. It emphasizes contributions to societal well-being beyond financial gains.	
Employees	Employees are vital to an organization's social value, focusing on essential data such as number, type, diversity, and compensation. Employee programs, including training, development, and onboarding, foster trust, belonging, and enhance the company's reputation.	
Governance	Governance encompasses organizational structure and decision-making policies, influenced by ownership types such as cooperatives, nonprofits, or for-profits. It affects transparency, profit sharing, and decision-making, adapting to the organization's goals.	
Communities	Communities refer to relationships between the organization, suppliers, and local stakeholders. Engaging local communities creates mutual benefits and reduces risks associated with supplier relationships, crucial for community risk management.	

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Societal Culture	Societal Culture reflects the organization's influence on society and the reciprocal impact of societal norms. Thriving within a healthy societal environment is essential, and NGOs often aid in societal acceptance and business integration.	
Scale of Outreach	The Scale of Outreach describes the scope of stakeholder relationships and geographical reach, from local to global. It considers cultural and ethnic diversity across regions, aiming for long-term, integrative relationships that support growth.	
End-users	End-users are the recipients of an organization's value propositions, with products and services tailored to diverse groups based on age, income, education, etc. The goal is to improve quality of life and promote inclusivity.	
Social Impacts and Benefits	Social Impacts and Benefits assess an organization's societal contributions, both positive and negative, through indicators like working conditions, health, safety, and community engagement. Positive impacts include opportunities for personal development and training.	

15. Annex 2: Financial instruments

In Annex 2: Financial instruments, a detailed breakdown of individual funding programmes is presented.

15.1. Summary of the Total Budget Allocated to Each Political and Regional Objectives, and the Budgets of Each Project Country.

Table 15-1: Summary of European Programs Funded by ERDF and Their Breakdown by Amount.

Policy Objectives (PO)	Financing	Regional Support Objectives (RSO)	Financing
1. Smarter Europe	74.910.449.568 €	1.1 Enhancing research and innovation	32.142.963.052 €
		1.2 Reaping the benefits of digitalisation	10.670.639.362 €
		1.3 Growth and competitiveness of small & medium-sized enterprises	23.332.352.381 €
		1.4 Skills for smart specialisation and transition	1.376.404.519 €
		1.5 Digital connectivity	2.388.124.046 €
		1.6 Development or manufacturing of critical technologies	4.999.966.208 €
2. Greener Europe	73.042.965.128 €	2.1 Energy efficiency	18.374.912.556 €
		2.2 Renewable energy	7.965.027.392 €
		2.3 Smart energy systems	5.141.193.588 €
		2.4 Climate change adaptation	10.686.088.412 €
		2.5 Sustainable water	8.806.629.753 €
		2.6 Circular economy	4.278.746.921 €
		2.7 Nature protection and biodiversity	5.543.069.644 €
		2.8 Sustainable urban mobility	10.807.610.168 €
		2.9 Clean technologies	954.991.481 €
		2.10 Reconstruction in response to natural disasters	484.695.212 €
3. Connected Europe	22.333.444.992 €	3.1 Sustainable TEN-T	7.133.119.577 €
		3.2 Sustainable transport	15.200.325.415 €
4. Social Europe	19.089.087.131 €	4.1 Labour market infrastructure	110.712.526 €
		4.2 Education and training infrastructure	5.537.153.734 €
		4.3 Integration of marginalised communities	2.854.736.091 €
		4.4 Integration of third country nationals	25.072.705 €
		4.5 Access to health care	6.861.387.323 €
		4.6 Culture and sustainable tourism	3.700.024.753 €
5. Europe closer to citizens	19.413.831.715 €	5.1 Integrated development in urban areas	12.728.873.046 €
		5.2 Integrated development in rural and coastal areas	6.684.958.670 €
Partnership Objectives Territoriality Actions (POTA)	5.589.020.801 €	(TA) Technical assistance	5.589.020.801 €
TOTAL	214.378.799.335 €		

Table 15-2: Summary of Programs Funded by ERDF in Spain and Their Breakdown by Amount.

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Policy Objectives (PO)	Financing	Regional Support Objectives (RSO)	Financing
1. Smarter Europe	8.664.278.401 €	1.1 Enhancing research and innovation	4.654.502.360 €
		1.2 Reaping the benefits of digitalisation	1.849.061.580 €
		1.3 Growth and competitiveness of small & medium-sized enterprises	1.571.163.867 €
		1.4 Skills for smart specialisation and transition	10.841.224 €
		1.5 Digital connectivity	276.422.198 €
		1.6 Development or manufacturing of critical technologies	302.287.171 €
2. Greener Europe	9.484.035.193 €	2.1 Energy efficiency	2.035.645.509 €
		2.2 Renewable energy	2.435.860.009 €
		2.3 Smart energy systems	856.666.488 €
		2.4 Climate change adaptation	843.770.771 €
		2.5 Sustainable water	1.438.296.024 €
		2.6 Circular economy	145.645.897 €
		2.7 Nature protection and biodiversity	620.158.317 €
		2.8 Sustainable urban mobility	954.118.444 €
		2.9 Clean technologies	153.873.735 €
3. Connected Europe	1.273.564.863 €	3.1 Sustainable TEN-T	1.022.756.463 €
		3.2 Sustainable transport	250.808.400 €
4. Social Europe	1.861.228.436 €	4.2 Education and training infrastructure	384.817.998 €
		4.3 Integration of marginalised communities	75.074.822 €
		4.5 Access to health care	1.187.923.277 €
		4.6 Culture and sustainable tourism	213.412.339 €
5. Europe closer to citizens	2.114.335.480 €	5.1 Integrated development in urban areas	2.056.375.480 €
		5.2 Integrated development in rural and coastal areas	57.960.000 €
TOTAL	23.397.442.373 €		

Table 15-3: Summary of Programs Funded by ERDF in Bulgaria and Their Breakdown by Amount.

