BECOOP

UNLOCKING THE COMMUNITY BIOENERGY POTENTIAL

Replication Handbook

APRIL 2023

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About the BECoop project

Over the last years, the EU has witnessed some remarkable steps in Renewable Energy (RE) deployment. However, at the same time, we see an increasingly uneven penetration of RE across the different energy sectors, with the heating and cooling sector lagging behind. Community bioenergy schemes can play a catalytic role in the market uptake of bioenergy heating technologies and can strongly support the increase of renewables penetration in the heating and cooling sector, contributing to the EU target for increasing renewable heat within this next decade. However, compared to other RES, bioenergy has a remarkably slower development pace in the decentralised energy production which is a model that is set to play a crucial role in the future of the energy transition in the EU.

The ambition of the EU-funded BECoop project is **to provide the necessary conditions and technical as well as business support tools for unlocking the underlying market potential of community bioenergy.** The project's goal is to make community bioenergy projects more appealing to potential interested actors and to foster new links and partnerships among the international bioenergy community.

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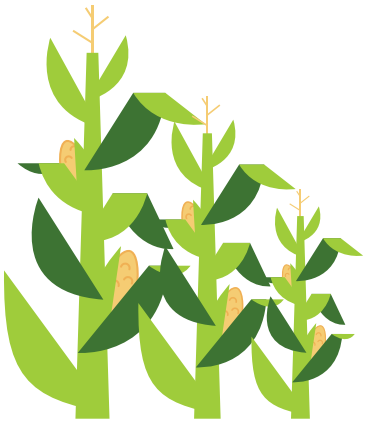
Abbreviations

BECoop	Bioenergy Cooperative
CAPEX	Capital expenditures
CHP	Combined Heat and Power
DH	District Heating
EC	Energy Community
ESCO	Energy Service Company
EU	European Union
FTTH	Fiber to the home
GDPR	General Data Protection Regulation
IEMD	Internal Electricity Market Directive
ktoe	Kilotons of oil equivalent
NGO	Nongovernmental Organisation
OPEX	Operating Expenses
O&M	Operation and Maintenance
RECs	Renewable Energy Communities
RED	Renewable Energy Directive
RES	Renewable Energy Sources
RE	Renewable Energy
RESCoop	Citizen or Renewable Energy Communities



EXECUTIVE SUMMARY

The BECoop Replication Handbook is designed to assist community bioenergy projects and initiatives of varying levels of maturity across Europe. The knowledge gained through our work in the EU-funded project BECoop, has been distilled into a stepwise approach, enabling readers to better understand the various factors to consider when developing a bioenergy-focused Energy Community.

The handbook provides comprehensive guidance for the initiation and establishment of community bioenergy projects, taking into account that each initiative may have unique characteristics and may encounter diverse challenges during its development phase. Thus, this document showcases a range of proven models and successful practices for addressing the social, technical, and business aspects of project establishment and implementation.

Drawing inspiration from other existing guides on RESCoops' development[1][2][3][4], this handbook serves as an additional valuable resource, specifically focusing on promoting and expanding community heating projects based on biomass resources throughout Europe. It covers the entire spectrum of actions necessary for building a bioenergy heating community, making it one of the few comprehensive handbooks on this topic available at European level. It is organised as a clear and straightforward step-by-step guide, designed for stakeholders involved in community bioenergy projects.

Throughout this report, readers shall be able to identify and consult the respective sections that correspond to their needs, current project state and ambitions, without necessarily following a sequential order.

After an introductory section where **a state of play analysis** on the matter is provided, a thorough presentation of the array of **BECoop-generated tools and resources** is included before the **stepwise process on the initiation and establishment of bioenergy community heating projects** is showcased.

The BECoop Replication stepwise journey is clustered as follows:

- Step 1 aims at supporting the initiator at **understanding the energy community dynamics and organisational structure**, as well as building a team and identifying the suitable stakeholder **engagement strategy**.
- Step 2 provides guidance on the assessment of their current state regarding **raw material availability**.
- Step 3 is about **identifying the activity** that suits the community's needs and possibilities, and guiding the reader through the available **technologies** for the local community's activities and needs.
- Step 4 elaborates on the various **investment schemes** to help the reader choose the optimal one for their bioenergy community.
- Step 5 presents the **RESCoop Business models** and aims at supporting the initiator towards the identification of the optimal model for their case.
- Step 6 provides a summarising overview of the stepwise approach, helping users visualise their community's roadmap towards implementation.

Recommendations, best case examples, easily accessible solutions as well as references to BECoop-generated tools and services can be found throughout the entire handbook.

1 RESCoop.eu - Community Energy Guide
2 European Citizen Energy Academy (EUCENA) - Balkan Best Practices Guide
3 RESCoop 20-20-20 Project – Report on RESCoop Business Models
4 Sustainable Energy Authority of Ireland (SEAI) - Sustainable Energy Communities Programme

INTRODUCTION

The Replication Handbook is a comprehensive guide designed to simplify the process of creating a community-based bioenergy project. Its purpose is to encourage readers to envision a sustainable and equitable local heating system for their community and to take concrete steps towards its implementation.

Who can benefit from the BECoop Replication Handbook?

The Handbook serves as a valuable resource for key stakeholders interested in initiating or expanding their involvement in the field of community bioenergy. This includes citizens, public authorities, small and medium-sized enterprises (SMEs), farmers, feedstock suppliers, civic organisations, non-governmental organisations (NGOs), existing renewable energy cooperatives (RESCoops), and educational institutions. By providing the necessary information and support, the Replication Handbook empowers these groups to successfully launch and manage their own community bioenergy projects.

Citizens: The EU Renewable Energy Directives[5], aiming to boost the uptake of renewables, encourage citizens to get involved in the RE sector, through the creation of energy communities. The BECoop handbook aims to further empower citizens to learn more about their new role in the clean energy transition mission and utilise the BECoop knowledge and tools' generated inventory to attempt a shift - at the personal and community level - from passive consumers, as traditionally established, to active prosumers. BECoop has generated knowledge around capacity building activities and targeted awareness raising campaigns, which can support citizens through the different stages of building and sustaining a team.

Municipalities & Local Authorities: Public authorities, particularly at the regional and local level, play a critical role in the initiation and support of energy communities, especially when it comes to bioenergy. It has been reported that the most effective community energy initiatives in Europe are those that involve strong partnerships between citizens and local authorities[6]. Local municipalities often have a better understanding of the regional heating demands and the availability of local biomass resources, which makes them ideal partners in the creation of a successful community energy project. This handbook offers a set of guidelines, combined with a legal framework analysis around energy communities that public authorities (such as mayors and local councils) can use to start their own community bioenergy project, and become key players in promoting sustainability and social responsibility in their communities.

Local SMEs: Local businesses and SMEs are strongly encouraged to participate in the development of community energy initiatives, working hand-in-hand with citizens. This type of multi-stakeholder partnership provides a unique opportunity for not only strengthening the local economy but also fostering a more resilient and cohesive community. Energy communities can help SMEs reduce their energy costs by pooling resources and buying energy in bulk. This can result in lower electricity bills and more money to reinvest in their businesses. By getting involved in community energy projects, SMEs can benefit from income and job creation opportunities, access to more efficient energy technologies and services, and the satisfaction of helping to promote sustainability at the regional level. The BECoop handbook informs SMEs about the benefits of establishing a Bioenergy RESCoop and provides a well-rounded guide on success cases and financial schemes.

Local Farmers, feedstock suppliers, land owners: Farmers and feedstock providers can play a crucial role in the establishment and long-term success of bioenergy communities. Farmers' social networks, influence and direct access to by-products of agricultural activities i.e. biomass, allows them to contribute to the bioenergy supply chain, turning waste materials to inputs in heating production processes. This handbook provides in-depth analysis and insights to encourage those in the agricultural industry to initiate or participate in community bioenergy projects, shedding light to misconceptions and uncertainties in this domain. By establishing a sustainable biomass value chain, communities can work towards energy independence and security through their own heating systems.

Existing RESCoops: Existing renewable energy communities that specialise in other forms of renewable energy, such as solar, hydro, or wind, are encouraged to use this handbook as a resource for diversifying their portfolio and expanding into biomass-based heat production. Already established energy communities are encouraged to find useful insights about the technical assessment of establishing or expanding the biomass chain of their region. With a growing demand for renewable heating across Europe, this handbook provides valuable insights into the process and benefits of establishing a community bioenergy project, enabling these communities to stay ahead of the curve and contribute to a more sustainable future.

Guidelines provided by this handbook can overall help individuals and organisations evaluate the local potential for building a network of interested actors, creating a sustainable biomass value chain, and establishing a viable business and financial model. The utter aim is to inspire a sense of energy self-sufficiency and encourage the formation of bioenergy communities, where individuals and organisations can take charge of their energy security.

[5] https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en
[6] https://www.sccale203050.eu/out-now-sccale-20-30-50-community-energy-municipal-guide/

WHY BIOENERGY?

What is Bioenergy?

Bioenergy refers to energy produced from organic and natural sources (referred to as biomass), which can be used in electricity, heating, cooling and transport.[7]

Bioenergy relies on feedstock from agriculture and forestry, largely produced in rural areas, therefore having a positive socio-economic impact to the rural economies. For several European countries, bioenergy ensures their transition from fossil fuels, replacing oil, gas, and coal in the electricity and heating sectors to renewable energy, while in particular 75% of bioenergy is used for thermal activities. In fact, bioenergy represents almost 60% of European renewable energy consumption, of which 96% is produced within Europe.[8]

60% of renewable energy consumption is **BIOENERGY**

96% of bioenergy is produced within **EUROPE**

75% of bioenergy is used for **HEATING & COOLING**

[7] Carmen Lago, Israel Herrera, Natalia Caldés, Yolanda Lechón, Chapter One - Nexus Bioenergy–Bioeconomy, Editor(s): Carmen Lago, Natalia Caldés, Yolanda Lechón, The Role of Bioenergy in the Bioeconomy, Academic Press, 2019, Pages 3-24, ISBN 9780128130568

[8] European Commission, Joint Research Centre, Brief on biomass for energy in the European Union, Publications Office, 2019, https://data.europa.eu/doi/10.2760/546943

Uses and Types of Biomass

Methods to produce energy from biomass

There are three ways to obtain the energy stored in biomass using processes similar to those used in fossil fuels: ***thermal***, ***chemical and biological***. Doing so, bioenergy can offset the need for carbon fuels burned in power plants, thus lowering the carbon intensity of energy generation.

THERMAL: The most common thermal process for obtaining energy from biomass is combustion. This process involves burning the biomass, typically in the form of chips or pellets, to produce heat. This heat can be used to generate electricity through a steam turbine or to provide heat for industrial processes or buildings.[9]

Figure 1. Burning biomass to produce heat

CHEMICAL: An alternative to combustion, usually categorised as an intermediate process between thermal and chemical is gasification, in which the biomass is converted into a combustible gas mixture, thanks to a series of chemical reactions that happen in an oxygen deficient atmosphere. This gas is primarily made up of carbon monoxide and hydrogen, known as syngas. This syngas can then be burned to produce heat or used in the production of chemicals and liquid fuels.[10] Pyrolysis is a thermochemical process that involves heating biomass in the absence of oxygen, to decompose the biomass. It is a process in which the biomass is broken down into a liquid bio-oil, a gaseous mixture of hydrogen and carbon monoxide, and a solid residue called biochar.[11]

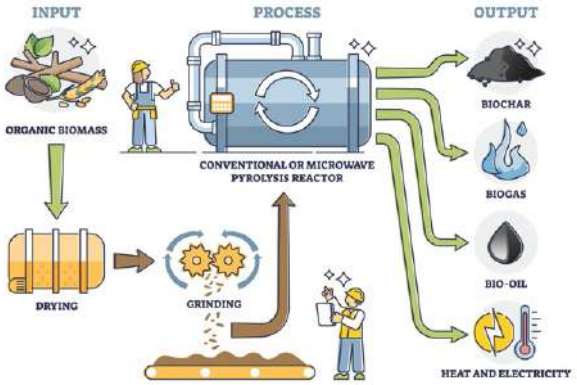


Figure 2. Pyrolysis plant

BIOLOGICAL: One of the most important biological processes for obtaining energy from biomass is anaerobic digestion. This process involves breaking down the biomass in the absence of oxygen, using microorganisms, to produce biogas, which is primarily made up of methane and carbon dioxide. This biogas can then be used as a fuel for heat and power generation.[12] Another process is fermentation, where biomass is broken down by microorganisms to produce liquid fuels like ethanol or butanol.[13]

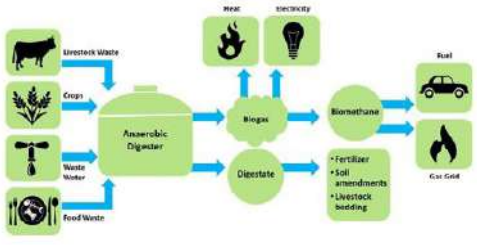


Figure 3. Anaerobic digestion process

[9] «Biomass Energy Basics» U.S. Department of Energy, https://www.energy.gov/eere/bioenergy/biomass-energy-basics
[10] «Biomass Gasification» U.S. Department of Energy, https://www.energy.gov/eere/bioenergy/biomass-gasification
[11] «Pyrolysis» Biomass Energy Resource Center, https://www.biomasscenter.org/processes/pyrolysis
[12] «Anaerobic Digestion» U.S. Department of Energy, https://www.energy.gov/eere/bioenergy/anaerobic-digestion
[13] «Fermentation» U.S. Department of Energy, https://www.energy.gov/eere/bioenergy/fermentation

Different uses of biomass

THERMAL ENERGY: Biomass can be used to generate thermal energy in various ways. Biomass can be burned in boilers or furnaces to produce heat, which can be used for space and water heating, industrial processes, and power generation. It can also be converted into biofuels, such as wood pellets or briquettes, which can be used to heat buildings and industrial processes. Thermal energy can also be obtained through anaerobic digestion of organic materials to produce biogas, which can be used to generate heat and power.[14] [15]

Figure 4. Biomass can be burned to create heat

ELECTRICAL ENERGY: It can be used to generate electrical energy through various methods such as direct combustion, co-firing, gasification and pyrolysis. Biomass can be burned in power plants to generate steam, which is then used to drive a turbine and generate electricity. It can also be used to synthesise liquid or gaseous biofuels, such as ethanol or synthesis gas, which can be then burnt to generate electricity.[16] [17]

Figure 5. Biomass can be converted into electricity

MECHANICAL ENERGY: Biomass can be converted into liquid biofuels, such as biodiesel, which can be used in engines to generate mechanical energy. Biomass can also be converted into gaseous biofuels, such as biogas, which can be used in engines to generate mechanical energy.[18]

Figure 6. Biomass can be converted into biofuels that can be used to generate mechanical energy

[14] IEA Bioenergy Task 40/Topic 6 «Thermal uses of biomass»
[15] Picture source: https://www.borgenmagazine.com/consequences-biomass-burning-india/
[16] IEA Bioenergy Task 32 «Electricity and Heat Production»
[17] Picture source: https://www.valmet.com/energyproduction/energy-solutions/biomass-to-energy/
[18] IEA Bioenergy Task 39 «Transport»

Different types of biomass

As mentioned, biomass is the main bioenergy feedstock, which can come from:

Table 1. Biomass Energy Sources

WOOD BIOMASS includes forest residues left after logging timber and whole-tree biomass harvested for biomass production. The collection of woody biomasses can reduce the risk of fire and pest while in parallel can support restoration, productivity, and vitality of forests. This biomass could be harvested for bioenergy without negatively impacting stability of forest ecological structure and function.

Examples: *All parts of the tree obtained during a sustainable rest management operation: logs, branches or even roots.*

AGRICULTURAL CROPS: Dedicated energy crops are non-food crops that can be grown in marginal land to provide energy biomass. It can be divided into herbaceous energy crops (taking 2 years to reach full productivity) and woody energy crops (taking at least 5 years to reach full productivity).

Examples: *Straw, miscanthus or short rotation coppice.*

AGRICULTURAL CROPS RESIDUES can be used without interfering with the production of food, feed, fibre, or forest products. Agricultural crop residues, which include the stalks and leaves, are abundant, diverse, and widely distributed across the world. It represents an opportunity for farmers to generate additional income.

Examples: *Prunings, plantation removals or stumps.*

SOLID MUNICIPAL WASTE is a mix of paper and paperboard, plastics, rubber, leather, textiles, and food wastes. It represents an opportunity to reduce residential and commercial waste by diverting significant volumes from landfills to the refinery.

INDUSTRIALS RESIDUES - WET WASTE FEEDSTOCKS are formed mainly by sewage sludge, manure slurries and organic wastes from industry.

ALGAE is a very diverse group of organisms that use sunlight and nutrients to create new biomass and key molecules, which can be converted also into energy products, such as biofuels. Additionally, algae can be grown in wastewater recovering quality water.

ANIMAL RESIDUES: Organic materials derived from the farming and livestock industry, such as manure, bedding materials, and slaughterhouse waste.

LANDFILLS GAS (rich in methane - the main component in natural gas) refers to the mixture of gases generated by the breakdown of organic waste in landfills. These gases typically include methane (CH_4) and carbon dioxide (CO_2). Landfill gas can be collected and used as an energy source through a process called «landfill gas recovery», where the gas is captured, cleaned, and then combusted or converted to electricity or heat. [19]

Forestry/woody biomass (wood chips, pellets, logs) is the most important bioenergy source and represents more than two thirds of the EU bioenergy consumption.