Policy Objectives (PO)	Financing	Regional Support Objectives (RSO)	Financing
1. Smarter Europe	1.565.060.000 €	1.1 Enhancing research and innovation	918.517.931 €
		1.2 Reaping the benefits of digitalisation	424.542.069 €
		1.3 Growth and competitiveness of small & medium-sized enterprises	205.000.000 €
		1.4 Skills for smart specialisation and transition	17.000.000 €
2. Greener Europe	1.629.648.777 €	2.1 Energy efficiency	114.000.000 €
		2.4 Climate change adaptation	186.240.254 €
		2.5 Sustainable water	324.779.918 €
		2.6 Circular economy	598.289.979 €
		2.7 Nature protection and biodiversity	406.338.626 €
3. Connected Europe	734.610.000 €	3.1 Sustainable TEN-T	734.610.000 €
5. Europe closer to citizens	1.501.780.000 €	5.1 Integrated development in urban areas	436.122.902 €
		5.2 Integrated development in rural and coastal areas	1.065.657.098 €
Partnership Objectives Territoriality Actions (POTA)	210.319.500 €	(TA) Technical assistance	210.319.500 €
TOTAL	5.641.418.277 €		

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Table 15-4: Summary of Programs Funded by ERDF in Estonia and Their Breakdown by Amount.

Policy Objectives (PO)	Financing	Regional Support Objectives (RSO)	Financing
1. Smarter Europe	768.203.120 €	1.1 Enhancing research and innovation	343.930.532 €
		1.2 Reaping the benefits of digitalisation	161.460.000 €
		1.3 Growth and competitiveness of small & medium-sized enterprises	185.787.888 €
		1.4 Skills for smart specialisation and transition	11.074.500 €
		1.5 Digital connectivity	65.950.200 €
2. Greener Europe	560.234.324 €	2.1 Energy efficiency	436.770.000 €
		2.2 Renewable energy	7.245.000 €
		2.4 Climate change adaptation	16.859.324 €
		2.8 Sustainable urban mobility	99.360.000 €
4. Social Europe	173.466.000 €	4.2 Education and training infrastructure	74.520.000 €
		4.3 Integration of marginalised communities	98.946.000 €
5. Europe closer to citizens	199.657.710 €	5.1 Integrated development in urban areas	43.176.060 €
		5.2 Integrated development in rural and coastal areas	156.481.650 €
TOTAL	1.701.561.154 €		

Table 15-5: Summary of Programs Funded by ERDF in Slovenia and Their Breakdown by Amount

Policy Objectives (PO)	Financing	Regional Support Objectives (RSO)	Financing
1. Smarter Europe	752.624.896 €	1.1 Enhancing research and innovation	428.376.150 €
		1.2 Reaping the benefits of digitalisation	90.996.314 €
		1.3 Growth and competitiveness of small & medium-sized enterprises	189.593.189 €
		1.4 Skills for smart specialisation and transition	23.308.303 €
		1.5 Digital connectivity	20.350.940 €
2. Greener Europe	514.913.941 €	2.1 Energy efficiency	44.727.973 €
		2.2 Renewable energy	104.766.557 €
		2.3 Smart energy systems	40.365.921 €
		2.4 Climate change adaptation	113.139.081 €
		2.5 Sustainable water	13.771.760 €
		2.6 Circular economy	59.352.799 €
		2.7 Nature protection and biodiversity	82.985.494 €
		2.8 Sustainable urban mobility	55.804.356 €
3. Connected Europe	109.594.577 €	3.2 Sustainable transport	109.594.577 €
4. Social Europe	134.438.026 €	4.2 Education and training infrastructure	33.948.063 €
		4.3 Integration of marginalised communities	19.302.750 €
		4.5 Access to health care	60.837.300 €
		4.6 Culture and sustainable tourism	20.349.913 €
5. Europe closer to citizens	88.213.862 €	5.1 Integrated development in urban areas	59.088.150 €
		5.2 Integrated development in rural and coastal areas	29.125.712 €
TOTAL	1.599.785.302 €		

15.2. Managing Bodies of ERDF Funds in the Different Project Countries

Table 15-6: *Managing bodies of ERDF funds in Spain. Amounts allocated to each ministry for the launch of various funding calls*

Managing Body	ERDF (€)	≈ % ERDF	≈ % National ERDF	Observations
Autonomous Communities (CCAA)	€14.038 M	≈ 60%		Regional management and direct execution
Ministries	€9.358M	≈ 40%	100%	ERDF under national management
Ministry of Science and Innovation (CDTI)	~€3.509 M	~15%	~37.5%	Management and national funds for business R&D&I, startups, CDTI/AEI calls
Ministry for Ecological Transition (IDAE, MITECO)	~€2.514 M	~10.7%	~27%	Energy, efficiency, and climate projects
Ministry of Finance (SGFE and DGFE)	~€1.310 M	~5.6%	~14%	Coordination, national funds, SGFE and DGFE management
Ministry of Industry, Trade and Tourism	~€1.310 M	~5.6%	~14%	Industrial support, internationalization, competitiveness
Sectoral agencies (ICEX, Others)	~€154M	~0.7%	~1.7%	Internationalization, culture, environment
Ministry of Culture	~€561M	~2.4%	~6%	Cultural and creative projects