Primary materials for this woody biomass are by-products like bark, sawdust and wood chips of other industries such as sawmills, pulp mills and wood-working industries. These feedstocks are produced in rural areas having a positive socio-economic impact and increasing job creation[20] .

[19] US Environmental Protection Agency's (EPA) website. The «Landfill Methane Outreach Program (LMOP)»

[20] BioEnergy Basics, BioEnergy Technologies Office, Office of energy efficiency & Renewable energy. https://www.hga-llc.com/industries/renewable-energy/landfill-gas/

Bioenergy in the EU heating sector

Heating (and cooling) represented nearly half of the final energy consumption in the EU27 in 2020[21]. With a share of only 23% of renewables in the heating sector, most of the heat is still being produced by fossil fuels in Europe. However, it is notable that 85% of the renewable heat (87,488 ktoe) used within the EU, is in the form of bioheat. Furthermore, solid biomass is the main feedstock used for heat production, with 85% of solid biomass used for this purpose, whereas the rest for bioelectricity. The related greenhouse gas (GHG) savings for using bioheat for heating are estimated to be approximately 160 MtCO2eq[22]. These critical numbers show how bioenergy, and especially solid biomass, is a key driver towards meeting the renewable energy targets in the heating sector.

Figure 7 displays the biomass used directly for household heating, not including heat from district heating systems. In the EU27, the residential sector is the largest market for bioheat, accounting for 41,974 ktoe. The industrial sector and commercial & services sector follow, with 14,725 ktoe and 8,645 ktoe, respectively. Meanwhile, the residential sector accounts for 20,329 ktoe of bioheat consumed through district heating systems, followed by the industrial sector at 14,725 ktoe and the commercial & services sector at 8,645 ktoe. Overall, the consumption of bioheat has been increasing in all sectors at an average rate of 2.8% annually since 2000. **It's worth noting that from 2000 to 2019, the total consumption of bioheat has risen by 70%, indicating that more sectors are starting to adopt biomass as a fuel due to its stability and reliability.**

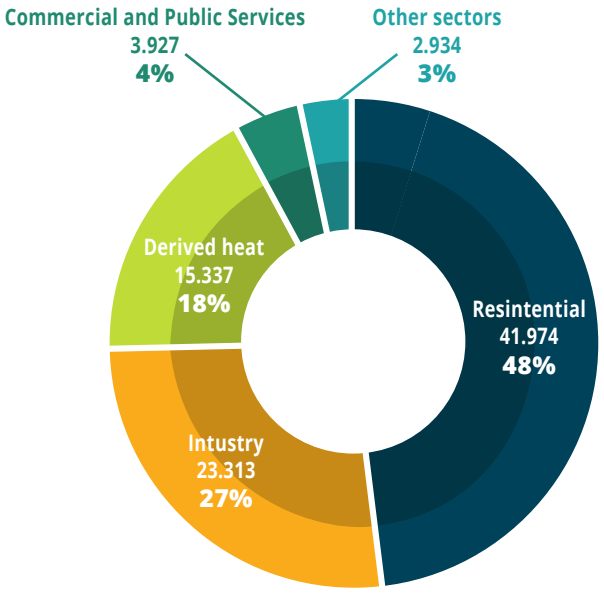


Figure 7. Total bioheat consumption in the different sectors in EU27 in 2020 (in ktoe, %)

[21] Thomaßen, G., Kavvadias, K. and Jiménez Navarro, J.P. (2021) «The decarbonisation of the EU heating sector through electrification: A parametric analysis», Energy Policy, 148, p. 111929. Available at: https://doi.org/10.1016/j.enpol.2020.111929

[22] Bioenergy Europe - Statistical Report Bioheat 2022

Did you know?

Sustainability is Critical for the Bioenergy Sector.

Sustainability is a crucial consideration for the bioenergy sector when compared to other forms of renewable energy. It encompasses various factors such as efficiency, emissions, land use, and ecosystem impact. According to the European Commission's 2018 Renewable Energy Directive, the main sustainability risks associated with bioenergy include: i) CO2 emissions, including those from the supply chain, ii) adverse impacts on biodiversity, iii) efficiency of installations, and iv) administrative costs[23].

As bioenergy is heavily dependent on the natural world, the supply chain, and people, finding the right balance between benefits and negative impacts is critical. Over the past decade, several measures have been put in place to ensure the sustainability of this resource, including government regulations that set minimum performance standards and the voluntary adoption of certification schemes that assess sustainability[24].

However, public debate surrounding the sustainability of bioenergy has been marked by disagreement and conflicting messages, which can be confusing to the general public. For example, some NGOs view bioenergy as a cleaner alternative to fossil fuels, while others vehemently oppose its use and launch campaigns against it. This, coupled with the influence of the gas and fossil fuel lobby and competition from more popular sources, has limited the adoption of bioenergy[25].

Therefore, it is more important than ever to raise awareness about bioenergy and share accurate scientific data. Fortunately, there has been a growing interest in bioenergy and sustainability over the past decade, and more research and data are becoming available.

Want to learn more?

- Find information and data on bioenergy and sustainability:
  Bioenergy Essentials report
- Learn more about the current state of biomass supply, forest and land management biomass supply:
  Biomass Supply Statistical Report 2022
- Find an in-depth overview of the bioenergy sector across the EU-27 here:
  Bioenergy Europe Statistical Report 2021; Bioheat Statistical Report 2022
- Indicative European organisations linked with Bioenergy:
  - Bioenergy Europe
  - AVEBIOM
  - European Biogas Association

BECoop tools and project-relevant resources:

- Learn more about bioenergy technologies here:
  BECoop D2.7 - Catalogue technical support services First
- Learn more on the different types of biomass here:
  BECoop Factsheet of solid biomass for small scale heating applications

[23] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the Promotion of the Use of Energy from Renewable Sources (2018) Belgium http://data.europa.eu/eli/dir/2018/2001/oj , https://eur-lex.europa.eu/eli/dir/2018/2001/oj

[24] Andrew Welfle, Mirjam Röder, Mapping the sustainability of bioenergy to maximise benefits, mitigate risks and drive progress toward the Sustainable Development Goals, Renewable Energy, Volume 191, 2022, Pages 493-509, ISSN 0960-1481, https://doi.org/10.1016/j.renene.2022.03.150

[25] BECoop D1.4_Definition_of_community_bioenergy_heating_uptake_needs_challenges

WHY COMMUNITY ENERGY?

What is an Energy Community

Energy communities can take on various legal forms, such as an **association, cooperative, partnership, non-profit organisation, or small/medium-sized enterprise**[26]. This structure makes it easier for citizens and market players to join forces and invest in energy assets collectively. By doing so, energy communities can play a crucial role in creating a more decarbonised and flexible energy system. Acting as one entity, energy communities can participate in all relevant energy markets on an equal footing with other market actors, helping to drive the transition towards a more sustainable energy future.

At the EU level, energy communities must meet the following criteria:

- The community must be effectively controlled by shareholders and members residing near the renewable energy projects.
- Shareholders or members must be comprised of individuals, local authorities (such as municipalities), or small and medium-sized enterprises (SMEs).
- The primary goal of the community should not be financial gain, but rather to deliver environmental, economic, or social benefits to the community.

Renewable energy service cooperatives (RESCoops) are a type of energy communities[27] which operates according to the principles set by the International cooperative alliance:

1. Democratic Member Control
2. Voluntary and Open Membership
3. Economic Participation through Direct Ownership
4. Autonomy and Independence
5. Education, Training and Information
6. Cooperation among Cooperatives
7. Concern for Community

These seven cooperative principles do not necessary apply to all energy communities. An energy community can take any legal form, with different structures and objectives, as long as it is aligned with the criteria that are contained in the EU definitions.

[26] According to art.22 Directive Renewable Energy - RED 2

[27] Beggio, G. and Kusch, S. (2015) «Renewable Energy Cooperatives: Main features and success factors in collectively implementing energy transition», Proceedings of The 3rd Virtual Multidisciplinary Conference [Preprint]. Available at: https://doi.org/10.18638/quaesti.2015.3.1.208

The EU Clean Energy Package and the Recognition of Energy Communities

In 2015, the EU announced its plans to establish an **Energy Union** where citizens would indeed be in its core, taking ownership of the energy transition, benefiting from new technologies to reduce their energy bills, participating actively in the market, and where vulnerable consumers are protected[28]. Finally, the EU released 8 legislative acts entitled as the Clean Energy Package (CEP) for all Europeans. **The Clean energy for all Europeans package (CEP)**[29] was published in 2016 and subsequently completed in 2019. It includes a set of eight legislative acts on the energy performance of buildings, renewable energy, energy efficiency, governance and electricity market design. Through the "Clean energy for all Europeans package", the EU has introduced the concept of energy communities in its legislation, notably as citizen energy communities and renewable energy communities.

The energy communities' concept is officially recognised and addressed more specifically in **the revised Renewable Energy Directive, RED II,** (EU) 2018/2001 and **Internal Electricity Market Directive, IEMD (EU) 2019/944.** The first one describes the framework for energy communities to be developed and implemented while the second one describes the respective communities' roles and responsibilities.[30]

Table 2. The Renewable Energy Directive (RED II) and the Internal Electricity Market Directive (IEM)

The Renewable Energy Directive 2018/2001 (RED II)[31]

Established a common framework for the promotion of energy from renewable sources in the EU and set a binding target of 32 % for the overall share of energy from renewable sources in the EU gross final consumption of energy in 2030. It also established sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels and lays down rules on financial support to enhance the use of renewable energy usage. The REDII is a recast of the Directive 2009/28/EC (REDI), which was made as part of the "Clean energy for all Europeans package".

Directive on common rules for the internal market for electricity 2019/944 (IEM)[32]

The directive on common rules for the internal market for electricity 2019/944 (IEM) includes new rules that enable active consumer participation, individually or through citizen energy communities, in all markets, either by generating, consuming, sharing or selling electricity, or by providing flexibility services through demand-response and storage. The directive aims to improve the uptake of energy communities and make it easier for citizens to integrate efficiently in the electricity system, as active participants.

Table 3. Concepts of energy communities as mentioned in RED II and IEM

Citizen Energy Communities

Common use of energy (also non-renewable) on a nationwide level.

Renewable Energy Communities

Common use of locally produced renewable energy (also heat production through biomass), e.g. within a neighbourhood.

Similarities

- voluntary association of people, public entities or companies
- common production and consumption of energy and distribution among members
- no profit purpose

[28] European Commission (2015). A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, http://bit.ly/climate-change-policy
[29] European Commission, Directorate-General for Energy, (2019) Clean energy for all Europeans. Publications Office. https://data.europa.eu/doi/10.2833/9937
[30] Caramizaru, A. and Uihlein, A. (2020). Energy communities: an overview of energy and social innovation, EUR 30083 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-10713-2, doi:10.2760/180576, JRC119433.
[31] https://eur-lex.europa.eu/eli/dir/2018/2001/oj
[32] https://eur-lex.europa.eu/eli/dir/2019/944/oj

Did you know?

The Need for Better Recognition of Energy Communities: Findings from a BECoop EU-level Survey Study:

Energy communities, despite being a crucial tool in promoting a fair and green transition, are often overlooked and not widely recognised. According to the findings of a BECoop large scale EU survey study[33], the concept of energy communities is not well known among European citizens and even less popular than other renewable energy terms. Even when people are aware of the term, they are most often not informed about established local initiatives in their surrounding area.

Negative past experiences and historical connotations (e.g., in eastern countries with a Soviet past, negative perceptions have been reported regarding cooperative structures) have also shaped a negative view of the concept in some communities. The survey also revealed that over 80% of the respondents were not aware of any existing energy community projects, highlighting the need for better promotion and dissemination of these initiatives.

Piece of advice: To raise awareness of energy communities, it is important to not only educate the local citizens about the concept, but also keep them updated about relevant projects in their area. This can be done through organising field visits, open days, and utilising local events and social media. For examples of effective awareness-raising strategies, you may refer to the ***"Awareness Raising Actions for Improving Bioenergy Perceptions and Image"*** (BECoop Deliverable D3.5)[34]. To effectively promote the concept of Energy Communities to local citizens, make sure to check the "Want to learn more?" section of this chapter. growing interest in bioenergy and sustainability over the past decade, and more research and data are becoming available.

[33] BECoop D1.3_Stakeholders'_perceptions_acceptance_levels_and_needs_on_bioenergy_heating_

[34] BECoop D3.5 Awareness Raising Actions For Improving Bioenergy Perceptions And Image - First

Legal forms of energy communities

According to EU legislation, the key legal principle for all forms of energy communities is that they should enable citizens to collaborate with other market players in the development of energy infrastructure. Another requirement is that the participation structure should be voluntary and open to all. As recognised legal entities, energy communities are able to access energy markets on an equal footing to commercial actors. Their regulatory position allows them to cover various parts of the energy value chain, including production, transmission, distribution, supply, consumption, energy efficiency services, and electromobility. They can also provide energy services to members or shareholders.

The European Commission (2022)[35] finds that the most frequent business models for energy communities involve activities such as:

- **Generation and supply:** The provision of secondary forms of energy from external local producers through Power Purchase Agreements, wholesale markets, or community-owned production capacities.
- **Collective investments in production installations,** whereby final consumers pay a fixed membership fee or a variable stake to become members of an energy community which is also an energy producer. Co-operative investments may also be underpinned by Power Purchase Agreements, covering the produced energy and related financial products.
- **Collective self - consumption:** These forms of energy community building link energy consumers and producers in the same area. They are highly dependent on national regulation.

All types of generation technologies and entities can be involved in citizen energy communities. These include municipal companies and NGOs. However, the effective control of the community can only be in the hands of natural persons, local authorities or SMEs, across a range of geographical locations.

Both the heating and electricity sectors are covered by renewable energy communities. However, only SMEs, local authorities and natural persons can participate, if they are in the immediate geographical area of the project. In addition to ensuring balanced and democratic decision-making among controlling actors, the renewable energy community also needs to be autonomous.

It is not necessary for each member of an energy community to bring in generation capacities, but members with ample energy production facilities can share them with others.

A policy brief by Interreg Europe's Policy Learning Platform on the Low Carbon Economy (2018)[36] distinguishes among **five legal forms of renewable energy communities**, ordered here starting from the most bottom-up structures (not including unincorporated associations, which are the most grassroots form):

[35] https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en

[36] A Policy Brief from the Policy Learning Platform on Low-carbon economy by Interreg Europe

Legal Form	Characteristics
Co-operatives	Primarily benefit their members. Membership is voluntary and open – each member has a single vote. Members benefit from generated energy, and shape governance and profit allocation. They may provide training and other benefits to members, to maintain the co-operative.
Partnerships	Involve individuals collaborating to establish a legal partnership that will provide energy to a community. Voting power is determined by each individual's stake in the company. They can provide community benefits.
Trusts and foundations	Established as charitable organisations. They offer a social benefit rather than generating profit. Entire communities can benefit even if individuals cannot afford to participate.
Public utility company	Run and developed by local authorities on the behalf of taxpayers and citizens. Suitable for rural or isolated areas.
Public-private partnership	Established via agreements between municipalities, citizen groups and businesses to provide energy and other benefits for a community.

Table 4. Legal forms of renewable energy communities

BECoop Pilot Countries

There are specific legal provisions regarding renewable energy communities in the BECoop pilot countries, a summary of which is provided below:

In Spain, renewable energy communities are legally defined as subjects of the electricity system. The law sets out a number of minimum requirements for their establishment, including a founding contribution of EUR 3,000 paid at the time of registration, a horizontal structure and democratic decision-making.

In Italy, renewable energy communities need to be autonomous legal entities that cannot generate profits, are run by members in an open and voluntary manner, and have shareholders or members who are natural persons, SMEs, territorial bodies or local authorities, including municipalities. The current legislative framework provides for a collective self-consumption incentive (100€/MWh) for electricity only. The maximum power of each individual plant participating in RECs is 1 MW. The scope of intervention is the primary substation. There is currently no specific measure for the promotion of renewable heat.

In Poland, energy communities can legally take the form of energy co-operatives. They are subject to a number of limitations: the number of cooperative members may not exceed 1000 participants, the total installed capacity is limited to 10 MW in the case of electricity and 30 MW in the case of heat, they have to be located in an area of no more than three rural or urban-rural communes directly adjacent to each other, and outside of particular types of local authorities.

In Greece, energy communities were recently introduced into the national legislation. A set of rules are specified for their establishment, including a minimum number of 5 founding actors in the case of public law legal entities, a mandatory cooperative share contributed by members, and a set of obligatory activities that need to be undertaken by the organisation.

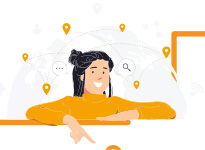
Bioenergy RESCoops in Europe

Despite the energy communities' number exponential growth across Europe[37], the majority of the cases involves solar and wind energy, with bioenergy being the third most popular RE source[38]. With Europe's increasing needs for sustainable heating, bioenergy's potential needs to be further explored. While the decarbonisation of the electricity sector has been progressing at high speed, the heating and cooling sector has been slower, as renewables currently provide only 23% of the relevant consumption[39]. Biomass-based technology options have the potential to directly substitute fossil fuels and cut down the CO_2 emissions from heat production.