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Managing Body	Functions
Council of Ministers / Ministry of Innovation and Growth	General coordination of structural and cohesion funds
EARI – Executive Agency for Research and Innovation	Implementation of national and international R&D programs
BSMEPA – Small and Medium Enterprises Promotion Agency	Support for internationalization and SME growth
Fund of Funds Bulgaria	Financial instruments (venture capital, loans, guarantees)
Managing Body	Functions

Table 15-7: Managing bodies of ERDF funds allocated to Bulgaria

Table 15-8: Managing bodies of ERDF funds allocated to Estonia

Managing Body	Functions
Ministry of Finance (Rahandusministeerium)	National coordination of EU funds (ERDF, ESF+)
EISA (Enterprise Estonia)	Business support, R&D, internationalization, digitalization
KIK (Environmental Investment Centre)	Green financing: renewables, efficiency, water and climate
Archimedes Foundation	Management of EU educational and research programs

Table 15-9: Managing bodies of ERDF funds allocated to Slovenia

Table S9

Managing Body	Functions
SVRK – Office for Development and Cohesion	National coordination of structural funds (ERDF, ESF+, CF)
SPIRIT Slovenia	Support for SME innovation, internationalization, and digitalization
ARRS – Slovenian Research Agency	Funding for scientific research projects
Eko Sklad – Environmental Development Fund	Energy sustainability and environmental efficiency programs

15.3. Priorities of the Different Countries for ERDF Funds

Table 15-10: Priorities and regional ERDF budget distribution in the Valencian Community (Spain)

Priority	% of Regional ERDF Budget
Innovation and R&D&I	25% – 35%
Ecological transition and energy	20% – 30%
Infrastructure and urban development	15% – 25%
Competitiveness and SME support	10% – 15%
Others (digitalization, training)	5% – 10%

Table 15-11: Estimated total budget allocated to Bulgaria (2021–2027): approximately ~€9,000M

Priority	% Allocation	Allocation (€)	Example Initiatives
Competitiveness and Innovation	~24%	~€2,129M	Support for business R&D, digitalization, advanced technologies
Sustainable Infrastructure	~20%	~€1,803M	Transport, sanitation, waste management, energy
Digitalization	~6%	~€568M	E-government, modernization of services
Education and Human Capital	~22%	~€2,000M	Training programs, STEM skills improvement
Social Inclusion and Employment	~28%	~€2,500M	Labor market access, support for vulnerable groups

Table 15-12: Total budget allocated to Estonia (2021–2027): approximately ~€3,400M

Priority	% Allocation	Allocation (€)	Example Initiatives
Digitalization and Innovation	~22%	~€748M	SME digital transformation, ICT development, digital public services
Sustainability and Green Transition	~26%	~€884M	Energy efficiency, sustainable mobility, renewables
Business R&D&I	~14%	~€476M	Innovation vouchers, applied research support
Regional Competitiveness	~18%	~€612M	Economic development in less advanced regions
Social Cohesion	~20%	~€680M	Training, inclusion, access to employment

Table 15-13: . Total budget allocated to Estonia (2021–2027): approximately ~€3,200M

Priority	% Allocation	Allocation (€)	Example Initiatives
Digitalization and Innovation	~18%	~€576M	SME digital transformation, ICT development, digital public services
Sustainability and Green Transition	~28%	~€896M	Energy efficiency, sustainable mobility, renewables
Business R&D&I	~14%	~€448M	Innovation vouchers, applied research support
Regional Competitiveness	~20%	~€640M	Economic development in less advanced regions
Social Cohesion	~20%	~€640M	Training, inclusion, access to employment

15.4. Regional and Multi-Regional ERDF Funding Calls for Project Financing in Spain.

Table 15-14: CDTI (Centre for the Development of Industrial Technology). Finances business R&D&I projects with ERDF (Multi-regional Programme)

Call	Period	Budget (€)	Description	Beneficiaries	Programme
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Science and Innovation Missions	2026–2029	€60,000,000	Collaborative R&D projects tackling national socio-economic challenges	Groups of 3–6 companies, at least 1 SME	CDTI (Ministry of Science)
EuroHPC (DARE)	2025–2026	€13,159,583	Supercomputing projects with RISC-V architecture	Companies/entities in supercomputing	EuroHPC European Programme
Med4Cure (IPCEI Health)	Until 31/08/2026	€126,980,000	R&D and industrial deployment in health	Companies in R&D and initial deployment	IPCEI European Strategic Project
NEOTEC	2025–2026	€20,000,000	Support for creation and growth of tech startups	Innovative startups < 3 years old	CDTI
Seal of Excellence +	2025–2026	€5,000,000	Support for projects with EIC Seal of Excellence	Spanish projects with EIC Seal	CDTI / EIC
CIIP (Eurostars CoD)	2025–2026	€20,000,000	International collaborative projects led by SMEs	SMEs in international consortia	Eurostars (EUREKA + CDTI)
SERA	2025–2026	Part of €182M*	International collaborative R&D projects (Eurostars)	Internationally collaborating companies	Eurostars (EUREKA + CDTI)
Cervera Centres	2025–2026	€10,000,000	Strategic technology funding for tech centres	Technology centres	CDTI / Ministry of Science
Innoglobal	2025–2026	€7,000,000	International R&D projects co-financed by ERDF	Companies with international projects	CDTI + ERDF
Innterconecta STEP	2025–2026	€90,000,000	Strategic Projects in Key Technologies for Europe (STEP)	Business consortia	CDTI + ERDF + EU
Horizon Challenge 2030	2024–2027	€50,000,000	Projects addressing major technological/social challenges for 2030	Companies and R&D centres	CDTI / Ministry of Science
Spain, Entrepreneurial Nation	2021–2025	€30,000,000	Promotion and consolidation of startups	Startups and spin-offs	Recovery Plan / Ministry of Industry
Individual R&D Projects	2021–2025	€50,000,000	Support for R&D by individual companies	Innovative companies	CDTI
Collaborative R&D Projects	2021–2025	€40,000,000	Joint R&D projects between several companies	Companies and collaborative centres	CDTI
Technological Innovation Project (PIT)	2021–2025	€15,000,000	Projects focused on technological innovation	Innovative companies	CDTI

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INNPRONTA Programme	2021-2025	€30,000,000	Projects accelerating the innovation process	Medium and large enterprises	CDTI / Spain Entrepreneurial Nation Plan
NEOTEC Express Programme	2023-2025	€10,000,000	Fast-track subprogram for tech startups	Startups	CDTI
Eurostars +	2024-2027	Part of €182M*	International collaborative projects led by SMEs	SMEs	EUREKA + CDTI
CDTI Innvierte	2021-2025	€800,000,000	Co-investment fund for startups and innovative SMEs	Investors and startups	CDTI
NEOTEC Programme 2021-2025	2021-2025	€20,000,000	Funding for tech startups	Startups < 3 years	CDTI

Table 15-15: MCIN and AEI – Co-funding of Research Activities with ERDF/ESF as Intermediate Body

Objective	Line / Body	Description	Status and Key Data
FID – Public Procurement of Innovation	SGFEII	Innovative public procurement	€177M, March 2024
ESFRI_GIC	SGGICT / SGFEII	ESFRI/GIC research infrastructure	> €500k, open from Sep 2024
ICTS and LifeWatch ERIC	SGGICT and SGINCI	Scientific-technological infrastructures	Equipment and international nodes
Scientific-Technical Equipment	AEI (with SGFEII)	Acquisition and upgrading of R&D equipment	

Table 15-16: MCIN and AEI – Research Calls Co-Funded with ERDF/ESF

Call	Duration	Budget (€)	Description	Beneficiaries
Knowledge Generation Projects (PGC)	2021-2027 (Plans 2021-23 / 24-27)	~€412M/year	Basic research in all disciplines (A/B modalities)	Public/private research groups
Proof of Concept Projects (PDC)	2021-2027	~€40-50M/year	Funding to mature R&D results for practical use	Researchers with PGC projects

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Researcher Consolidation ("R3 Certificate")	2025–2028	~€20M/year	Career stabilization program for postdoctoral researchers	Universities and public research bodies
International Collaborative Projects (ERA-NET/PCI)	2021–2027	~€3–5M/year	Transnational calls (Water4All, SBEP, JPI, etc.)	Universities, research centers, OPIs
TransMisiones Projects (AEI-CDTI)	2023–2026	€60M (AEI only)	Collaborative projects between public centers and companies	OPIs and public tech centers
Strategic R&D&I Projects (LIE)	2021–2027	~€50–60M/year	Public-private strategic research (energy, health, agri...)	Business + public research consortia
AI Research Projects	2025–2028	€31–36M (2025)	Interdisciplinary AI projects with direct funding	Public and private research centers
Severo Ochoa and María de Maeztu Excellence Centres	From 2025	€100–150M (multiannual)	Structural support for excellent research centres	Universities and public R&D centres
ATRAE Programme (Attracting Consolidated Talent)	2023–2027	€45M (2025)	Support for return of researchers from abroad	Universities and public R&D centres
Intl. Collaboration Projects (ERA-NET, Art. 185/187 TFEU)	2021–2022	€14.7M	Co-funding of European call projects	Public or non-profit SECTI groups
Interdisciplinary Projects in Strategic Areas	2021–2022	Variable	Key-area research (health, climate, agri...) with public-private collaboration	Business + public R&D bodies
Green and Digital Transition R&D Projects	2021	Variable	Research for sustainability and digitalization	Public and non-profit private centers

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Public-Private Collaboration Projects	2021–2022	Variable	Applied research with high TRLs, business-led	Companies and R&D bodies
ERC Excellence Projects (Europe)	Until 8 July 2022	€2.5M	Support for well-rated but unfunded ERC proposals	Public or non-profit researchers
Strategic R&D&I (Specific 2022 call)	14 Jun – 5 Jul 2022	€70M	Industrial research in 18 priority areas	Business + research centers consortia
Intl. Collaboration Projects (Horizon Europe, etc.)	24 Oct – 3 Nov 2022	€27.3M	Boosting Spanish participation in European programs	Spanish entities in European consortia
FID – Public Procurement of Innovation	2021–2027	€252M	Co-funding for innovative public solutions	Public contracting entities
ESFRI_GIC	Annual (2022–2031)	Variable (e.g., €11M)	Support for governance and ICTS participation in ESFRI	National ICTS managers
ICTS (Unique Scientific-Technical Infrastructures)	Varies by ICTS	Variable	Structural funding for major scientific infrastructures	Public entities or consortia
LifeWatch ERIC	Permanent / project-based	EU + MCIN funding	European infrastructure for ecology and biodiversity	LifeWatch consortium members
Scientific-Technical Equipment	Periodic (per Nat. Plan)	Variable	Acquisition/renewal of research equipment	Public or non-profit research centers

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Table 15-17: IDAE (Institute for Energy Diversification and Saving, MITECO). Management of ERDF funding lines for renewable energy investment, with regional support