Small-scale bioenergy systems based on local resources, seem to be one of the most promising solutions for establishing a sustainable heating system[40]. More specifically, there is great potential for fostering energy independence for rural and remote areas. These regions are of great importance to achieving EU's decarbonisation and energy security goals, as they comprise 80% of the EU territory, are home to 57% of its population and account for 46% of gross value added[41]. **The measurable demand, the availability of regional RE sources i.e. biomass, and the availability of land provide the optimal settings for local energy system development, through decentralised energy community projects[42]. Covering the basic heating needs through the build-up of a community-led project, creates the foundations for locals to appreciate the natural resources, create strong networks, engage in further entrepreneurial activities and thus generate additional local socio-economic benefits[43].**

Bioenergy community projects reportedly contribute to all three dimensions of sustainable development of local communities[44]. One of the key economic and social impacts driving the creation of such initiatives has been the generation of local jobs (project management, construction, maintenance and operation of the bioenergy plant, management of the biomass (value chain, logistics) etc.,) and opportunities for economic growth and further investments[45]. The network built to support such activities, creates bonds among citizens, tightens their relationships as they work together towards a shared goal. Regarding the environmental impact, biomass heating systems contribute to the reduction of CO_2 emissions, while also helping secure forest and species preservation through the collaboration among parties involved in agro and forest exploitation.

Bioenergy community projects across Europe fall under the broad category of cooperatives, which differs across EU member states, and thus can have various sizes, formats, and goals, depending on the national frameworks, local needs and ambitions. In different contexts, bioenergy communities might be presented in bibliography as bioenergy RESCoops, heating/thermal energy initiatives, bioenergy villages, community bioenergy initiatives etc[46]. Despite the various terms and legal particularities, the great majority of bioenergy community projects strive to empower local stakeholders to take control of their heating prosumption[47], relying on a localised supply chain of biomass materials. The BECoop Replication Handbook aims at facilitating the conceptualisation of the design of such a project, providing well-rounded guidance across the development stages.



Want to learn more?

- Find more information on the 7 cooperative principles by RESCoop.eu: **The 7 cooperative principles with examples from energy cooperatives**
- For effectively promoting the concept of Energy Communities to local citizens you may check the information presented in this report by RESCoop.eu: **Q&A: What are 'Citizen' and 'Renewable' Energy Communities?**
- Learn more about existing Bioenergy Community cases here:
  - **BECoop Atlas of Bioenergy community cases;**
  - **RESCoop.eu network members focusing on biomass**

[37] Schwanitz, V.J. et al. (2021) "The contribution of collective prosumers to the energy transition in Europe - preliminary estimates at European and country-level from the comets inventory." Available at: http://dx.doi.org/10.31235/osf.io/2ymuh

[38] European Commission, Joint Research Centre, Uihlein, A., Caramizaru, A. (2020) Energy communities : an overview of energy and social innovation. Publications Office. https://data.europa.eu/doi/10.2760/180576

[39] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20220211-1

[40] European Commission, Directorate-General for Energy, Gerard, F., Smit, T., Rademaekers, K., et al. (2022) Policy support for heating and cooling decarbonisation : roadmap. Publications Office of the European Union. https://data.europa.eu/doi/10.2833/977806

[41] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0345&from=EN

[42] Romero-Castro, N., Miramontes-Viña, V. and López-Cabarcos, M.Á. (2022) "Understanding the antecedents of entrepreneurship and renewable energies to promote the development of community renewable energy in rural areas," Sustainability, 14(3), p. 1234.

[43] Menghwani, V. et al. (2022) "Harvesting local energy: A case study of community-led Bioenergy Development in Galena, Alaska," Energies, 15(13), p. 4655. Available at: https://doi.org/10.3390/en15134655

[44] Welfle, A. and Röder, M. (2022) "Mapping the sustainability of Bioenergy to maximise benefits, mitigate risks and drive progress toward the Sustainable Development Goals," Renewable Energy, 191, pp. 493–509. Available at: https://doi.org/10.1016/j.renene.2022.03.150

[45] BECoop D1.1 State-of-play of community bioenergy across Europe: market size, applications and best practices

[46] Fouladvand, J. et al. (2022) "Analysing community-based initiatives for heating and cooling: A systematic and Critical Review," Energy Research & Social Science, 88, p. 102507. Available at: https://doi.org/10.1016/j.erss.2022.102507

[47] Inês, C. et al. (2020) "Regulatory challenges and opportunities for collective renewable energy prosumers in the EU," Energy Policy, 138, p. 111212. Available at: https://doi.org/10.1016/j.enpol.2019.111212

OVERVIEW OF BECOOP TOOLS AND RESOURCES

The BECoop project has developed a series of tools and catalogues to support the adoption of innovative biomass-based energy communities. These tools and catalogues aim to facilitate the identification of technical, business, financial or community model solution providers by enabling contact with relevant actors in the bioenergy sector. **The main available resources developed by BECoop project, as briefly introduced below, are freely available to any user through the project's website** www.becoop-project.eu.

BECoop Self-assessment tool

The BECoop self-assessment tool provides an evaluation methodology along with a set of indicators, metrics and definitions for preliminarily assessing the current status and future potential of a community endeavour regarding community bioenergy.

The tool consists of **self-evaluation forms that allow to assess an initiative's status and identify the process, technical solution and business model that needs to be followed for initiating and taking part in a community bioenergy heating project**. The questions asked act as a roadmap, helping the user to check if the most relevant aspects or considerations have been taken into account. The different answers provided suggest the steps needed to achieve a successful implementation of a new business model, as well as links (if applicable) to current tools and reports that may be useful to get beyond that stage. Such outputs offer:

- a clear picture of a user's project status,
- highlighting the strengths and weaknesses through a visual way in a spider-net, and
- providing a series of recommendations for further developing the initiative.

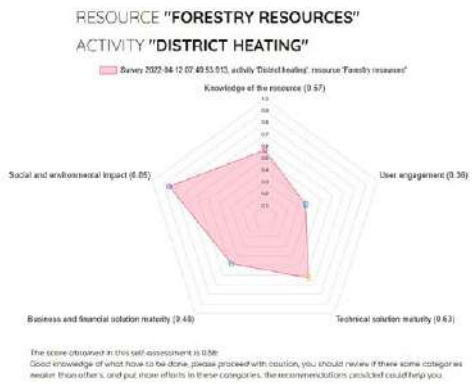


Figure 8. Example of a user-specific self-assessment outputs visualised as a spider-net diagram

BECoop Toolkit

An online repository of existing open-source tools, developed by other projects or institutions, that can complement the support services that are required during the entire community bioenergy project deployment process.

The BECoop toolkit has been designed as a user-friendly environment where browsing is easy. It has a simple and intuitive menu, based on the **four identified categories** under which the tools have been classified: **technical tools; business model tools; community model tools; related projects**. Once the users have identified the problem, it's just only a matter of time to find a tool that fits their needs.

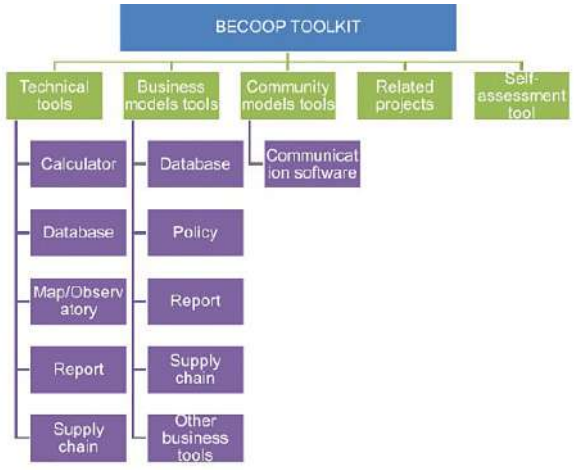


Figure 9. BECoop toolkit categories and subcategories of grouped tools

BECoop e-market environment

The BECoop e-market environment connects supply chain stakeholders in a virtual platform and supports the development and operation of community bioenergy heating projects. It further includes an educational vector, visually demonstrating to potential bioenergy RESCoops the various stakeholder interactions and activities that have to take place for setting up an effective and sustainable community bioenergy project.

Users can easily **identify the various types of actors** (technology providers, service companies, installers, consultants, etc.) **needed to implement their initiative and facilitate contact**. Through a simple registration process, users can offer a product or service or search for a partner to meet any identified needs in their initiative. The **educational vector provides an illustrative example of a typical energy community supply chain**, detailing the interactions between stakeholders necessary for its successful establishment. Additionally, it outlines the supply chain established in the BECoop cases and the initiatives supported by the project in its pilot regions.

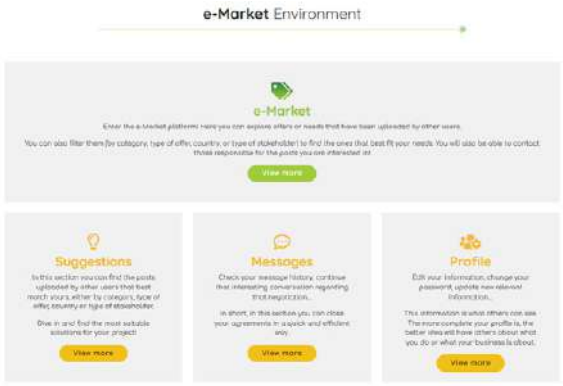
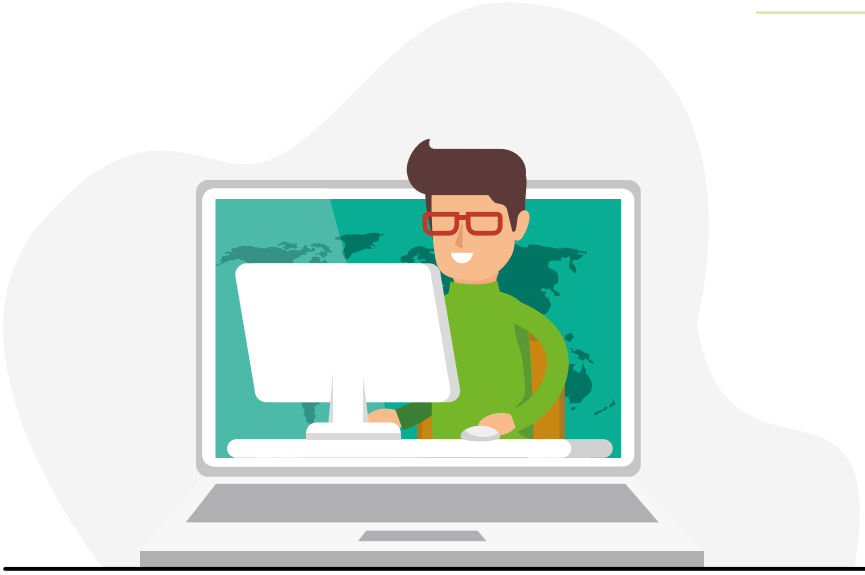


Figure 10. The BECoop e-market environment platform

Figure 11. BECoop Educational Vector - Steps for creating a RESCoop



BECoop Knowledge exchange platform (KEP)

The BECoop KEP has been developed for enabling exchange of knowledge among bioenergy actors, communities and regions. It acts as a forum to solve any doubts that may arise and as a repository of useful information. It hosts the BECoop developed tools and three other elements: the knowledge repository, the Atlas of bioenergy community cases and the Network of Interest (NoI).

Knowledge repository: an online source of information, tools and services in the field of community bioenergy heating and includes: the BECoop webinars, policy recommendations, external useful reports and the public deliverables.

Atlas of bioenergy community cases: an observatory/ atlas of RESCoops that are active in the field of bioenergy, as well as with potential to get involved in bioenergy including technologies, service providers and other useful information.

Network of Interest (NoI): a digital space with a liaison structure for fostering cross-regional networking, dialogue and knowledge exchange among community bioenergy stakeholders. To this end we have created several thematic groups in order to foster and promote better such communications.

Figure 12. BECoop NoI

Figure 13. BECoop Atlas of Community cases

BECoop Technical catalogue and factsheets

The BECoop technical catalogue presents in an easy-to-understand manner, the bioenergy heating solutions selected by BECoop, seeking to provide an overview of the technology process but also the steps that should be followed for its implementation.

It generates **recommendations to facilitate the conversation at the time of establishing the first contact with the energy services/engineering companies that will carry out the project**. The full technical support catalogue can be divided into sub-sections and covers the: (i) biomass direct heating, (ii) biomass district heating, (iii) biomass co-generation for small-scale applications, (iv) biogas/biomethane plant with biomass for small scale applications. Each catalogue provides insights into the process overview, the steps to be followed, the stakeholders that can support, the social, environmental and economic impacts, as well as success cases.

The factsheets focus on key technical services that can complement the technical solutions compiled in the catalogue for the uptake of community bioenergy heating.

Each factsheet is presented in an easy-to-grasp way, providing general information and recommendations about different technical services that the stakeholders could be interested in promoting. Four factsheets adding value to the catalogues have been developed on: (i) solid biomass for small-scale applications, (ii) biomass logistic supply chain, (iii) solid biofuels production and (iv) feedstock evaluation.

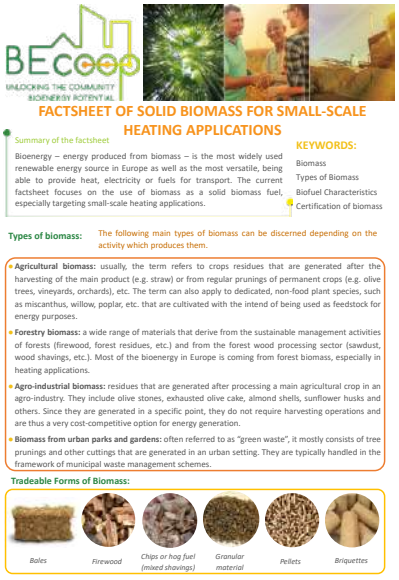


Figure 14. One of the four BECoop factsheets

BECoop Business and financial services catalogue

The Business and financial catalogue aims to collect all the necessary information for developing a comprehensive list of business, governance and financial solutions that will enable potential communities to easily navigate among appropriate solutions that are applicable and effective for their case.

It is a list covering the already available business and financial solutions that lead the deployment of our business support in our new BECoop RESCoop cases. It contains the most important information of our business support regarding business modelling, business planning, market analysis, mentoring, investment planning, financial and funding solutions, as well as investment readiness support and networking.

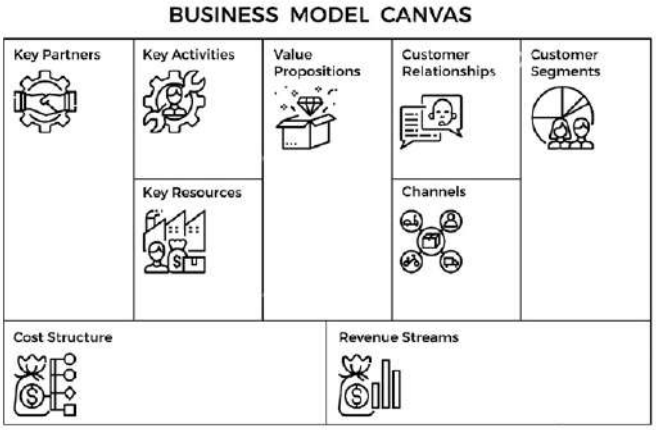


Figure 15. RESCoops governance models template

Step 1

A STEPWISE JOURNEY

Step 1: Build your team

RESCoops are closely linked to local communities and stakeholder groups. Building strong and active teams plays a significant role in shaping the future of renewable energy and its development. In order to get actors involved, it is necessary to have a broader picture of who these stakeholders are, and what they will provide to the decision-making process to improve the reliable and responsible development of a bioenergy RESCoop. Strong and constant stakeholder engagement is also required for successfully implementing and developing sustainable relationships. Overall, engaged community members tend to perceive fewer barriers to local energy projects, thereby facilitating their implementation.

Stakeholder mapping

As an initial step, mapping the RESCoops' stakeholders is a practical way to ensure that relevant stakeholders are involved, while providing a structure for defining the local governance within the community project. As shown in Figure below, it is important for a successful transition to have a balanced representation of different types of stakeholders in the creation of a bioenergy community. Each step in the process of establishing a bioenergy community initiative requires different types of stakeholders involved to facilitate the processes. The following table presents some indicative types of actors engaged in the different stages of the community project development.