Call	Year / Status	Budget (€)	Final Beneficiaries	Summary
1. Innovative Renewable Energies (PRTR)	2024 – processing	Not published	Energy companies, tech centers, public-private consortia	NextGen fund for renewables, storage, and thermal systems
2. Energy Storage (ERDF 2021-27)	2025	€699,757,316	Large energy firms, grid operators, tech consortia	Innovative large-scale energy storage projects
3. Energy Storage (PRTR, hybrid + renewables)	2023 – resolved Dec	~€150M	Energy companies, local cooperatives, renewable promoters	First NextGen call for hybrid storage and renewables
4. RENOCICLA – Circular Economy for Renewables	2025 – application	€164,000,000	Recycling firms, renewable equipment manufacturers, industrial SMEs	ERDF co-funded: circular goods for renewable sector
5. RENOAGE – AGE Renewables	2025 – until Mar 2026	€312,287,223	National Government entities (AGE), autonomous bodies	Expression of interest for installations in national government buildings
6. Expressions of Interest – AGE Energy Efficiency	2024 – open	Not published	Ministries and national government agencies	Projects to reduce energy consumption in public buildings
7. New Business Models (PERTE ERHA)	2023 – submission	Not published	Startups, SMEs, tech clusters, innovation centers	Energy model innovation projects under PERTE
8. Renewable Hydrogen – PRTR Component 31	2025 – submission	Not published	Energy companies, green H ₂ developers	Grants for green hydrogen production (BES scheme)
9. HY2MOVE – Hydrogen/Mobility Transport	2025 – submission	Not published	Transport companies, vehicle manufacturers, logistics operators	Hydrogen projects for transport (PRTR C9)
10. HY2USE – Hydrogen for Industry	2024 – submission	Not published	Large industrial energy consumers (chemical, metal sectors)	Industrial hydrogen projects (PRTR C9)
11. Renewable Equipment Value Chain (PRTR)	2024 – submission	Not published	Renewable equipment manufacturers, industrial SMEs, engineering firms	Equipment for energy transition
12. Photovoltaics and Renewables with Storage (Order TED 765/2024)	Oct–Nov 2024	~€219M	Farmers, agrarian cooperatives, renewable SMEs	Subprograms: agrivoltaics, floating, storage, self-consumption, heat pumps
13. Energy Efficiency in Agricultural Holdings (RD 149/2021)	2021–2023	Not published	Farms, agricultural cooperatives, self-employed	RD 149/2021 Program (mod. 1126/2021) for agri holdings

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Table 15-18: ICEX Spain Trade and Investment. Acts as intermediate body for internationalization projects co-funded by ERDF. These are annual calls

Call	Foundation	Budget / Beneficiaries	Approximate Deadline
ICEX Next	SME Internationalization	~€3M, 125 slots per call	Sept–Oct 2024; Nov–Dec 2024
Innova Invest	Innovative Foreign Investment	€4M, up to €800,000/project	10 Feb – 9 Apr 2025
ICEX Vives	Scholarships for youth	—	2025 call approved in February
ICEX Internships	Young internationalization	12 months	9 Jun – 9 Jul 2025

Table 15-19: ICEX Spain Trade and Investment – Annual Calls Details

Call / Programme	Period	Total Budget (€)	Brief Description	Beneficiaries
ICEX Next	2021–2024	Not published	Export initiation and consolidation; several annual calls	Internationally oriented SMEs
Innova Invest (1st call)	2021	Part of €10.8M (2021–27)	Support for foreign companies' R&D; projects ≥ €500k, max aid €800k	SMEs/midcaps with ≥50% foreign capital
Innova Invest (2nd call)	2023	€5.1M	Continuation of foreign R&D investment support	Same as above
Innova Invest (3rd call)	Until 08/04/25	€4M	New call for foreign R&D investment	Same as above
ICEXDANA	Until 25/05/25	€6M	Recovery of export activity post-floods (DANA)	Affected companies
ICEX Vives Project	2022 → 2025	€27M (2022), €10M (2025)	International internships for youth in Spanish companies	Youth and collaborating firms
Foreign Companies R&D (Tech Fund)	2022	Up to €3M per call	Support for foreign capital companies' R&D projects	Companies with ≥10% foreign capital
ICEX Support to Partners	Until 01/12/25	Not disclosed	Financial support via partners for internationalization	Partner entities and companies

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Table 15-20: Regional Aid Calls – Valencian Community (Autonomous)

Area / Programme	Call Year(s)	Application Periods	Amount & Terms	Organism	Description
SME R&D (PIDICV)	2021, 2023, 2025	Feb–Mar (varies)	Up to 45% small / 35% medium; €30k–175k projects	IVACE	Supports industrial research and experimental development in SMEs
R&D Cooperation (PIDCOPCV)	2021, 2023, 2025	Feb–Mar	Up to 60% small, 50% medium, 40% large; €80k–500k projects	IVACE	Encourages collaborative R&D among firms
Tech Centres	2025	4 Mar – 16 Apr	100% ERDF; up to €200k individual, €180k in cooperation, max €1.8M total	IVACE+i	Funds non-economic R&D led by tech centers; must include at least one company
DigitalizaCV	2021	11 Feb – 10 Mar	ERDF co-financing (rate not specified)	IVACE	SME digitalization
InnovaCV (SME Innovation)	2021, 2025	Same as PIDICV	Similar intensities to PIDICV	IVACE	Innovation in SMEs
Self-consumption in Regional Gov.	2021	15 Dec 2021 – 31 Jul 2024	NextGen / MRR; 18-month justification deadline	IVACE	Supports self-consumption installations in public buildings
MOVES III (e-mobility)	2021	Varies by stream (2021–2025)	NextGen / MRR; justification deadlines 8–12 months	IVACE	Supports electric mobility and clean energy
Energy Efficiency in Industry	2019–2024	3 Aug 2019 – 30 Jun 2024	ERDF; details vary	IVACE	Energy efficiency improvements in industry
Post-DANA (ARA EMPRESSES)	2025	15 Apr – 1 Jul	70% of costs; up to €50k/company + audit	IVACE	Business recovery post-flood (DANA)

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Self-consumption in Municipalities	2025	17 Apr – 19 May	Not ERDF (regional programme); similar to NextGen	IVACE	Renewable energy installations in municipalities
SME Internationalization	2025	16 May – 20 Jun	ERDF co-financed	IVACE	Promotion of international strategy for SMEs

Table 15-21: Valencian Community: Aid Calls and Deadlines by Sector

Area	Call Focus	Beneficiaries	Deadline
Innovation (IVACE, AVI)	SME R&D, cooperation, tech centres, talent	SMEs, tech centres, universities, startups, individual researchers	Feb – Apr 2025
Sustainable Energy (IVACE)	Renewable and self-consumption installations	Individuals, energy communities, SMEs, local governments	From Feb 2025
Social Housing & Renovation	Energy housing, asbestos removal	Public admin., social orgs, HOAs, low/mid-income households	From Jan 2025
DANA Resilience	Local recovery projects	Municipalities, associations, provinces, public consortia	Ongoing
Sports and Cultural Events	NextGen aid in sports and circuits	Federations, local entities, event organizers, clubs	As per NextGen programme

Table 15-22: Valencian Community: Autonomous Aid Calls for SMEs

Call	Fund	Application Period	Beneficiaries	Objective
PIDI-CV – SME R&D 2025	ERDF	11 Feb – 25 Mar 2025	SMEs	Non-repayable grant for R&D projects (<45% small / <35% medium)
PIDCOP-CV – Cooperative R&D 2025	ERDF	11 Feb – 25 Mar 2025	Consortia (min. 1 SME)	Financing for collaborative R&D among companies
INNOVA-CV – SME Innovation 2025	ERDF	11 Feb – 25 Mar 2025	SMEs	Support for innovation projects in SMEs
Tech Centres + Companies (IVACE)	ERDF	4 Mar – 16 Apr 2025	Tech centres with companies	Joint R&D projects

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SME Grants	Internationalization	ERDF	16 May – 20 Jun 2025	SMEs	Support for internationalization strategy and global presence
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Table 15-23: Autonomous Aid Calls for Renewable Energy and Climate Change (Valencian Community)

Call	Target Group	Fund	Application Period
Renewable Energies 2024	Companies, individuals	ERDF	14 May – 13 Jun 2024
Self-consumption (energy communities) 2024	Communities, municipalities	ERDF	15 May – 28 Jun 2024
Municipal Self-consumption	Municipalities	ERDF	Until 16 May 2025
Biomass for Companies	Companies	ERDF	Until 3 Nov 2023 (exec. until Jun 2026)
Off-grid Installations (solar, wind...) 2024	Companies, entities	ERDF	Closed (Apr – Jun 2024)

15.5. Regional and Multi-Regional ERDF Funding Calls for Project Financing in Bulgaria.

Table 15-24: Calls managed by the Ministry of Innovation and Growth / EARI (Bulgaria) (<https://www.mig.government.bg>) for SME financing.

Call	Period	Budget (€)	Description	Beneficiaries
Innovation and Competitiveness (OPIC)	2021–2027	€1.5 billion	R&D projects, digital transformation, energy efficiency	All types of companies
StartUP BG	2025–2026	€50 million	Direct financing and seed capital for tech startups	Startups and entrepreneurs
Euroclusters Bulgaria	2024–2026	€40 million	Promotion of industrial clusters and collaborative innovation	Business associations/clusters

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Table 15-25: Calls managed by Fund of Funds Bulgaria(<https://www.fmfib.bg>) for SME financing.

Call	Period	Budget (€)	Description	Beneficiaries
Financial Instruments for Innovation	Venture capital	€150 million	Co-investment funds for startups and tech companies	Investors, SMEs
Energy Efficiency in Industry	Subsidized loans	€80 million	Support for energy efficiency investments in industry	Industrial, manufacturing sector
Urban Development and Green Projects	Guarantees and loans	€200 million	Sustainable urban development and climate projects	Municipalities, consortia

Table 15-26: Calls by the SME Promotion Agency (BSMEPA) – Bulgaria for SME financing

Call	Period	Budget (€)	Description	Beneficiaries
SME Export Hub	2025–2026	€20 million	Support for internationalization, fairs, export promotion	SMEs
Digitalisation Support	2024–2026	€30 million	Digital transformation in production and commerce	SMEs and microenterprises
Clustering and Networks	2024–2025	€10 million	Creation of business networks and clusters	Associations, cooperatives

15.6. Regional and Multi-Regional ERDF Funding Calls for Project Financing in Estonia.

Table 15-27: Calls by EISA – Enterprise Estonia (EAS) (<https://eas.ee>) for SME financing

Call	Period	Budget (€)	Description	Beneficiaries
Innovation Voucher	2024–2027	~€25,000/company	Technical validation and feasibility studies	Startups, innovative SMEs
Applied Research Support	2025–2026	~€500,000	Co-funding of applied industrial R&D	Medium and large enterprises
Digital Product Development	2025	~€300,000	Digital product development	ICT companies

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Green ICT Program	2024–2027	~€45M (EEA Grants)	Sustainable digitalization and green industry innovation	International consortia
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Table 15-28: . Calls by KIK – Environmental Investment Centre (Estonia) for SME financing

Call	Period	Budget (€)	Description	Beneficiaries
Climate and Energy Program	2024–2027	~€300M	Energy renovation, sustainable mobility, energy efficiency	Companies, municipalities
Water Management Program	2025–2026	Variable	Water infrastructure and sanitation	Municipalities, consortia
Circular Economy Grants	2025–2027	In preparation	Investments in circular economy and recycling	Industry and SMEs