Building the Team	Assessing/Collecting Raw Material	Getting involved in bioenergy production	Investing in the project	Designing the project's business plan
Group of citizens	RESCoops	Biomass Management Companies	SMEs	RESCoops
RESCoops	Research Centres	Equipment Manufactures	Investors	Investors
Research Centres	Equipment Manufactures	ESCOs & Installers	Local Authorities	Local Authorities
Local Authorities	Biomass Owners	RESCoops	Public Institutions	Public Institutions
Local SMEs	Local SMEs	Local SMEs	Local SMEs	
Public Institutions	Universities	Research Centres Universities	Associations Research Centres	Local SMEs

Table 5. Types of actors engaged in stages of the community project development

Based on the comprehensive list above, the stakeholders' involvement in the community project can be mapped. The potential contribution that each of these types of stakeholders can make to a community project can be as follows:

Table 6. Major stakeholders' contribution in a community energy project

Group of citizens/ General Public	Biomass Owners	Research Centers and Universities	Equipment Manufacturers
• A group of citizens with **common interests** (biomass availability, needs to renew heating system, etc.) • Ideally closely situated can collaborate and establish an Energy Community • Some members (e.g. farmers) are providers of biomass availability throughout the year	• **Providers farmers of different biomass types:** agricultural (straw, pruning), forestry or agro-industrial (olive pits, almond shells, sunflower husks etc.) • Also, **different agents,** such as municipalities or biomass logistic distribution companies, can provide biomass (parks and/or forest management etc.)	• Are usually experts on **technical aspects** regarding biomass in all the steps of the supply chain • They can also collaborate in **business modeling** providing consultancy support	• **Producers and sellers of devices** useful for the whole biomass supply chain
Local Authorities/ Public Institutions	**Biomass Management Companies**	**Associations**	**ESCOs and Installers**
• They can inform energy communities about funding call • Provide institutional support or facilitate meeting spaces • They can also be in charge of managing the facilities of the RESCoop/Bioenergy Community	• **Involved in the logistics supply** of biomass and biomass processing operations such as different treatments to adjust biomass properties • They can act also as biomass boilers	• **Such as** local development associations, biomass or renewable energy associations or clusters, citizen associations, etc. • They can help in various ways the Bioenergy Communities, depending on their core	• **Energy services providers** for the implementation of energy efficiency and renewable energy projects • They can help design and provide solutions for biomass utilization
			Investors
			• **Especially green and ethical banks** can provide the capital for developing this kind of project

Engagement Actions

It is highly recommended that stakeholder involvement begins in early stages, such as in dialogue on underlying assumptions, values, and agenda-setting. This approach creates credible project organisation, and better, socially acceptable, and desirable projects and technologies. Meetings are a fundamental part of teamwork, but to be effective, they should not be based on improvisation.

All members are welcome to join the annual general assembly where decisions for the future of the cooperative are made. Involving actors that have already worked in the same area could anticipate social problems in engaging people in the community.

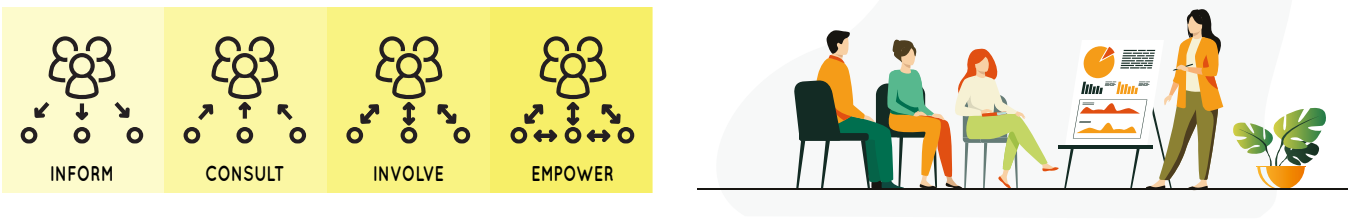


Figure 16. Different engagement levels

An energy community should investigate various engagement strategies based on the members' interests and level of involvement if it wishes to secure their participation. These strategies could include everything from ***information*** sharing and ***consultation*** at the project's conceptualisation phase to encouraging active ***participation*** such as ***empowerment*** and collaboration during the project's execution and operation. There is no approach that works the same for all energy communities due to their extreme diversity and the environments in which they function[48]. The different stages of engagement are summarised in the table below:

Table 7. Stakeholder engagement stages

Stages of Engagement	What	How
Information	Keep the members up to date about the energy community's actions and development	Online and printed informational material (e.g. brochures, social media posts etc.)
Consultancy	Keep your members informed about general energy related- issues, and most importantly make sure to hear and consider their opinions and ideas.	Interactive neighbourhood events (for example, energy coffee meetings at various local venues).
Involvement	Invite your members to participate in innovative research projects.	Active involvement of the members: • Increased know-how exchange • Direct participation in shaping the energy system of the future
Empowerment	Invite all members to participate in collective decision making of the cooperative.	General Assembly

Group Dynamics

The group dynamics of a bioenergy cooperative group can be as follows:

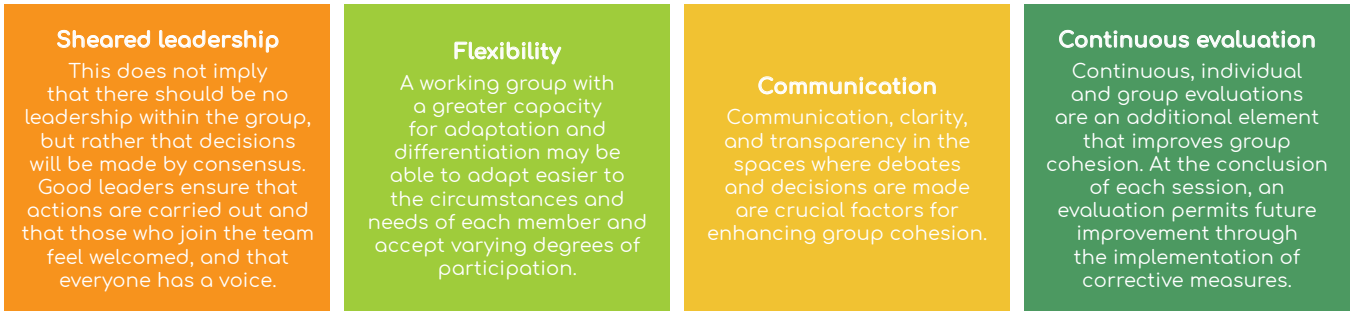


Figure 17. Group dynamics of a bioenergy cooperative[49]

[48] RESCoop - Community Energy Communications at the local level. Available at: https://www.rescoop.eu/uploads/rescoop/downloads/Community-energy-communication-guide.pdf
[49] GOIENER guide for setting up a RESCoop; Friends of Earth: Community energy -A practical guide

Membership terms

How can one be a member of a bioenergy cooperative?

As introduced in the "*What is an Energy community*" section, open and voluntary membership is the first of the seven guiding principles of energy cooperatives. This indicates that everyone is welcome, regardless of race, gender, socioeconomic status, political or religious beliefs. An essential step towards the creation of a Bioenergy Community is examining the various financing options in establishing a project's economic and financial viability. It is interesting to reflect on potential financing sources with early founding members, experts, mentors, or financial consultants. The financial model should be as simple and clear as possible.

In a Bioenergy RESCoop, each member is typically required to make an initial capital contribution (e.g., a registration fee), and additional capital is provided through the cost per kilowatt hour consumed. The capital investment required by members to maintain economic viability is governed by the financial policies and conditions of the cooperative. Most practical information on the available financial resources for RESCoops can be found in the following section of "Financial resources for RESCoops".

Due to the substantial costs of developing the events, RESCoops typically combine creatively various funding contributions from the public, private, and non-profit sectors. Other funding options have also been identified, including revolving funds, grants, crowdfunding, and member donations[50].

Internal Organisational structure

Four (4) groups of people are required for the initiation of cooperative operations, and that would include the following:

1. **Members** are the decision-makers as they are the business' owners. Members govern their cooperative through a
2. **board of Directors** elected from within the members and are accountable to them. The Board of Directors submits the policies to the General Assembly for approval by the members.
3. **A Manager** is hired by the Board of Directors to oversee the daily operations of the cooperative.
4. **Employees** are hired by the manager; they do the production and marketing of product or services of the cooperative.[51]

To ensure that all members have equal voting rights, the "one member, one vote" principle is applied.

Relevant/Recommended tools identified under the BECoop Toolkit:

- Best Practice Guides: Peer-to-peer learning programs about municipal-led energy poverty work and co-creation with citizens
- Community model Tool: a tool to assess the maturity and growth of your energy community
- Communication Software: Links to platforms designed to facilitate communication and decision making

Development of an action-plan and a set of targets for the community

Clarifying the main concepts and guiding principles of the community while outlining its core beliefs and goals, must be the first step in any effort to establish an energy community. It may be driven by a desire to strengthen community ties among residents, organisations, and companies. It can also be supported by taking actual steps to decrease a neighbourhood's carbon footprint or by providing better and more affordable renewable energy sources for electricity and heating. Following this, a number of crucial actions that all help to realise the concept of an energy community are presented here[52]:

1. **Initiation**
   a. Analysis of the RESCoop's scope and basic conditions for its creation, placing the community at the centre.
2. **Preparation**
   a. Empowerment of stakeholders through technical and participatory aspects
   b. Sharing knowledge about the RESCoop
3. **Co-Creation**
   a. Establishment of the promoter group, essential for the creation of the RESCoop: used to discuss and resolve challenging management and communication challenges, as well as promote democratic decision-making
   b. Set-up the characteristics of the RESCoop
   c. Selection of the first energy project
   d. Finalisation of the characteristics of the cooperative and preparation of the formalities for its constitution
   e. Design of a Communication strategy
4. **Implementation**
   a. Development of a communication plan
   b. Registration as a cooperative
   c. Actions needed to implement the energy project
   d. Activation of hosting actions for new members
   e. Good organisation and good functioning of the community[53]

[50] BECoop Catalogues For The Provision Of Business And Financial Support Services – First
[51] StartCoop – Module 4 – Organisational Setup
[52] EBO guide – Handbook for Energy Communities
[53] GOIENER: A guide for setting up a RESCoop; Friends of the Earth -Guide

Mobilisation and outreach to the wider community

A Bioenergy RESCoop must always educate the public on energy democracy and the advantages of community energy. To encourage the larger community to participate, engaging in diverse communication strategies will be essential. This can be achieved through different activities such as:

1. **Awareness campaigns:** A nice example comes from Poland and the awareness campaigns that the BECoop Polish pilot partner has organised throughout the course of the project. Some of these activities have included info-days in local events in the area, where the local populations have had the opportunity to learn more not only about the project itself, but mainly about the benefits of the creation of a bioenergy community in the area.
2. **In-person communication (door-to-door visits, phone calls etc.„):** On the other hand the Spanish BECoop pilot partner GoiEner (RE cooperative) has figured out that phone calls to the people of the area is the most effective way to reach out to and inform them about the local community bioenergy initiative.
3. **Interactive workshops/ games and community meetings:** The Greek BECoop pilot partner ESEK (RE cooperative) has organised different interactive workshops for promoting their actions and growing the community.
4. **Online communication (websites, newsletters, social media advertising, online meetings):** The Italian BECoop pilot partner FIPER (RES energy producers Federation) has been keeping their Social Media accounts updated with news, activities, and newsletters to reach a broader audience.
5. **Printed material (brochures, leaflets, posters, local newspapers, etc.„):** Another good example is the promotional material that all the pilot partners of the BECoop project have produced for their activities.

Fig. 19. Activities in Oborniki Śląskie (2)

Fig. 20. Screenshot of a post on FIPER's LinkedIn account

Fig. 22. Promotional material produced by the BECoop pilot partners

Fig. 18 Physical meeting organised by ESEK pilot team

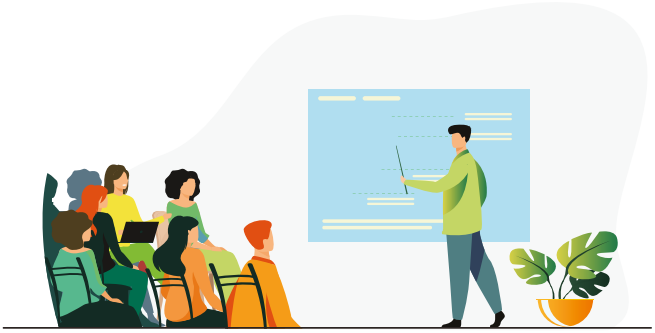
Fig. 21. Interactive workshop organised by ESEK

Fig. 23. Awareness Activities in Oborniki Śląskie, 2023 (1)

Ensuring long-term engagement

Achieving long-term engagement can be challenging, but there are several communication strategies that can help maintain members' interest and commitment:

- Be transparent and honest about the project's activities
- Communicate project results to members
- Consider feedback, comments, and complaints from members
- Use language that builds up the public identity of the cooperative
- Plan meeting and communication frequency to avoid overwhelming members
- Respect and be sensitive to members' personal obligations and time
- Use various strategies and resources to promote teamwork and create a positive environment
- Plan fun activities and celebrate achievements[54].



Capacity-building (training and education)

A RESCoop should provide training and education to its members, elected representatives, managers, and employees so that they can effectively contribute to the organisation's growth. These training and educational programs are essential because they enable members and citizens to better appreciate and comprehend energy production and consumption. Therefore, when creating an energy community, it should be a top concern to provide enough educational activities and coaching. For the purpose of collaboratively meeting these training objectives, it is beneficial to collaborate with other energy groups.

Table 8. Capacity building programs

Courses (Title, topic)	Provider	Link
A series of educational Webinars covering all aspects of Bioenergy Community development	BECoop	BECoop Webinars
A series of Educational Guides for Starters	RESCoop.eu	RESCoop Guides for starters
Capacity-Building Programme (CBP) on innovative financing for energy and climate actions and other crucial aspects of capacity building, decision-making and replication processes.	Prospect+	Prospect+ CBP
Free Online Courses with Certification	European Citizen Energy Academy (EUCENA)	EUCENA Online Courses
The Community Energy Academy connects collective energy actions, social justice, and empowering participation to provide creative solutions and new pathways. The programme is designed for public administrators, members of energy communities and researchers.	EC2	The Community Energy Academy
Community Energy Ambassadors Course: for anyone who is interested in setting up an energy community in their local area and looking for information and tools on how to get started.	Friends of the Earth Europe	Community Energy Ambassadors course

[54] RESCoop guide; Spanish replication handbook

Interaction and networking with other RESCoops

Bioenergy RES Cooperatives should always choose to cooperate with other similar initiatives. To strengthen the cooperation movement, they should collaborate within national, regional, and international structures.

These kinds of interactions and networking can provide the cooperatives with exchange of valuable knowledge, experiences, and expertise. In some cases, well established cooperatives can even support financially new initiatives.

Table 9. Organisations for networking

Organisation	Short description	Link
RESCoop	The European federation of citizen energy cooperatives, working to promote the possibility of local actors to join forces and produce renewable energy.	RESCoop.EU
Energy Communities Repository	An initiative on behalf of the European Commission to assist local actors (including citizens, local authorities, and businesses) with setting up and advancing clean energy projects driven by energy communities in urban areas across Europe.	Energy Communities Repository
The European Community Power Coalition	The European Community Power Coalition promotes the development of citizen and community ownership of energy in the urgent transformation towards 100% renewable energy	The European Community Power Coalition
The Rural Energy Community Advisory Hub	The RECAH focuses on assisting citizens, rural actors and local authorities in setting up a Citizen Energy Community or Renewable Energy Community in rural areas through technical and administrative advice and encouraging their development.	The Rural Energy Community Advisory Hub

Did you know?

Local community's engagement and support is vital for the successful establishment of a community energy project:

Local beliefs and attitudes towards the concept of "energy communities" can vary from country to country[55] [56]. Common core values of the local areas such as low environmental awareness and concern for the future environmental negative consequences of the fossil fuels can hinder the successful implementation of a new project. The lack of motivation for their participation in collective projects that require engagement and communication and the adoption of sustainable management of resources only makes the matters worse. In addition, citizens in rural areas are more hesitant and reluctant with regard to changes, and only positive and successful examples in their surrounding area can empower a behavioural shift towards more sustainable practices[57]. The engagement of the local community is a crucial step for the successful implementation of the energy community. The establishment of incentives (economic or social) could improve the participation rates of the citizens, while the organisation of warm-up activities in the onset of the project could motivate key stakeholders.

[55] Kania, J.; Bomba, J.; Leśniak, L. 2013. Cooperative Movement in the Minds of Farmers and Advisers and the Practical Use of the Cooperative Idea for the Development of Entrepreneurship in Rural Areas: (Agreement no. KSOW / 82/09/2013).

[56] Beckmann, V., I.M. Otto, and T. Tan. (2016). Overcoming the Legacy of the Past? Analyzing the Modes of Governance Used by the Polish Agricultural Producer Groups, Agricultural Economics (Zemědělská Ekonomika), Vol. 61, No. No. 5, June 6, pp. 222– 233

[57] https://www.becoop-project.eu/wp-content/uploads/D1.4_Definition_of_community_bioenergy_heating_uptake_needs_challenges_V1.0.pdf

SUCCESS CASE

Empowering the community through education | District heating plant Dobbiaco San Candido, Italy

The District Heating Plant Dobbiaco Cooperative was established in 1994 and quickly gained traction, with the first members receiving district heating from biomass as early as 1995. By 1999, the cooperative had extended its heating network to the nearby village of San Candido. Over the years, the cooperative has consistently expanded and modernised its facilities, leading to the creation of the Dobbiaco San Candido District Heating Plant, a beacon project for decentralised production of heat and electricity from biomass. Today, the cooperative boasts an **impressive membership of over 950 individuals and services more than 1700 consumers across a network spanning 50km.** The network is powered by biomass boilers with a capacity of 20 MW, making it one of the most efficient biomass heating plants in South Tyrol. Despite its growth, the cooperative has maintained one of the lowest heat prices in the region since its inception thanks to the foresight of its dedicated members. The Dobbiaco-Innichen district heating plant has also sought to engage with the community and share its knowledge with the public. **In 2005, the cooperative opened a show walk that offers visitors an immersive experience, bringing them closer to the subject of district heating. The show corridor and nearby biomass nature trail are open to the public and offer a unique learning opportunity for school classes and guided tours.** With its commitment to sustainability, community engagement, and education, the District Heating Plant Dobbiaco Cooperative is a true success story.

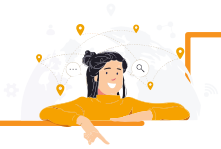
More information can be found here: www.fti.bz

Fig. 24. The district heating plant in Toblach (down). The show corridor (up).

Questions to answer before you start...

Before embarking on a community bioenergy project, it is crucial to consider stakeholder engagement. The following factors must be carefully considered to ensure the success of the project and the ongoing engagement of all relevant stakeholders.

- Who are the key stakeholders who would be interested in participating in the project?
- What are the existing relationships among the stakeholders?
- What are the shared objectives among the stakeholders?
- What are the most effective communication channels to be used?
- What incentives can be provided to maintain stakeholder interest?
- What engagement activities and actions should be organised to keep stakeholders involved and engaged?



Want to learn more?

- Check out the RESCoop Guide for Stakeholder Management here:
  RESCoop Guide for Stakeholder Management
- Learn more about successful engagement strategies here:
  People of the Earth: Community Energy - A practical guide
- Find here a Complete Stakeholder Mapping Guide by Miro:
  Complete Stakeholder Mapping Guide
- Check out more on how to build an Awareness Raising Campaign here:
  RESCoop Communication Guide
- Learn more about how to start an energy community:
  RESCoop Starters Guide
- Learn more about the benefits and challenges of community energy projects with regards to their environmental, social and economic aspects by Interreg Europe:
  Empowering Citizens for Energy Communities

BECoop tools and project-relevant resources:

- Explore the BECoop Knowledge inventory:
  BECoop Knowledge Exchange Platform
- Join the e-market environment to identify supply chain stakeholders to support the operation of your bioenergy community project:
  BECoop E-market
- Learn more about the types of key community stakeholders:
  BECoop Educational Vector
- Find out more about local and EU level framework circumstances and the environment concerning the activation and development of community bioenergy heating:
  BECoop D1.2 Regional and EU framework and value chain conditions affecting community bioenergy uptake
- Read about the stakeholders' needs, perceptions and acceptance levels around community energy and community bioenergy heating aspects:
  BECoop D1.3 Stakeholders' perceptions, acceptance levels and needs on bioenergy heating
- Find out more about the bioenergy uptake challenges and needs both at the BECoop pilots and EU level:
  BECoop D1.4 Definition of community bioenergy heating uptake needs and challenges
- Read about the BECoop capacity-building program:
  BECoop D3.3. Deployment of the BECoop Capacity Building Program – First
- Learn more about the development of the BECoop Knowledge Exchange Platform:
  BECoop D5.1 BECoop Knowledge Exchange Platform – First
- Find tools that can help you shape a bioenergy community:
  BECoop Toolkit
- Check out these useful tools:
  (available through the BECoop Toolkit)
  Best Practice Guides: Peer-to-peer learning programs about municipal-led energy poverty work and co-creation with citizens
  Community model Tool: a tool to assess the maturity and growth of your energy community
  Communication Software: Links to different platforms designed to facilitate communication and decision making

Step 2

Step 2: Assess your raw material resources

Raw material assessment

As far as the technical aspects of the project are concerned, one of the key steps to developing a successful community energy initiative is assessing the adequate availability and high quality of resources at the local and regional level. This is the reason why one of the first actions in establishing a community energy project is to carry **out an assessment and evaluation of the type of available resources**.

> Identifying the geographical location, distance to the point of use/consumption and availability of biomass resources in the local region is a significant exercise which needs to take place during the first stages of the bioenergy community development in order to ensure the project's feasibility at the local scale.

Once the resource has been identified and located, it is highly recommended to carry out **an analysis of the physical-chemical and energetic properties to assess the suitability of the resource for its intended use.** There are databases that can help to estimate these properties, but it is always advisable to carry out a specific analysis, since the properties of biomass as a fuel can differ from crop to crop.

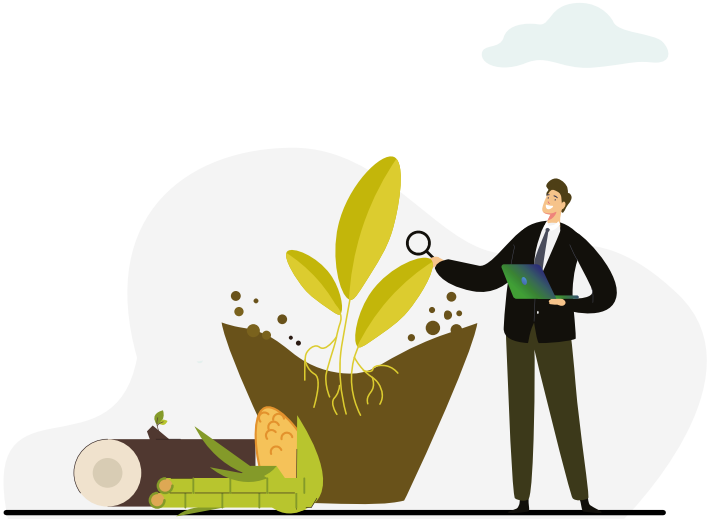
Common chemical biomass analyses for energy use include proximate analysis, ultimate analysis, and heating value analysis. Proximate analysis is a test that determines the amounts of moisture, ash, volatile matter, and fixed carbon in a sample of biomass. Ultimate analysis is a test that determines the amounts of carbon, hydrogen, nitrogen, sulphur, and other elements in a sample of biomass. Heating value analysis is a test that determines the amount of energy that can be obtained from a sample of biomass when it is combusted. These analyses can give information about the quality and composition of the biomass, which can be useful in determining its suitability for use as a source of energy.[58]

Regarding the availability of biomass for its use as a fuel, there are three major factors influencing it:

- The **temporality** of the resources is one of the most important factors to take into account when assessing the biomass resource available in the local region. These resources are usually obtained at certain periods of the year, so it is necessary to foresee what the growing and harvesting periods of the resource are going to be.
- **Processing** is, therefore, a fundamental factor - generally, processing operations will be concentrated at certain times of the year, so it will also be essential to have agents or biomass management companies available for short but busy periods. In these periods, biomass will be dried, and chipped or pelletised in order to improve its characteristics as a fuel along with its mechanical properties.
- Finally, it will also be important to correctly dimension the **storage** space, in order to have resource availability throughout the whole year. The temporality of the resources will impact the storage capacity and an adequate sizing of storage facilities is crucial.[59]

The **BECoop project** has developed a series of tools and services that can help allocate and assess the quality of the selected raw materials. Before you begin, check out the section **Overview of BECoop Tools and Resources** for more information.

Make sure to examine the **BECoop self-assessment tool,** the **BECoop toolkit** and the project-developed **e-market environment.**



[58] https://www.e-education.psu.edu/egee439/node/606

[59] Donald L. Klass, Chapter 2 - Biomass as an Energy Resource: Concept and Markets, Biomass for Renewable Energy, Fuels, and Chemicals, Academic Press, 1998, ISBN 9780124109506, https://doi.org/10.1016/B978-012410950-6/50004-0

SUCCESS CASE

Exploitation of locally available feedstocks | Energy Community of Karditsa (ESEK), Greece

Energy Community of Karditsa (ESEK) is a profit citizen energy cooperative. It was established in 2010 and the main purpose was to foster renewable energy in the region. In 2019, according to the provisions of the law 4513/2018 and following the unanimous decision of the General Assembly, the Energy Cooperative was converted into an Energy Community. Nowadays more than 400 people are members of the community (an estimated 8% rate is comprised by municipalities, SMEs, associations etc.).
ESEK operates in Thessaly, an area with strong agricultural production. The region has a great biomass supply chain potential through agricultural, forestry and wood processing industries that can easily support the uptake of bioenergy technologies. The main activity of the Energy Community is related to the management of a biomass plant for the production of solid biofuels to generate energy for heating (or cooling) purposes. The first phase of the investment project has been accomplished: an Energy Community with a solid biofuel plant which can set up the value chain for the local community.

Fig. 25. The biomass plant in Karditsa

Fig. 26. Different types of raw material converted into pellets

A manufacturing unit for processing and standardising local biomass and converting it into a commercial form, such as pellets, has been created. The raw material for pellet production consists of industrial residuals (sawmills) such as sawdust woodchips and logging residues such as branches, tops and stumps, coming from Forest Cooperatives. Partnerships with local authorities allow the Energy Community to expand the supply chain with plant biomass coming from Municipal waste (branches and tops of city trees).

Fig. 27. ESEK biomass supply chain expansion based on urban prunings, coffee and forest residues

More information can be found here:
https://www.esek.gr/en/archiki-english/

BECoop tools and project-relevant resources:

Check out these useful tools:
(available through the BECoop Toolkit)

The BIOPLAT-EU WebGIS tool provides a comprehensive online platform for supporting the decision-making process for new bioenergy investment projects that rely on biomass from MUC lands in Europe and neighbouring countries.

The BioRaise tool provides a geographic information system where the user can explore the potential of forest and agricultural biomass at European level and estimate the potential in a circular area around a centre set by the user.

The Hotmaps tool is an open source mapping and planning toolbox that provides default data for the EU28 at national and local level. These data can allow energy communities to identify, analyse, model and map resources and solutions to supply energy needs within their territory in a resource and cost efficient way.

The S2Biom tool enables the user to make selections of biomass types for which data can be displayed in a map in relation to the amount of biomass available per year and potential type combination.

The Phyllis2 tool is Database of a great variety of biomasses, including biochar, char, fossil fuels, manure, grass plants, marine biomass, non-organic residue, sludge, straws, treated wood, etc. Where you can find a detailed analysis of its composition and properties (macroelements, heating value, trace elements etc.,) plus classification, literature. Phyllis can also be used to get all accessible information on a single sample or to get average values for groups or subgroups in any desired combination.

Step 3

Step 3: Choose your activity

The purpose of this section is to assist the reader, particularly those already or soon-to-be involved in RESCoops, in **selecting an activity that aligns with the unique needs and capabilities of their community.**

> It is essential that before making any decisions, the reader takes into account the **resources and logistics available** within their community. To aid in this process, this section will provide examples of different technologies that can be utilised for each potential activity. By carefully evaluating the options and considering the resources at their disposal, the reader will be able to make an **informed decision on the activity that will be the most beneficial for their community.**

Logistics of biomass supply chain

Biomass logistic operation is a critical step of the solid biofuels value in terms of economic feasibility, quality and environmental performance. There are different possibilities when collecting these resources, some of them are better than others, the most suitable alternative will depend on a number of factors such as:

- The amount of biomass to be mobilised yearly according to availability and market potential
- Investment cost of the new machinery needed
- Access and slope to the field/forest, since it can constrain the suitable machinery to be used and the supply chain that follows
- Distribution and amount of biomass to be harvested from the fields/forest/urban parks
- Quality requirements of the fuel, for instance: moisture content, size distribution, etc.

It is worth noting that **each type of biomass will need some specific considerations to be taken into account**:

AGRICULTURAL BIOMASS:

It is usually generated after pruning/harvesting operations, fulfilling RED II criteria. Its high dispersion and low productivity per hectare make the logistic operation a critical parameter. The radius from which it is obtained should be low, not larger than 30 km, but it also depends on the type of biomass, as for instance, bales can be obtained from a larger area. Due to the content in sand and stones, which need to be avoided, the shredder machinery is usually more suitable than chippers.

FOREST BIOMASS:

It is obtained after the forest management operations. Depending on the type of forest, the quantity of biomass can vary enormously: from 20 to more than 100 tonnes per hectare. In this case, the radius of operation is increased to almost 100 km, because of the specific characteristics of the fuel. This also affects the selected machinery, where usually large chippers are preferred. This is due to the more homogeneous and productive fuel properties.

BIOMASS FROM URBAN PARKS AND GARDENS:

It is obtained when maintenance operations of urban parks and gardens take place. The amount of obtained biomass will also depend on the species, but a first estimation shows that 15-30 tonnes per hectare could be obtained. Differently to the prior cases, small chipper machinery is preferable, since the product obtained is usually homogeneous. This type of machinery is easier to move from one site to another and can offer alternatives regarding the fuel feeding: manual or automatic machines can be both employed.

Did you know?

Establishing a local supply chain is crucial for the success of any bioenergy community project

One of the biggest challenges in achieving this is ensuring that the supply chain is both sustainable and efficient. Transporting and storing biomass can be expensive, which can increase the overall production costs and require a significant investment up front[60]. Although having a short supply chain can help reduce costs, there are still obstacles to overcome. One major issue is the lack of knowledge among local stakeholders about the concept of bioenergy communities, which can lead to a shortage of informed biomass producers and a lack of organisations that can collect and assess biomass quality in rural areas.

To address these challenges, it is essential to educate the local community and key stakeholders, such as farmers, biomass producers, and traders, to help design and establish a reliable, short supply chain that will reduce logistics costs and ensure a steady supply of high-quality biomass.

[60] Lautala, P.T., Hilliard, M.R., Webb, E. et al. Opportunities and Challenges in the Design and Analysis of Biomass Supply Chains. Environmental Management 56, 1397–1415 (2015). https://doi.org/10.1007/s00267-015-0565-2

SUCCESS CASE

Powering the Community with Local Biomass| Bioenergie Ritten Cooperative, Italy

The Bioenergie Ritten cooperative was founded in 2007 with a mission to provide renewable and sustainable heat to the community, reduce dependence on fossil fuels, and support local forestry and agriculture. In 2008, a trial operation of the cooperative's biomass boiler with 5.4 MW and ORC plant was successfully carried out.

One of the cooperative's key values is **relying on local cycles and resources**. As such, 100% of the 62,000 bulk cubic metres of biomass required annually comes directly from the community. The biomass is delivered in the form of roundwood or wood chips from small agricultural and forestry enterprises. The delivery can be made directly to the heating plant or to an external storage site. The delivered biomass is weighed, and the moisture content is determined, which influences the pay-out price. The delivered roundwood is chipped on site, dried, and fed into the thermal utilisation process. By using low-grade wood assortments for fuel, the cooperative reduces waste and encourages sustainable forestry practices. This has benefits for the forest owners of Ritten, who can economically exploit low-grade wood assortments that still frequently occur in the municipal area. Furthermore, using biomass instead of fossil fuels reduces greenhouse gas emissions and helps combat climate change. The cooperative is committed to expanding its impact in the community. It plans to supply a remote hamlet with district heating through a small micro-district heating network. This will contribute to phasing out fossil fuels such as oil or gas. In addition to the main purpose of providing heat to the community, Bioenergie Ritten also operates a composting plant that recycles a portion of the biomass ash.

Fig. 28. Biomass wood chips storage

Fig. 29. 69% of the total wood is delivered in the form of wood chips and logs.

More information can be found here:
www.bioenergie-ritten.it

The supply of heat to residents and other end-users in rural areas can be achieved through direct or district heating as further explained in the section below.

Direct and District Heating

The technical implementation depends on several factors such as the degree of density or dispersion of heat consumers, the heat power demand of end consumers, the availability of a heat network, the feasibility of its construction, the willingness of heat consumers to switch to the proposed heating system or connect to the heating network, the final costs associated with implementing a particular heating system, and the preferences of end consumers.

Direct Heating

Direct heating is a system where the conversion of energy into heat takes place in the independent boiler at the site to be heated. Therefore, the direct heating system may take place not only in the strictly single households, but also in smaller family buildings, institutional buildings or offices, where the heating unit is located within or by the building. Figure 30 presents examples of direct heating systems.

a) single-family house[61] **b) residential block**[62]

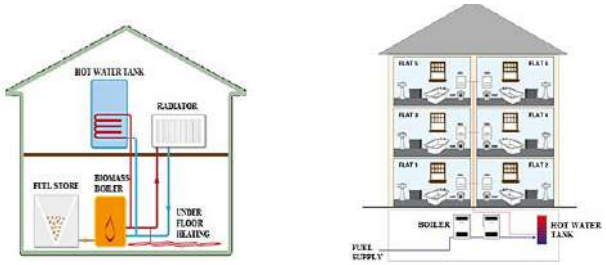


Figure 30. Scheme of direct heating systems

Direct heating installations are characterised by relatively low investment and operational costs, together with limited transmission losses resulting from the location of the heat source in the heated building. This solution also has its disadvantages, such as: occu pying a certain space in the building by the heating unit and/ or by stored fuel, or the need for maintenance and periodic inspections of the installation.

In general, direct biomass heating installation consists of (Figure 31): (i) fuel storage/feeding system, (ii) the boiler for solid biofuel combustion, and (iii) heat distribution system in the object.