15.7. Regional and Multi-Regional ERDF Funding Calls for Project Financing in Slovenia.

Table 15-29: Calls by SPIRIT Slovenia (<https://www.spiritslovenia.si>) for SME financing

Call	Period	Budget (€)	Description	Beneficiaries
Support to Innovative Startups	2025	€5–€10M	Initial support for tech startups	Tech startups
Green and Digital Transition for SMEs	2025–2027	€80M	Co-funding for digitalization and efficiency	SMEs
Internationalisation of SMEs	Annual	€15M	Export promotion and international trade fair support	Exporting SMEs

Table 15-30: Calls by ARRS – Slovenian Research Agency for SME financing

Call	Period	Budget (€)	Description	Beneficiaries
Public Research Projects	2021–2027	€120 million/year	Competitive funding for basic and applied research	Universities, institutes

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Bilateral R&D Projects	2024–2026	Variable	International cooperation projects (Germany, Austria, etc.)	Academic consortia
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Table 15-31: Calls by Eko Sklad – Slovenian Environmental Public Fund

Call	Period	Budget (€)	Description	Beneficiaries
Energy Efficiency in Buildings	2025–2026	€150 million	Grants for energy renovation of buildings	Municipalities, owners
E-Mobility Support	2024–2025	€60 million	Incentives for electric vehicle acquisition	Companies and individuals
Solar Energy and Heat Pumps	2025–2027	In preparation	Support for household renewable installations	Households, local communities

15.8. CAP Funding Allocated to Spain, and Its Calls, for the 2021–2027 Period

Table 15-32: CAP Funding in Spain – Pillar I (EAGF) and Pillar II (EAFRD)

Fund	Total Spain (€M)	% of EU-27 Total	Managing Bodies	Directly Managed (€M)	% of Spain Total	Calls / Notes
EAGF	≈ €24,177M	≈ 12.5%	FEGA (MAPA) + Regional Governments	≈ €5,030M	~20.8%	Basic payment, eco-schemes, redistributive, coupled, sectoral, crisis
				≈ €535M	~2.2%	Market measures, promotion, crisis reserve
				≈ €18,612M	~77%	Same types of aid, implemented regionally
EAFRD	≈ €7,802M	≈ 7.9%	Regional Governments + LAGs (via FEGA)	≈ €2,015M	~25.8%	Investments, agri-environmental, organic, disadvantaged areas
				≈ €5,287M	~67.7%	Multi-year projects, pending payments, 2023–25 carryover

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LEADER	≈ €540M (part of EAFRD)	≈ 0.7%	Local Action Groups (LAGs)	≈ €540M	≈ 6.9% (of EAFRD)	Local projects, entrepreneurship, rural development
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Table 15-33: Published CAP Calls – Spain (EAGF) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Notes
Direct Payments (Single Application)	Annual	Regional Governments	Farmers and livestock keepers	Based on hectares, eco-schemes, sectors
Young Farmers Payment	Annual	Regional Governments	Age ≤ 40	~€100/ha approx. (varies by region)
Coupled and Ecological Payments	Annual	Regional Governments	Specific sectors	E.g. protein crops, beet, sheep, cattle
Wine Promotion in Third Countries	Variable	MAPA + Regions	Wine-producing companies	Up to 50% of eligible expenses (EAGF)
School Program (fruit/milk)	Annual	Regional Governments	Schools	Co-funded by EAGF + national funds
Market Measures / Intervention	Exceptional	MAPA + FEAGA	Agri-food sector	For market crises (meat, milk, cereals...)

Table 15-34: Published CAP Calls – Spain (EAFRD) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Notes
First Installation – Young Farmers	1–2 years	Regional Governments	≤ 40 years old, business plan	€20,000–70,000 depending on region and criteria
Modernization of Farms	1–2 years	Regional Governments	Professional farmers	30–50% subsidy on investments
LEADER (Local Development)	Phased	Local Action Groups	Entrepreneurs, rural SMEs	40–70% subsidy, “rural ticket” up to €19,000
Forestry / Agroindustry Investments	Variable	Regional Governments	SMEs and forest holdings	According to regional measures (e.g., Galicia)
Innovation – Operational Groups (EIP-AGRI)	1–2 years	MAPA + Regions	Innovation consortia	Up to 80% co-financing, €100k–600k per project

EAP – Priority Associative Entities Variable MAPA + Regions Agri cooperatives National total ~€33M, divided into specific calls

15.9. CAP Funding Allocated to Bulgaria, and Its Calls, for the 2021–2027 Period

Table 15-35: CAP Funding in Bulgaria – Pillar I (EAGF) and Pillar II (EAFRD)

Fund / Pillar	Total Bulgaria (€M)	% of EU-27 Total	Main Authority	Managing	Directly Managed (€M)	% of National Total	Direct Calls / Schemes
EAGF	≈ €843.2M	≈ 2.25%	National Paying Agency		≈ €843.2M	~100%	Basic payment, eco-schemes, redistributive, coupled payments, crisis support
EAFRD	≈ €354.6M	≈ 2.25%	Central Authority	Coordination	≈ €354.6M	~100%	Investments, agri-environmental, organic, constraints
LEADER	Included in above	≈ 0.7% (EU)	Local Action Groups		≈ €354.6M	100% of EAFRD	Local development projects, entrepreneurship

Table 15-36: Published CAP Calls – Bulgaria (EAGF) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Notes
Direct Payments (Single App.)	Annual	Ministry + Agencies	Active farmers	Per hectare based on national criteria
Young Farmers Aid (CISYF)	Annual	AGEC + national co-funding	Age ≤ 40	Extra per hectare, max 50 ha over a period