61 http://www.wattenergysaver.co.uk/biomass.html. [Available online: 06 12 2021].
62 https://insite-energy.co.uk/what-is-heat-network

When comparing automatic and manual fuel feeding systems, it is important to consider the efficiency of the combustion process. Complete combustion requires proper air, which necessitates precise control over the amount of air entering the combustion chamber or furnace. Manual feeding requires frequent opening of the fire door for fuel, which can cause excess air to enter the furnace, resulting in heat wastage and reduced boiler efficiency. Additionally, manual feeding does not distribute fuel evenly over the furnace grate, leading to a poor air-fuel mix and often resulting in black smoke from the chimney. Despite being an inconvenient system that requires periodic fuel supply to the combustion chamber, manual feeding has the advantages of a lower cost and simpler design, which can facilitate repairs in the event of a failure and reduce the time without access to heat[63].

a) automatic system of direct heating **b) manual system of direct heating**

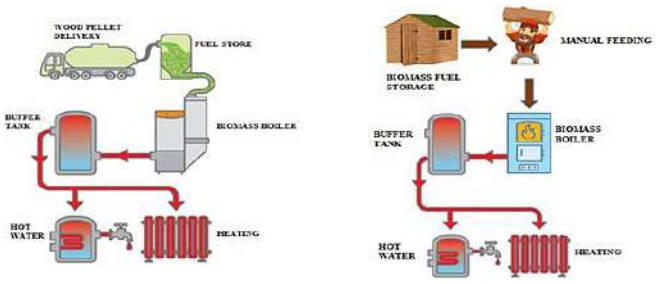


Figure 31. Main components of typical biomass direct heating installations.[64]

Different biomass boilers and technologies have been developed based on the form of biomass used. Types of solid biofuels that can power biomass boilers include:

- **pellets**
- **briquettes**
- **chips**
- **logs and**
- **bales/cubes**

Check out the **BECoop Technical catalogue and factsheets** for a comprehensive explanation of the different technical solutions.

Thermal biomass utilisation for heat generation can be achieved through combustion or gasification processes. According to the EU Directive, all new boilers with a heating water capacity of less than 500 kW or heating air capacity of less than 50 kW must meet ECODesign requirements[65].

The Figure below presents examples of boilers powered by biomass fuels with varying types of fuel storage rooms.

Fuel storage rooms vary depending on the size, construction, and form of the biomass. The storage room should be large enough to allow for filling a maximum of 3-4 times a year, and it should prevent moisture from entering and be free from contaminants such as stones, animal carcasses, metals, coatings, or preservatives[66]. Storage rooms also require proper ventilation to prevent rotting, decomposition, and to ensure air access for maintaining proper hygienic/climatic conditions. It is recommended to clean the storage room once a year, after the heating season[67].

Examples of Biomass Boilers[68 69 70]

automatically fed by wood pellets

manually fed by wood logs

manually fed by straw cubes

Figure 32. Examples of biomass boilers

63 http://steamaxindia.com/why-is-automatic-fuel-feeding-better-than-manual-feeding
64 https://www.treco.co.uk/news/article/what-is-biomass-heating
65 Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.
66 https://www.treco.co.uk/news/article/what-is-biomass-heating [Available online: 27.01.2023]
67 EPC Storage Guidelines. Recommendations on the design, installation and operation of fuel stores for heating appliances.
68 https://www.domuscalida.pt/shop/caldeiras/caldeiras-pellets/caldeira-a-pellets-greenecotherm-long-time-30-kw/
69 https://www.greensquare.co.uk/biomass-boilers-product. [Available online: 24.12 2022]
70 https://termomont.rs/en/products/magna-products/btk-2/

The profitability of a biomass-based heating system depends on factors such as the range of modernisation work, system size, frequency of use, and the chosen fuel type. It is difficult to provide an exact price for biomass boilers across the EU, as the costs vary depending on factors such as type, size, manufacturer and location. However, the tables below provide some rough estimates of the current (2023) prices of biomass fuel and boilers, that can help assess the economic efficiency of such solutions.

Fuel	Unit fuel price, €/kg	Average unit calorific value, kWh/kg
Wood pellets	0.26–2.87	4.8
Briquettes	0.18–2.10	4.6
Wood logs	0.10–1.41	4.1
Wood chips	0.05–0.19	3.5
Straw bales	0.05–0.37	4.0

Table 10. Estimated unit biomass fuels' prices and their calorific values[71].

Boiler's power output	Price, €
15 kW	2,400 – 9,800
25 kW	3,000– 12,600
50 kW	3,400–21,200
100 kW	8,300–36,200

Table 11. Estimated costs of a biomass boiler depending on its power[72].

If there is a lack of knowledge or data about the annual heat demand of a building (or household or office), the thermal power of a biomass boiler can be estimated based on the heated surface area of the under study building. The figure below shows an example of such a relationship for a temperate climate. It should be noted that this is a rule of thumb. This estimation may differ significantly from the actual demand under certain circumstances, so it is recommended to consult with a specialist.

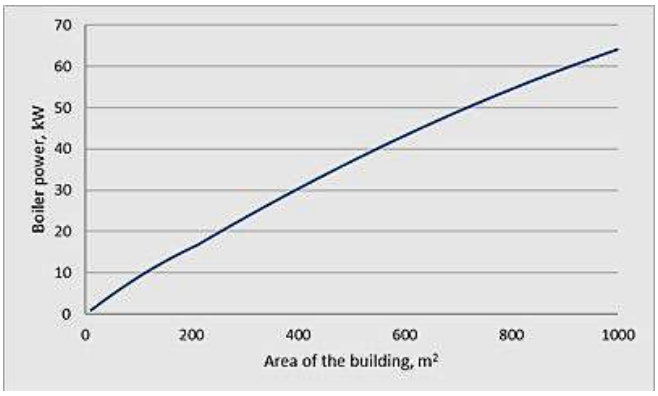


Figure 33. Thermal power of the boiler vs. heated surface area of building

District Heating

A brief description on the Biomass District Heating (DH) system, as provided below, can also help you find out if your community could benefit from such a system. A biomass district heating system is basically a heating power plant that generates heat and supplies it through a piping network to different consumers in different buildings. A scheme of a District System is depicted below.

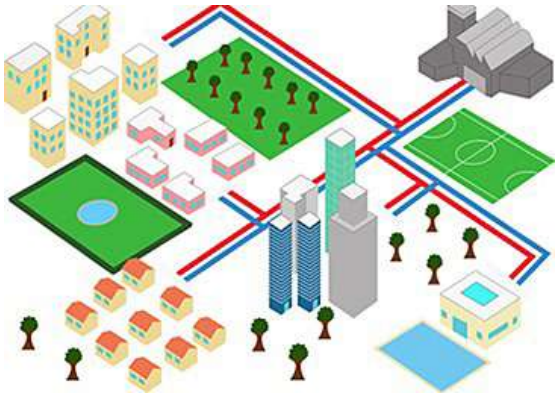


Figure 34. Scheme of a District Heating system

[71] Based on data from the following providers and organisations across EU (Idealo, Palet de Pellets, Ecopellets, Amazon, Leñas el Puente, Waldholz, Avebiom, Energia dal legno, Agraria Tocchio, Camera di commercio di Alessandria, Biznes Oferty, Stefa Agro, Data of Deutches Pellet Institute, C.A.R.M.E.N. e.V.)

[72] Based on data from the following providers and organisations across EU (Idealo, eBay, Kotły c.o., Allegro, Braccioni srl, Gruporp, Nuevas energias, Central Biomasa, Tienda de Calefaccion, Biomasalamanca, Gemsasolar, Estufas y Calderas Mudéjar)

This system is consisted of four (4) core elements:

1. **Generation plant:** Heat production is carried out centrally to meet the demand of different consumers. The power generating elements (boiler room), as well as the main pumping units, which drive the heat transfer fluid to the different consumption points, are located inside this building.
2. **Distribution piping network:** The pipes are usually distributed in subway trenches that follow the layout of streets in urban areas. The heat transport line consists of two pipelines (with their corresponding collectors), one for the supply and one for the return.
3. **Substations:** Through substations, the thermal energy transported through the distribution network reaches the consumers. There, both temperature and pressure are adapted to the specific conditions of consumption.
4. **Control and management of district heating networks:** Control of regulation between the generation of energy and the real demand in the network in each moment as well as the regulation of the supply and return operating temperatures are managed through a "Supervisory Control and Data Acquisition" tool (SCADA).

It is important to highlight the most commonly used biomass boiler technologies as they are considered the "heart" of the thermal generation plant, particularly for small to medium heating capacities. **The selection of technology should be based on the specific fuel characteristics, such as size, moisture and ash content, as well as the required power.** The table below can assist in determining which technology would be the most suitable for your project based on the chosen biofuel.

Table 12. Biomass boilers for small-medium heating capacities

Technology	Power range	Fuel size(mm)	Ash (%)	Moisture (%)
Underfeed	20 kW – 2 MW	≤ 100	< 1	≤ 30
Fixed grate	20 kW – 2 MW	≤ 100	1 - 3	≤ 30
Mobile grate	200 kW – 200 MW	High flexibility to handle heterogeneous fuels in terms of particle size (≤ G100), moisture (≤ 55%) and ash content		

Economic factors are a crucial consideration that should be taken into account before investing in a biomass district heating (DH) plant. The investment cost (CAPEX) depends on various factors such as location, biomass type, etc.

However, an initial estimation with a range of uncertainties for DH plants that use biomass is provided by the Danish Energy Agency[73], as also presented below, along with the Corresponding Operating Expenses (OPEX).

		Wood-chips	Pellets	Straw
CAPEX (€/kWth – heat output)	Equipment	410 (350-470)	440 (380-510)	460 (370-550)
	Installation	300 (250-340)	290 (240-330)	460 (390-530)
Mobile grate	*Fixed O&M (€/MWth/year)	27,800-37,700	28,000-37,900	43,900-59,600
	*Variable O&M (€/MWh)	2.34-3.71	1.81-2.30	1.92-2.59

** Fixed costs refer to biomass cost, maintenance, etc., while variable costs refer to electricity, etc.*

Table 13. CAPEX and OPEX for a DH plant (6 MW) fed with different biomass fuels

Once CAPEX and OPEX are analysed, an assessment of annual savings from the new installation is necessary to take place in order to evaluate economic profitability. Once these calculations are complete, a payback period can be determined to identify the level of risk associated with the investment. It should be noted that while a first estimation might be simple, additional parameters must be considered for more accuracy.

[73] Danish Energy Agency, "Technology Data for Energy Plants Updated chapters", 2016

Despite their many benefits, there are certain challenges associated with implementing district heating systems, particularly with regards to legal and economic barriers. The absence of a proper legal framework at a regional and national level can hinder the implementation of DH projects. Additionally, the high capital costs required for DH establishment and the lengthy payback periods increase investment risks. Despite these challenges, it is important not to overlook **the environmental benefits of biomass DH plants, as district heating systems are a highly effective solution for generating, distributing, and consuming thermal energy, and can significantly contribute to reducing emissions.** From a user's perspective, modern DH systems offer significant economic and technical benefits, particularly in terms of mitigating operation and maintenance costs associated with individual building boilers.

Before committing to the investment in a biomass district heating (DH) project, various stakeholders must be brought on board to collaborate. Key stakeholders that should be engaged are as follows:

- **Biomass producers/suppliers** to guarantee a stable supply of biomass
- **Energy Services/Engineering Company (ESCO)** to oversee the design of the installation
- **Equipment manufacturers** that will select the proper/best equipment for the installation
- **Public/Local institutions**, necessary to secure public resources, coordinate required permits/licences, and potentially serve as end consumers of the produced heat
- **RESCoops** who are experienced in community models and can promote new district heating installations
- **Consumers** that they will be the "clients" of the DH
- **Transversal stakeholders such as research centres, biomass associations, and** investors, who can provide advice, financing, and other forms of support to advance the development of bioenergy communities based on biomass district heating.

Always bear in mind

Before you begin, it's essential to consider what type of activity you want to undertake. Do you want to focus on the logistic supply of biomass, such as harvesting, hauling, or storage? Or do you prefer solid biofuel production, such as chips, hog fuel, pellets, or briquettes? Alternatively, are you considering a biomass district heating plant for the production of heat or a CHP plant to co-produce electricity as well?

It's vital to choose the activity that is best suited for your energy community based on the local supply and availability of biomass and local demands and challenges. Once you have decided on the activity, it's time to carefully select the technology and equipment needed. There are various types of boilers available in the market, so it's crucial to choose the right one based on the feedstock you plan to use, as not all boilers can burn all types of biofuels. Additionally, the size of the boiler should be considered depending on the energy needs you aim to cover. However, **the priority should be to assess the technical potential of the feedstock you plan to use.**

Don't worry if this seems overwhelming; there are many resources available to help you make informed decisions. Remember, creating a sustainable energy community is a significant undertaking, but with careful planning and the right tools, you can achieve your goals and make a positive impact on the environment and your community.

BECoop E-Market Platform

Join the **e-market platform** and receive support on identifying the services and experts you need to carry out your community project.

Explore the **Educational vector**, part of the e-market environment, depicting the various stakeholder interactions and activities for the set-up of a sustainable community bioenergy project.

SUCCESS CASE

Localised biomass supply chain | The Sluderno Energy Cooperative (SEG)

The cooperative was established in 2000, and by November 2001, the first customers were already being supplied with heat from biomass. In 2008, a new heating plant was built in Taufers in the Münstertal to provide district heating from biomass to the village of Taufers.

The SEG district heating system is a central heating system that distributes heat from a central source to multiple buildings in the town of Sluderno (Schlanders) in South Tyrol, Italy. The system is designed to operate at low temperatures, which reduces heat loss and improves efficiency. The district heating system is also equipped with a backup boiler that can be used during peak demand periods or in the event of an outage. The current infrastructure provides several benefits, including energy efficiency, cost savings, and environmental sustainability. The system is designed to reduce energy consumption and greenhouse gas emissions, as well as to promote the use of renewable energy sources. By providing a reliable and efficient source of heat, the district heating system helps to improve the quality of life for residents and businesses in the communities of Schluderns, Glurns and Taufers.

Fig. 35. Biomass district heating plant in Taufers in Münstertal

More information can be found here: www.seg.bz.it

SUCCESS CASE

How District Heating is Changing the Energy Game in Prad | Village of Prad am Stilfserjoch, Italy

The Energie-Werk-Prad Cooperative (EWP) is a success story of renewable district heating. The cooperative was established in 1926 as an electricity cooperative and now counts approximately 1500 members. In 1999, the heating was supplied for the first time by constructing a combined heat and power plant. This project was made possible through an agreement with the biogas cooperative Prad, which provided a guaranteed purchase of biogas from the E-Werk Prad cooperative. The purchased biogas was used for the production of electricity and heat.

Due to the high demand for district heating from biomass, the cooperative built a second heating plant in 2002. Currently, another heating plant is being planned, which will be implemented in the next few years and will supply the village of Prad with cost-effective district heating from biomass using the latest technology. The electricity is mainly produced with 4 hydroelectric power plants and 4 combined heat and power modules. Today, the EWP operates two district heating plants, which supply heat to the community of Prad through an approximately 28 km long district heating network.The district heating plants use the latest technology to generate cost-effective, renewable energy from biomass.

The EWP has become a multi-utility in recent years, offering electricity and heat, as well as fiber (FTTH) and an electric car for car sharing. Under the motto “Energy from home,” the cooperative is committed to supplying the community of Prad (which has a population of about 3,400 and is located in the Stilfserjoch National Park) with renewable energy generated independently and efficiently at favourable prices. Overall, the EWP’s success in renewable district heating is a testament to their commitment to sustainability and innovation. Their use of biomass for district heating has not only reduced carbon emissions but has also provided the community of Prad with reliable and cost-effective energy solutions.

Fig. 36. Village of Prad am Stilfserjoch

Fig. 37. EWP District heating Plant

More information can be found here: www.e-werk-prad.it

SUCCESS CASE

Vineyard prunings for covering energy demands| The Vilafranca del Penedés, Catalonia, Spain

One of the several successful biomass DH stories around Europe is the Vilafranca del Penedés case, where a biomass DH supplied by vineyard pruning is used to cover the energy demands of four buildings in the local town located in Catalonia, Spain. The value chain consists of multiple local and private actors, working on different aspects, from the collection phase of biomass to the generation and distribution of energy. The selection of equipment was made according to specific biomass characteristics; a Heizomat RHK-AK-500 boiler of 500 kW was installed and runs solely on vineyards pruning wood hog fuel. The savings in natural gas and electricity are up to 153 and 13 MWh respectively, thanks to the use of biomass. The total investment for the installation was 600,000 €, with an annual consumption of 225 t/y (although the potential can be up to 30,000 t/y in the area) derived from 375 ha within a radius lower than 15 km. Regarding the project's environmental and socio-economic impact at regional scale, the emissions avoided have been at the order of 125 t CO2/y, and four permanent jobs have been created throughout the entire value chain.

More information can be found here:
https://agrobioheat.eu/vilafranca-del-penedes-visit/

Want to learn more?

- Learn more about biomass assessment
  EarthScan - the Biomass Assessment Handbook

BECoop tools and project-relevant resources:

- Learn more about the different biomass technologies:
  BECoop D2.7 Catalogue for the provision of technical support services
- Learn more about the different types of Biomass:
  BECoop Factsheet Of Solid Biomass For Small-Scale Heating Applications
- Learn more about the biomass logistic supply chain here:
  BECoop Factsheet Of Biomass Logistic Supply Chain
- Learn about the CAPEX and OPEX of a DH plant:
  BECoop Technical catalogue on biomass district heating
- Self-assess the current state of your community bioenergy project:
  BECoop Self-assessment tool

Questions to answer before you start...

- What iomass sources exist in your local region?
- Have you evaluated which technologies are appropriate for your energy community based on local conditions and challenges?
- Have you identified individuals with the technical expertise to support your community?
- Have you identified your activity's end-users?
- What is the energy demand of your consumers in terms of heat and power?
- Have you designed the necessary equipment and capacity to meet your community's energy needs?

Step 4

Step 4: Investment Schemes

Financing a Renewable Energy Service Cooperative (RESCoop) is a complex and multi-faceted process that depends on many factors. The size of the initiative is a key component, as is the type of technology used and the type of activity (producing, supplying or distributing energy or services). It's essential to consider these variables at the earliest stages of planning to determine the most suitable investment scheme and ensure that it complies with county-level regulations. A well-thought-out business model is essential for success, as it will cover factors such as governance and the size of the project. With the right approach, you can ensure that your RESCoop is adequately supported and ready to reach its full potential.

In the context of RESCoops, **an investment scheme can be defined as a type of investment which not only aids in the development of renewable energy and energy efficiency projects but is also tailored specifically to the identity and nature of a RESCoop project**. Finance solutions are essential for allowing RESCoops to flourish, and as such, it is important to be able to indicate relevant schemes coming from the private sector that can be utilised, all with the aim of minimising any negative impacts these projects may have on the environment.

The financing stages of a RESCoop initiative

Different types of financing stages can be defined for a project, depending on its primary activity. The key phases for the development of a RESCoop can be identified as follows:

- The pre-planning phase.
- The development phase.
- The construction phase.
- The operating and maintenance phase

The different phases of the development of projects require different types of resources, for instance: the pre-planning and study phase require **venture capital** while the setting-up and building of production installations require **capital** and **loans**. The nature and scale of the project also influence the financing-mix: developing a biogas plant obviously requires much more starting capital (even with loans) than developing photovoltaic panels, biomass boilers or consultancy services towards RESCoops.

Always bear in mind

Investment regulations can vary depending on the country and the type of organisation, such as cooperatives or associations. Therefore, it is essential to carefully research the legal framework for project financing in the country where the RESCoop will be established during the planning phase. By doing so, a RESCoop can ensure that it operates within the legal boundaries of the country, which can help to avoid potential legal issues and financial penalties. It can also help to identify any government incentives or subsidies available to support renewable energy projects, which can be leveraged to help finance the respective project.

Understanding the legal framework of project financing can, furthermore, help a RESCoop to attract investors who may be hesitant to invest in projects located in countries with unclear or unstable legal environments. Having a clear understanding of the legal framework can provide investors with the confidence they need to invest in the RESCoop and its renewable energy projects.

In summary, researching the legal framework of project financing is a critical step in the planning phase of establishing a RESCoop. It can help ensure compliance with local laws, identify potential government incentives or subsidies, and confidence in potential investors.

Table 14. Financing stages of RESCoop projects

Phase	Description	Type of Financing	Challenges & Risks
Pre-planning	• Project planning • Identification of site/ type of RES • Feasibility Study • Draft Business Plan • Legal agreements	• Grants • Soft loans • Self financing • Seed capital	• First phase of the project, most risky part of the project to fund, investors are not often willing to risk investing in the early stages of a project • Financial guarantees needed by financial institutions in case the energy production does not repay the interest costs of the loan • Patrimonial guarantees requested by banks
Development	• Business plan • Permitting procedure • Grid access permit • Power Purchase Agreements • Legal agreements • Legal & Financial Due Diligence • Financial closing	• Equity investment • Grants • Loans	• Delays in obtaining licences and permits
Construction	• Construction contracts • Connection to the grid	• Equity investment • Grants • Loans	• Construction risks: financial operators are willing to take on construction risk often subject to their appointment of an independent consultant to undertake due diligence on the contracts, business models, etc. (has to be taken in charge by the RESCoop.)
Operation & Maintenance	• Production • Operation & Maintenance Contracts	• Revenues from energy production • Public support schemes for RES	• Revenues • Regulatory risks on public support schemes • Financial viability of the installer and the manufacturer and credibility of their warranty

Financial resources for RESCoops

The most practical financial resources include:

- **Self-financing:** is an effective method of raising project capital as it involves raising funds from within the cooperative through member shares or loans. This approach can help to foster a sense of community and ownership among members.

- **Bank loans** can provide additional financial resources, but they require guarantees and payment of interest. Traditional, cooperative, and ethical banks can provide these loans, depending on the preferences of the RESCoop.

- **Public funds in the form of subsidies for capital or investment, as well as crowdfunding**, can help to provide additional capital to support the development of renewable energy projects.

- **Private funds** can also provide capital and investment support for RESCoops. Project financing, cooperative funds, and other private funds can be leveraged to support project development.

- **Venture capital** can be another option for RESCoops looking to combine their assets with other developers. This can take the form of joint ventures or leasing, which can provide access to additional capital and investment.

- **EU/national** funding opportunities

There are other financial resources available to RESCoops, including crowdfunding, grants, members' donations, and revolving funds.

Always bear in mind

RESCoops often face significant implementation costs for their renewable energy projects. As a result, they must be creative and innovative in combining financial contributions from citizens, public entities, and private organisations to support their activities. Citizen financing can play a vital role in supporting RESCoops, as members of the community can invest in renewable energy projects and contribute to the development of sustainable energy solutions. By investing in RESCoops, citizens can have a direct impact on the transition to a low-carbon economy, which can help to reduce greenhouse gas emissions and mitigate climate change.

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Public entities can also provide financial support through grants, subsidies, or other financial incentives. This type of funding can be critical to the success of RESCoops, as it can help to offset the high costs of renewable energy projects and provide an important source of funding. Private organisations can also play a role in supporting RESCoops through investment and financing. This can include project financing, private equity, or venture capital. By working with private organisations, RESCoops can access additional financial resources and expertise, which can help to ensure the success of their renewable energy projects.

Use of profits

As organisations inspired by cooperative principles, RESCoops operate on a member-driven model where members themselves decide on the use and allocation of profits. Most RESCoops distribute dividends to their members, while others may use alternative methods to remunerate members, such as offering energy at favourable prices up to a certain limit (with a maximum amount of kWh/year). By allowing members to have a say in the allocation of profits, RESCoops foster a sense of community and ownership among their members. Members are invested not just in the financial success of the cooperative, but also in the success of its sustainable energy projects. This sense of ownership can help to build a more engaged and committed membership, which is essential to the success of RESCoops.

Considerations for Choosing the Right Investment Scheme

Two critical factors can determine the most appropriate investment scheme for a RESCoop:

- The Business Model employed
- The stage of under examination project(s)

In the case of the Business Model you will find more information in the section below (Step 5: Make your Business Plan), whereas Figure 36 represents a good matching among the project phases, the size of the investment and the relevant investment schemes.

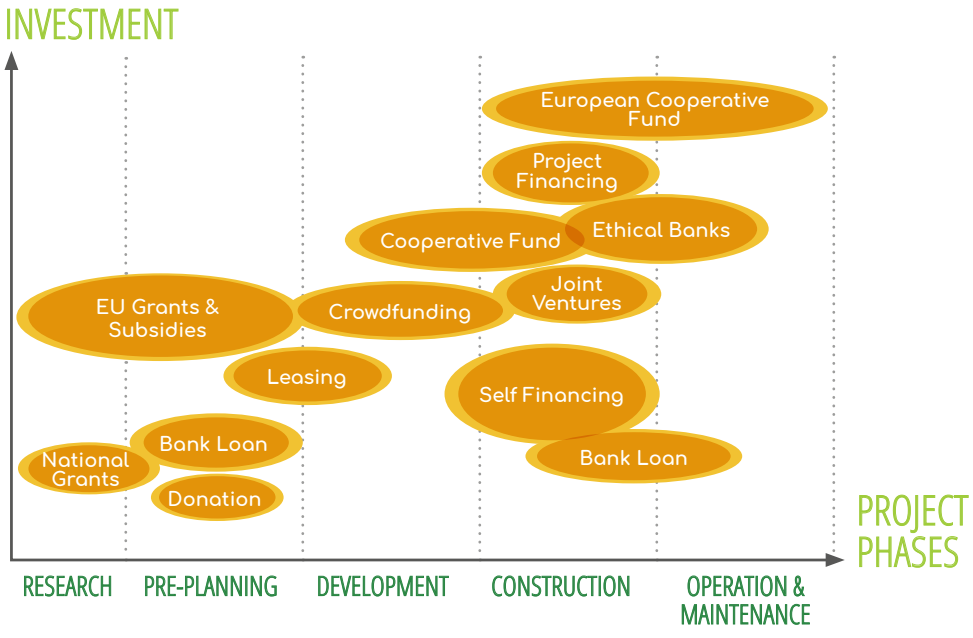


Figure 38. Potential financing opportunities

Did you know?

The atmosphere of uncertainty can hinder the relevant stakeholders and economic actors from joining energy community projects and making long – term decisions:

The non-stable or ever-changing regulations linked with complex administrative procedures and the lack of adequate structural and financial mechanisms often create an atmosphere of uncertainty, hindering long-term planning and investment. Such factors discourage citizens from getting involved or participating in energy communities, further claiming a lack of local and national governance support[74]. A common problem is also related to the forestry regulation which is still unclear. Current misleading measures such as banning the transfer of forest residues out of the woods set obstacles to the exploitation of forestry biomass for heating purposes and confuse the involved actors.[75]

SUCCESS CASE

Members' fees support the cooperative's collective capital | Goiener Cooperative, Basque Country

GoiEner is a RESCoop active in the Basque Country, with the goal of recovering energy sovereignty for citizens by participating in the liberalised parts of the energy sector, i.e. retail, generation and energy services. Key attributes of the GoiEner approach are democratic and participatory involvement, the alleviation of energy poverty and equal representation of men and women. GoiEner also supports the creation regionally of Renewable Energy Communities, and of new RESCoops in other regions of Spain, in order to increase local, democratic and renewable energy resilience. GoiEner aims to attract more citizens, companies, public entities and organisations contributing to the social and environmental economy. The members include citizens, SMEs and even political parties. The cooperative started with 32 founding members in 2012 and has expanded to over 16,500 members, over 20,000 contracts and 6 regional offices in December 2022. The membership fee of 100 euros entitles members to take part in decision-making and join the general assembly. The fees contribute to the cooperative's collective capital, and if a member decides to leave GoiEner, this contribution is paid back at the value of the share at the time of withdrawal.

The cooperative has 61 employees and 200 volunteers working in altogether 30 working groups. In 2015 volunteer-based Goiener Elkartea association was established to promote the social objectives of the GoiEner S. Coop. retail cooperative.

Its main actions include the promotion of renewable energy generation, the achievement of e-mobility and the tackling of energy poverty. The association is also active in carrying out awareness and training activities and promotes research and studies contributing to the objectives, and the networking with entities such as municipalities, universities and other cooperatives.

One of the 26 Renewable Energy Communities supported actually by Goiener is located in Aberasturi. Aberasturi is a village member of Vitoria-Gasteiz municipality with around 250 inhabitants who are planning to build a biomass-fed district heating network based on local resources. Actually over 70% of the buildings use fossil fuels for heating so the planned district heating network will replace around 1 million kWh per year of non-renewable energy with local and sustainable energy. Around 200 t/year of wood chips will be produced from the sustainable management of the surrounding forests and 175 t/year of straw from wheat, oat and barley production residues.

Figure 39. Goiener 10 years anniversary

Fig. 40. Forestry Biomass demonstration activity

More information can be found here: www.goiener.com

[74] Ruggiero, S., A. Isakovic, H. Busch, K. Auvinen, and F. Faller.(2019). Developing a Joint Perspective on Community Energy: Best Practices and Challenges in the Baltic Sea Region, No. 2, p. 33

[75] D1.4_Definition_of_community_bioenergy_heating_uptake_needs_challenges_V1.0

Want to learn more?

- Find here more about RESCoop investment schemes: **Handbook on Investment schemes for RESCoop projects**
- Learn more about the forms of financing available to your energy community: **COMPILE Financing guide for Energy Communities**
- Get inspired by some successful RESCoop cases across Europe: **RESCoop MECISE H2020 Mobilising European Citizens to Invest in Sustainable Energy**
- Read about the benefits and barriers around community involvement in the energy transition: **Financing community energy report by Friends of the Earth Europe**
- For more information on the policy environment, private financing, and public funds: **Energy communities in the EU - Opportunities and barriers to financing by Friends of the Earth; JRC report on the use of woody biomass for energy production in the EU**
- Explore *Citizenergy*, the first platform to encourage cross-border investment in sustainable energy and the first to provide information on sustainable energy opportunities from both crowdfunding platforms and cooperatives: **Citizen crowdfunding platforms and cooperatives**

BECoop tools and project-relevant resources:

- Learn more about the relevant EU and regional framework conditions: **BECoop D1.2 - Regional and EU framework and value chain conditions affecting community bioenergy uptake**
- Explore the catalogue of business and finance options for potential bioenergy communities: **BECoop D2.9 BECoop catalogues for the provision of business and financial support services – First**

Questions to answer before you start...

- What types of renewable energy projects will the cooperative develop?
- How will ownership of the energy community be structured?
- How many members will participate and in what capacity?
- What financial resources are available?
- Will the community have a for-profit or not-for-profit legal structure?
- What will be the governance model?
- What kind of funding will be required for activities?
- Who could be potential collaborators for financing (such as private investors, banks, ESCOs, other RESCoops, and citizens)?

Step 5

Step 5: Make your Business Plan

What is a business model?

A business model describes the rationale of how an organisation creates, delivers, and captures value, in economic, social, cultural, environmental and other contexts. The development of a business model forms a part of innovation, business strategy and sustainability, especially when dealing with Energy Communities.

Sustainable business models can be an effective tool in both de-risking and encouraging investments in Renewable Energy. By identifying **potential pathways of profitability within a product or service, its intended target market, and any associated expenses**, business models are increasingly being seen as crucial for both new and established Energy Communities. By having a strong business model in place, these communities have the potential to attract investments, recruit talent, and motivate management and staff in order to increase their overall performance. As a result, **having a well-structured and sustainable business model in place is becoming an increasingly important factor for success in the Renewable Energy sector.**

Some other key advantages of the Business modelling are to:

- Align better the operations with the community strategy.
- Improve process communication within all operations of an Energy Community.
- Increase control and consistency among all the operations and members.
- Improve operational efficiencies and increase business performance with a simple model.
- Help the Energy Communities to become different and gain competitive advantage.
- Attract more investments and increased profitability by considering environmental and social aspects.

Within our BECoop actions we have identified 4 main RESCoop Business Models regarding their internal governance.

Different types of RESCoop Business models

Business Model 1: Local integrated group of citizens

This model is typically born from a grassroots approach where citizens identify a need and aim to fulfil it. It is the most common and original bottom-up scheme of a RESCoop. These coops remain small in size and focus on developing local projects, such as solar panels, watermills, or biomass boilers. As they have limited capital, financial resources invested mainly come from members through shares and loans. For instance, a group of citizens that decides to renovate a watermill in their village to produce electricity would fall under this category. This model may also include integrated concepts in terms of services such as production, supply, and distribution where possible, resulting in a longer organisational trajectory. The objective is to function independently on the different dimensions of energy provision, mainly on volunteering without many employees. However, the lack of financial resources may limit the RESCoop's ability to expand or undertake larger projects, and may also create challenges in terms of maintenance and management of existing projects. **Urberoa in Spain and Ecopower in Belgium are good examples for this model.**

SUCCESS CASE

RESCoop bottom-up approach| UR BEROA, Spain

UR BEROA S.COOP is an energy cooperative made up of 550 families from the region of Donostia-San Sebastián and is dealing with the provision of hot water and renewable heating. They also have a cogeneration plant in Spain, as well as biomass boilers and a photovoltaic installation. Their main objectives are the environmental awareness of the local community along with the reduction of CO2 emissions and the continuous optimisation of the cost of its energy services.

Their business model is typically born from groups of citizens in a bottom-up approach with the motivation to fulfil a need they have identified. The RESCoop keeps a small size and develops small local projects, such as solar panels and biomass boilers. They have limited capital and the financial resources invested mainly come from the members (shares, loans). Typically, it is a group of citizens that decides to renovate the local energy systems. This model also includes integrated concepts in terms of services: production, supply, distribution when possible, and other services which results in a quite long organisational trajectory. Their main goal is to function independently on the different dimensions of energy provision, mainly on volunteering without many employees.

More information can be found here: https://urberoa.com/

SUCCESS CASE

One of the first RESCoops in the EU | Ecopower, Belgium

Ecopower, one of the pioneering RESCoops in the EU and the founder of RESCoop.eu, was established in 1991 by a group of environmentally conscious people. The first idea was to renovate the water mills in the area and potentially generate electricity from them. Initially 30-40 people joined the cooperative and the first capital was 10,000 euros. At the end of 1990, one of the members became aware of the new EU energy directive and started looking for people to strengthen the board of the cooperative. Ecopower does not make a profit on its energy supply activities: all surplus is reinvested in new renewable energy and energy efficiency projects. All of the cooperative's members can each buy up to a maximum of 20 shares, and each of the 60,000 members has one vote in the general assembly. If someone can't financially afford a share, solutions are offered to potential members.