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Coupled / Ecological Payments	Annual	Ministry of Agriculture (MAF)	Specialized agriculture	Biodiversity, species-specific, eco-measures
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Table 15-37: Published CAP Calls – Bulgaria (EAFRD) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Notes
First Installation – Young Farmers	1–2 years	Ministry of Agriculture (MAF)	Young farmers with plan	Single or multi-year grant; amount varies
Farm Investment Support	1–2 years	MAF + State Fund Agriculture	Farmers, Agri SMEs	% subsidy of eligible investment
LEADER / CLLD	Phased	MAF + Local Action Groups	Rural promoters, local orgs	Lump sum / SCO payments for approved local projects
Innovation Operational Groups (EIP-AGRI)	1–2 years	MAF + NRN	Agricultural innovation consortia	Up to 80% co-financing for collaborative projects

15.10. CAP Funding Allocated to Estonia, and Its Calls, for the 2021–2027 Period

Table 15-38: CAP Funding in Estonia– Pillar I (EAGF) and Pillar II (EAFRD)

Fund / Pillar	Total Allocated to Estonia (M €)	% of Total EU-27	Main Managing Authorities	Amount Managed Directly (M €)	% of National Total	Calls / Schemes Managed Directly
FEAGA (Direct Payments)	≈ 165.4	≈ 0.47%	National Paying Agency / Ministry of Agriculture	≈ 165.4	~100%	Basic payment, eco-schemes, redistributive, coupled payments, sectoral and crisis aid
FEADER (Rural Development)	≈ 91.6	≈ 0.47% (of FEADER EU-27)	Ministry of Agriculture / National Authority	≈ 91.6	~100%	Investments, agri-environmental, organic, natural constraints
LEADER (part of FEADER)	Included in the €91.6	~0.5% of FEADER EU-27	Local Action Groups (LAGs)	≈ 91.6	~100% of FEADER	Rural ticket, local projects, rural cooperation

Table 15-39: Published CAP Calls –Estonia (EAGF) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Notes
Direct Payments (Single App.)	Annual	MAF + PRIA	Active farmers	Per hectare: basic, redistributive, CISOYF (young)
Young Farmers Payment (CISOYF)	Annual	PRIA + co-funding	Age ≤ 40	Up to 50 ha, up to 5 years
Coupled / Ecological Aid	Annual	MAF / PRIA	Specific sectors	Targeted eco-practices, species, production types

Table 15-40: Published CAP Calls -Estonia (EAFRD) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Notes
First Installation - Young Farmers	1-2 years	MAF + PRIA	Young farmers with plan	Lump sum / annual grant based on project and region
Farm Modernization	1-2 years	MAF + PRIA	Farmers and agri-SMEs	Partial subsidy (30-50%), capped based on criteria
LEADER / CLLD	Phased	LAGs + PRIA	NGOs, rural SMEs	40-70% subsidy, lump sum or SCO methodology
Innovation Operational Groups	- 1-2 years	MAF + Rural Network	Agri-tech, sustainability consortia	Up to 80% co-financing for collaborative projects

15.11. CAP Funding Allocated to Slovenia, and Its Calls, for the 2021–2027 Period

Table 15-41: CAP Funding in Slovenia– Pillar I (EAGF) and Pillar II (EAFRD)

Fund / Pillar	Total Allocated to Slovenia (M €)	% of Total EU-27	Main Authorities	Managing	Amount Managed Directly (M €)	% National Total	of Calls / Schemes Managed Directly
FEAGA (Direct Payments)	≈ 132.5	≈ 0.50%	National Authority / National Paying Agency		≈ 132.5	~100%	Basic payment, eco-schemes, redistributive,

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FEADER (Rural Development)	≈ 119.1	≈ 0.50% (of FEADER EU-27)	National Development Authority	≈ 119.1	~100%	coupled payments, crisis support Investments, agri-environmental, organic, natural constraints
LEADER (part of FEADER)	Included in the €119.1	~0.5% of FEADER EU-27	Local Action Groups (LAGs)+MAFF+CAP Network	≈ 119.1	~100% of FEADER	Rural ticket, local projects, rural cooperation

Table 15-42: Published CAP Calls –Slovenia (EAGF) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Notes
Direct Payments (Single App.)	Annual	MAFF + ARSKTRP	Active farmers	Basic, eco-schemes, redistributive, CISOYF
Coupled / Ecological Aid	Annual	MAFF + ARSKTRP	Sectoral producers	Organic, biodiversity, animal welfare support
Market Measures / Promotion	Variable	MAFF + ARSKTRP	Wineries, cooperatives	Storage, marketing, promotional activities

Table 15-43: Published CAP Calls -Slovenia (EAFRD) 2021-2027 period

Call	Frequency	Management	Beneficiaries	Amount / Notes
First Installation of Young Farmers	Every 1–2 years	MAFF (Managing Authority) + ARSKTRP	Farmers ≤ 40 with a business plan	One-time or multi-annual payment, amount based on plan and conditions; foreseen as a national measure (Skupna kmetijska politika)
Farm Modernization	Every 1–2 years	MAFF + ARSKTRP	Farmers and agri-SMEs	Partial subsidy (30–50%) of the investment — under the national investment program (EU CAP Network)
LEADER / CLLD (Community-Led Local Development)	Ongoing (2023–27)	37 LAGs + MAFF + ARSKTRP + Slovenian CAP Network	Rural entrepreneurs, NGOs, cooperatives	40–70% subsidy; local projects according to approved Local Development Strategy (Evropska sredstva, EU CAP Network)
Innovation – Operational Groups (EIP AGRI)	Annual or biennial	MAFF + Slovenian CAP Network + ARSKTRP	Agricultural innovation consortia	Up to 80% co-financing for collaborative sustainability/competitiveness projects (EU CAP Network)