The average annual consumption in Belgium is 4,000 kWh for electricity and 20,000 kWh for heating. Ecopower's stakeholders are families, who consume most of the kWh for heating. This was the reason why the cooperative started to think about heating and realised that almost half of the families were still heating with fuel oil. The idea was to focus on the families using heating oil and propose to them the use of biomass as an alternative. The suggestion was to put pellets in the tank instead of oil. An information campaign took place, which also took into account the new law on energy renovation of houses. Ecopower tried to convince them not to install oil-fuelled infrastructures again, but to prefer the biomass-based ones.

Fig. 41. Ecopower biomass plant


Fig. 42. Ecopower pellets

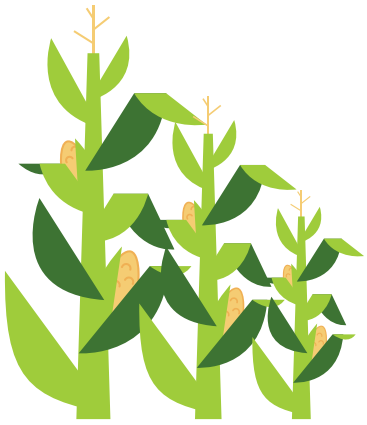
More information can be found here:
https://www.ecopower.be/

Business Model 2: Regional-national RESCoop

This model is typically founded by a group of citizens that has scaled up or by an external initiative that brings together relevant stakeholders. It aims to develop a mix of activities and/or to be active on various energy sources, with different projects developed at a regional or national level and different production sites. This model operates with both volunteers and employees to handle operational issues, and it has more diversified financial sources and develops partner relationships on various matters. A key advantage of this model is its ability to achieve economies of scale, which can reduce costs and increase efficiency. Furthermore, it allows for a wider range of projects to be developed, including photovoltaic, wind and biomass projects, making it suitable for RESCoops that operate on a regional or national level. This model is well-suited for bioenergy RESCoops as many have been identified to operate under this model. **BECoop's consortium partners such as ESEK in Greece and Goiener in Spain are typical examples of this model** and are further presented in Step 2: Assess your raw material resources and Step 4: Investment Schemes correspondingly.

Business Model 3: Network of RESCoops

The third model consists of a network or group of RESCoops. In this model, a RESCoop developer or incubator invests venture capital in a new project and creates autonomous RESCoops at the local level using the same business model. The strategy for scaling up relies on replicating a proven and successful organisational structure in various locations, which enables economies of scale, time, and energy in developing the projects. This model mainly focuses on gathering small RESCoops to develop large-scale solar and wind projects, although biomass and hydro are also considered to a lesser extent. They also establish partnerships of the same types, both at the local and meso-levels. **A typical example of such a business model is implemented by SEV and Energy4All.**



SUCCESS CASE

Umbrella organisation for local energy initiatives| SEV, Italy

SEV is a major feature of the local energy sector and currently has 304 members, including 120 hydropower plants, 45 heating plants and 149 photovoltaic installations. Since 1 January 2018, SEV acts as an umbrella organisation for small- and medium-sized energy firms in South Tyrol. SEV represents power utilities and cooperatives as well as private companies and municipalities, have as a main role to link the separate areas of services and decentralised businesses that arise. Given its umbrella role, SEV can measure up in organisational terms to the affiliated business associations on the South Tyrolean economic scene. Considering the use of renewable energy, South Tyrol has a long history of local energy and heating production and supply, offering a significant technical expertise in terms of existing infrastructures. Energy transition in South Tyrol began long ago, resulting in an increased level of municipal utilities, medium-sized enterprises and co-operatives, that ensure efficient energy supply even in remote mountainous areas. South Tyrol indicates significant experience in renewable energy applications, that require decentralised production structures such as "smart" distribution, where individuals can produce electrical energy and become an active market player.

More information can be found here:
https://www.sev.bz.it/en/south-tyrol-energy-association/1-0.html

SUCCESS CASE

A network of RESCoops| Energy4All, UK

Energy4All supports a network of 33 independent renewable-energy co-operatives, which have in total 17,308 individual members. The RESCoop was founded by the Baywind Energy Co-operative (UK's first renewable energy co-operative) in 2002 and Energy4All demonstrates the power of co-operation in the renewables sector. They work along with other communities to develop innovative renewable energy projects, in most of the cases they are raising their own funds and they are also bringing high-quality project managers to support the construction process. For Energy4All, it is essential that the energy transition should be citizen-based and above all to benefit the local economy and the inhabitants.

Figure 43. Energy4All network of cooperatives' members

More information can be found here: https://energy4all.co.uk

Business Model 4: Multi-stakeholder governance model

The multi-stakeholder governance model is a complex RESCoop model that gathers all stakeholders involved in renewable energy provision and consumption, including consumers, producers, workers, communities, and partners. This model is designed to encourage the development of synergies between public authorities, social enterprises, and local businesses. It can be implemented at the local level with multiple stakeholders or at a territorial level with a pyramidal structure from the local to the territory level. While this approach has elements of public-private partnerships and can offer benefits, it also has the challenge of governance complexity and is highly dependent on regulatory clarity and efficiency. Nonetheless, it holds great potential for scaling up and achieving economies of scale, more effective sharing of best practices and know-how. It should further be noted that this model requires a high level of sophistication and presupposes the development of synergies among local and regional communities and entities. **This business model is, for example, implemented by Enercoop.**

SUCCESS CASE

A 100% cooperative green energy supplier | Enercoop, France

Enercoop is an energy community which provides guaranteed 100% renewable energy thanks to direct supply from more than 350 producers throughout France. Its producers use exclusively renewable sources such as water, wind, sun, biomass and the 50% of this production is owned by citizens or local authorities.

The RESCoop operates with the multi-stakeholder governance model which gathers all the stakeholders who have a role to play in the provision and consumption of renewable energy (consumers, producers, workers, communities, partners) through a complex governance structure. The RESCoop can be organised at the local level (with local multiple stakeholders) or at the level of a territory with a pyramidal structure from the local to the territory level. Indeed, this model encapsulates the development of synergies between public authorities, social enterprises and local businesses as well as public – private partnerships.

More information can be found here:
https://www.enercoop.fr/

Build your own business model...

Check out the template for the BECoop RESCoop business model (Figure 44). Follow the instructions and fill in the template in order to build your own business model.

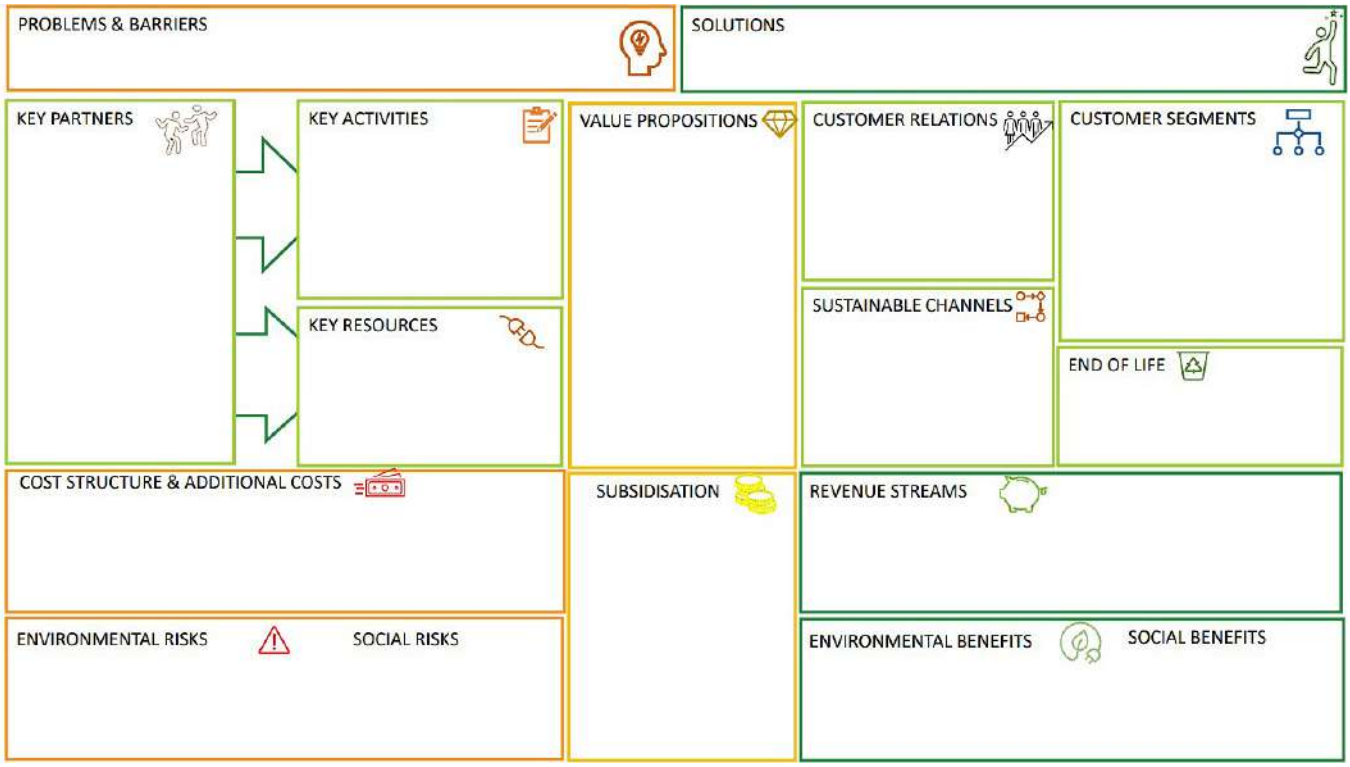


Figure 44. BECoop RESCoop business model template

1. ***Key partners*** involve the most leading members of the community profile, either person or entities (NGOs, associations, local or regional government etc)
2. ***Key activities*** mainly concerning the ways that the Energy Community utilises renewable energy to the local markets and its stakeholders (electricity generation, heating etc)
3. ***Key resources*** are dealing with the renewable energy sources and their core technologies that are usually implemented within the community projects (e.g. electricity generation connected to the grid, electricity generation for self-consumption)
4. ***Value propositions*** have to do with the possible utilisation pathways of the produced renewable energy or the community activities. (What is the KEY product)
5. ***Customer segments*** include the potential stakeholders as beneficiaries from the community actions and projects.
6. ***Cost structure*** comprises the most relevant Capital and Operational Expenditures within the community activities and running of the business.
7. ***Subsidisation*** includes the possible available financial and funding resources at which the community operates.
8. ***Revenue streams*** (How do you make money? For profit? Non-profit? memberships? Fees?) refer to all the possible pathways that can bring value to the community within its activities and projects.
9. ***Environmental benefits*** as an outcome of the community actions respecting the local/national ecosystems.
10. ***Socio-economic benefits*** to the local and national societies and other communities.

Always bear in mind

Internal governance and membership sustainability

Energy cooperatives are a prime example of citizen-led initiatives in which end-users pool funds to own energy generation systems. These cooperatives operate on voluntary and democratic membership rules with an economic participation of members. The success of RESCoops is largely dependent on their membership. They require a continuous inflow of new members and stakeholders to keep the community thriving and sustainable.

RESCoops try to financially incentivise their members or potentially new ones by, among else,:

- defining billing conditions;
- mobilising self-consumption through dynamic pricing schemes;
- exempting cooperative members of paying some use-of-system tariffs;
- offering cheaper or market equivalent prices for renewable energy;
- charging tariffs above retail competitors and justifying the gap with the remuneration of suppliers.

Want to learn more?

- Learn more about the RESCoop business models: Report on RESCoop Business Models by RESCoop 20-20-20
- Check here an analysis of the business models for energy communities: Business models for energy communities: A review of key issues and trends (F.G. Reis et al., 2021)
- How to create a business model canvas: Canva's online business model canvas creator

BECoop tools and project-relevant resources:

- Read about the RESCoop business models and the Sustainable Business Model Canvas: BECoop D2.9 BECoop catalogues for the provision of business and financial support services – First

Questions to answer before you start...

- Who are the main competitors and what will be the community's competitive advantage?
- Will the community be able to meet its needs with its members?
- Has the community conducted feasibility studies to assess the profitability of its concepts?
- Does the community have a specific timeline for its activities?
- Has the community analysed potential risks / are there mitigation measures in place?

Make it happen

Roadmap towards Building a Sustainable Bioenergy Community Heating Project

To set up a bioenergy cooperative, it is undoubtedly useful to consider all handbook's steps. In this regard, it is also essential that a roadmap is created by actors involved in such an endeavour to ensure that all necessary steps (such as setting up a governance structure, finding suitable partners, obtaining funding, and creating a business plan) are indeed well-thought and taken into consideration. By following a series of indicative actions, as presented below, a bioenergy community roadmap can be designed and the means by which such an initiative could turn into a sustainable energy solution for the community can be identified.

BECoop tools and project-relevant resources:

- How to build a roadmap: D4.1. Co-definition of community bioenergy heating roadmaps
- Self-assess the current state of your community bioenergy project: BECoop self-assessment tool

- It is important for **initiators to reach out to other community members who are interested** in getting involved and seek their support through discussion. This will not only help to gain support for the central vision and **define the objectives** for the cooperative, but also show a willingness to integrate the ideas of potential partners, resulting in a more robust and sustainable plan. Keep in mind that community members should be involved in each step of the process.
- It is then crucial to determine the quantity of resources each member is willing to contribute towards the development of the cooperative.
- It is also important to **analyse the annual heat demands that need to be met** to ensure that the cooperative can provide for the community's energy needs.
- Various scenarios should be explored in terms of the type and availability of resources, technology to be used, business models, policies, and regulations.
- As thoroughly explained in sections above, it is important to pay attention to the policies and regulations in each country concerning RESCoops and bioenergy RESCoops.
- A feasibility study should be conducted to examine the technical and business characteristics of the energy community to ensure that the cooperative is set up for long-term success.
- Further identifying **interested stakeholders** who are willing to join or form an alliance with the bioenergy community and potential **end-users** is also important for the cooperative's growth and sustainability.
- Finally, information should be gathered on possible sources of funding in order to make an informed decision about the most suitable investment scheme for the cooperative.

Make it happen

At first contact between local members of community interested to get involved

Identification of total number of partners who will participate and quantity of resources they can provide

Analysis of the annual heat demands

Different scenarios will be set for the extent of bioenergy cooperative in terms of type and availability of resources, technology to be used, business model etc.

Feasibility study regarding the energy community's technical and business characteristics

Identification of interested stakeholders willing to form alliance

Finding funding opportunities. Decide the most suitable investment scheme for your RESCoop

Figure 45. Schematic roadmap of setting up a bioenergy community

Check out relevant organisations that may provide valuable support:

Table 15. Key organisations supporting energy community initiatives

Organisation	Description	Link
Rescoop.eu	REScoop.eu is the European federation of citizen ener-gy cooperatives.	https://www.rescoop.eu/
Energy cities	A community of several hundred local authority repre-sentatives from 30 countries. The network gathers frontrunners and energy transition beginners, city offi-cials and technical experts.	https://energy-cities.eu/
Friends of the Earth Europe	Friends of the Earth Europe is the largest grassroots environmental network in Europe, uniting more than 30 national organisations with thousands of local groups. They campaign for a just, sustainable future at the EU level and across Europe.	https://friendsoftheearth.eu/

In addition to the references in the document, you can also find the following available handbooks to help you navigate around community energy projects:

Table 16. List of available handbooks on community energy project development

Organisation, Year	Handbooks	Link
Friends of the Earth Europe, Rescoop.eu, Energy Cities, 2020	Community Energy: A practical guide to reclaiming power (availa-ble in 9 languages)	https://www.rescoop.eu/toolbox/community-energy-a-practical-guide-to-reclaiming-power
Rescoop.eu, Electra Energy, Milieukontakt Albania, 2022	EUCENA - Best Practice Guide: presentation of inspiring cases of energy communities in the region of Southeast Europe (available in 3 languages)	https://www.rescoop.eu/news-and-events/news/best-practice-guide-for-southeast-europe
REScoop.eu, Energy Cities, 2022	SCCALE20-30-50 project - Commu-nity Energy Municipal Guide	https://energy-communities-repository.ec.europa.eu/support/toolbox/community-energy-municipal-guide_en
Heinrich Böll Stiftung, CRES, Electra Energy, Technical University of Crete, 2018	Building Energy Communities in Greece (available in Greek)	https://gr.boell.org/el/2019/09/24/htizontas-energeiakes-koinotites
RESCoop 20-20-20 Pro-ject, 2014	Report on RESCoop Business Models	https://www.rescoop.eu/uploads/rescoop/downloads/REScoop-Business-Models.pdf
RESCoop 20-20-20 Pro-ject, 2014	Handbook on Investment schemes for RESCoop projects	https://www.rescoop.eu/uploads/rescoop/downloads/Financial-Handbook-for-REScoops-English_2020-10-19-171323.pdf
Sustainable Energy Authority of Ireland (SEAI), 2022	Sustainable energy communities handbook	https://www.seai.ie/publications/Sustaina-ble%20Energy%20Communities%20Handbook.pdf

Project partners

www.becoop-project.eu